Ecoline International

# ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (ESIA)

# GANJA WASTEWATER PROJECT,

# AZERBAIJAN

# ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT REPORT

**May 2026**

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## LIST OF ABBREVIATIONS

| | |
|---|---|
| AD | Anaerobic Digestion |
| ASWRA or "the Company" | Azerbaijan State Water Resources Agency |
| AZN | Azerbaijan manat |
| BMP | Biodiversity Management Plan |
| BAT | Best Available Techniques |
| BOD5 | Biological oxygen demand for 5 days |
| CAPEX | Capital expenditure |
| CHA | Critical Habitat Assessment |
| CHP | Combined Heat and Power plant |
| COD | Chemical oxygen demand |
| dB(A) | Decibel |
| E&S | environmental and social |
| EBRD | European Bank for Reconstruction and Development |
| EHS | Environmental, Health and Safety |
| EIA | Environmental Impact Assessment |
| EIB | European Investment Bank |
| ELV | Emission Limit Value |
| EPA | (US) Environmental Protection Agency |
| EROS | Earth Resources Observation Systems |
| ESAP | Environmental and Social Action Plan |
| ESIA | Environmental and Social Impact Assessment |
| ESMP | Environmental and Social Management Plan |
| ESMS | E&S Management System |
| EU | European Union |
| EUR | Euro |
| GCAP | Green City Action Plan |
| GDP | Gross Development Product |
| GHG | Greenhouse gases |
| GIIP | Good International Industrial Practise |
| GIP | good international practice |
| GNJ | Ganja International Airport |
| HDD | Horizontal Directional Drilling |
| HDI | human development index |
| IDPs | internally displaced persons |
| IFC | International Finance Corporation |
| ILO | International labour organization |
| IUCN | International Union for Conservation of Nature |
| KfW | Kreditanstalt für Wiederaufbau (German State Bank) |
| LLC | Limited liability company |
| MENR | Ministry of Ecology and Natural Resources |
| MPN/100mL | Most Probable Number |
| Mt | Megatonnes |
| MWh/year | Megawatt-hours per year |
| NDC+ | Nationally Determined Contribution |

| | |
|---|---|
| NPA | Nationally Protected Area |
| OHS | Occupational Health and Safety |
| OJSC | Open joint-stock company |
| OPEX | Operational expenditure |
| OUE-s | European Odor Unit |
| PBF | Priority Biodiversity Feature |
| PE | Population Equivalent |
| PIP | Priority investment project |
| PPE | Personal Protective Equipment |
| PR | Performance requirement (of the EBRD) |
| PV | Solar power panels |
| RA | Republic of Azerbaijan |
| SCADA | Supervisory Control and Data Acquisition |
| SEA | Strategic Environmental Assessment |
| SEE | State Ecology Expertise |
| SEP | Stakeholder Engagement Plan |
| SME | Small and Medium enterprises |
| SPP | Spill Prevention Plan |
| SPZ | Sanitary protection zone |
| TSS | Treated Sanitary Sewage |
| UNDP | United Nations Development Programme |
| UNECE | United Nations Economic Commission for Europe |
| US | United States |
| UV | Ultraviolet |
| VAT | Value Added Tax |
| VEC | Valued Environmental Component |
| WWTP | Wastewater Treatment Plant |

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## Executive Summary

The European Bank for Reconstruction and Development - (EBRD) is considering financing to the Azerbaijan State Water Resources Agency (ASWRA) for the proposed Ganja Wastewater Treatment Plant (WWTP). Wastewater is currently discharged untreated into the environment creating odour and human health risks. The proposed WWTP is crucial to modernising wastewater treatment for Ganja city. The proposed WWTP will be a three-step process namely mechanical (separation), biological, and tertiary treatment using UV disinfection. The WWTP will be designed to achieve between 75 and 90% reduction in different pollution parameters. Sludge will be stored initially on land belonging to ASWRA for a 2-year (but potentially extendable) period, during which time a medium to long term sludge disposal strategy must be developed. Alternative treatment technologies, and effluent discharge pipeline and access road routings have also been considered.

The project will be implemented in an area with an arid to semi-arid hot and dry climate. Land use is mostly agriculture. Climate change predictions are a progressive temperature increases but limited or no change in rainfall. Azerbaijan is one of the most seismically active regions in the Alpine fold belt with frequent earthquakes. The primary water source is the Ganja River and some limited groundwater use. Surface water is heavily polluted. Traffic and industrial activities result in elevated ambient $SO_2$ concentrations. Agricultural soil is declining with possible pollutant contamination unknown. Waste management is generally poor with only one overused landfill available that does not comply with modern standards. Given the intensive agricultural and residential land use around the proposed WWTP site, biodiversity is very limited. Five plant, three animal, two avifaunal and one fish species were identified as Priority Biodiversity Features (PBF).

Ganja is the 3rd largest city in Azerbaijan with a population growth estimate to between 430 000 and 564 000 by 2050. The city has a high literacy rate and is one of the largest industrial cities in the country. The population is predominantly urban with 3.9 % poverty and 6.8% poverty in rural areas. Gender based violence and harassment is problematic. The city has important cultural heritage. The Samukh District borders the city, has a relatively much smaller population and also a rich cultural heritage. Literacy is also very high, but the economy is primarily agricultural and unemployment is 3.8%. Domestic violence is similarly problematic in the district. There are several villages near the proposed WWTP and effluent pipeline, with varying populations. Crops and livestock are important economic activities but unemployment is high. Drinking water is mostly from Artesian wells.

With mitigation, negative construction related impacts are unlikely to be significant. There will be employment benefits of moderate significance in Samukh District. The only habitat that will be physically transformed is the old, partially constructed WWTP that provides non-native habitat to the glass lizard. Search and rescue and recreation of similar habitat would ensure no net loss of the species. Operational impacts are overwhelmingly positive with the cessation of untreated effluent into the Goshkar River, a net reduction in GHG emissions and economic opportunities for local residents and businesses.

The following mitigation is key to ensuring that project implementation complies with the EBRD Sustainability Policy:

- Prior to construction, conduct detailed biodiversity surveys in areas where land will be transformed by construction, including the treated effluent discharge point into the Goshkar River and the power line routings when they have been defined. Mitigation must be defined and implemented where biodiversity risks are identified, together with ongoing monitoring.
- The sludge storage area will need to be equipped with leachate management mechanisms to prevent sludge leachate from mobilising off site.
- A medium to long term sludge disposal strategy must be developed and implemented well before sludge storage capacity is exhausted. Agricultural disposal is the preferred option provided the sludge meets the quality criteria

defined for such. Landfill is the least preferred option and will also need to meet quality requirements for disposal and take up valuable airspace.

- The WWTP will need to be very well maintained and operated to achieve the treated effluent limits and to prevent odour.
- ASWRA will decide on whether to make treated effluent available for irrigation once detailed design has been completed.
- Although not in the scope of the WWTP. It is also essential that the old sewer system in the city be fully connected to the new collector pipeline to stop ongoing discharge of untreated wastewater into the Goshkar River, or else the positive effect of the WWTP will be reduced.

# 1 INTRODUCTION

The European Bank for Reconstruction and Development ("the EBRD" or "the Bank") is considering providing finance to the Azerbaijan State Water Resources Agency (ASWRA or "the Company") for construction of the Ganja Wastewater Treatment Plant (WWTP) ("the Project"). The proposed Project is one component of the wider Ganja Water and Wastewater framework project and Priority Investment Programme being implemented under the Ganja Green City Action Plan (GCAP)[1].

ASWRA, a state-owned company, was established in 2023 to oversee the management and governance of all water resources in Azerbaijan, including providing ASWRA water supply and wastewater collection and sewage treatment services in Ganja City. ASWRA will implement the Project with support of its Ganja branch and the Project Implementation Unit (PIU).

The WWTP Project has been categorised as "A" in accordance with the EBRD's 2019 Environmental and Social Policy. This means that it is required to conduct a formalised and participatory Environmental and Social Impact Assessment (ESIA) of the proposed Project and associated infrastructure. The ESIA documents have been publicly disclosed for a minimum period of 120 days.

A consortium of environmental and social (E&S) consulting companies[2] ("the Consultant") prepared the ESIA and associated E&S documents. The Scoping Report and Stakeholder Engagement Plan (SEP) were developed and disclosed on 31 May 2025 for consultation. In June and July 2025 Scoping consultations and social studies took place in the City of Ganja and Samukh District. The ESIA package, including the ESIA report, the Environmental & Social Management Plan (ESMP), the Environmental & Social Action Plan (ESAP), the Resettlement Framework (RF), and an updated SEP reflecting the outcomes of the Scoping consultation, was compiled and disclosed on 15 December 2025. Public hearings were held in Samukh and Ganja and informal meetings in Ziyadli and Garayeri.

This, the ESIA Report is structured to present:

- A project description;
- An overview of national E&S legislation in Azerbaijan together with the EBRD and EU requirements;
- A characterisation of the E&S baseline in the area where the Project will be developed and that may be affected by the project;
- The assessment of potential Project impacts and proposed mitigation to prevent or reduce the significance of impacts.

The report has been updated to include issues raised during the 120-day consultation period and respond to the same.

[1] EBRD. 2025. GrCF3 W2 - Ganja Water and Wastewater. https://www.ebrd.com/work-with-us/projects/psd/55197.html

[2] The consortium encompasses Ecoline International Ltd. (Bulgaria), Integra Consulting Ltd. (Czech Republic) and ABAK-Az Crowe Ltd. (Azerbaijan).

# 2 PROJECT DESCRIPTION

The description of the WWTP Project in this section is based mainly on the Feasibility Study[3] and the ESIA Scoping report[4], prepared by SWECO in 2024, and the updates obtained from ASWRA in 2025.

## 2.1 Current status of wastewater treatment

The existing wastewater system dates to Soviet times, with some upgrades. For the ESIA, it is necessary to detail this status. North of the City is the relics of a WWTP, construction of which was initiated in the 1980s but never completed. There is no functional WWTP for Ganja. The main sewage collectors have been constructed (for transporting the wastewater from Ganja to the WWTP), and this has resulted in increased flow to the area of the relic WWTP and resultant uncontrolled discharge close to the effluent ponds and localized flooding. The local authorities excavated temporary drainage channels to divert the flow away from residential areas but it is simply not known where the flow ultimately stops.

The circumstance has created significant odour episodes and the discharge of untreated wastewater in this manner, also constitutes a human health risk. Stakeholders living close to the discharge point are understandably concerned about the situation. It is thus imperative that the new WWTP be constructed as soon as possible, to start treating the wastewater from the new sewage collector system.

The wastewater is principally sourced from residential areas but there are sources of industrial wastewater too, up to 444 $m^3$/day. As a function of direct connection only 237 $m^3$/day would be discharged to the sewer. A key concern is the introduction of industrial pollutants to the sewer, because these pollutants would not be treated at the WWTP and end up in the sewage sludge. The presence of heavy metals is especially problematic in limiting the agriculture use of sewage sludge. There is an aluminium factory ("Azeraluminiumt") which would be the only significant source of heavy metals but is not connected to either the water supply nor the sewerage system.

## 2.2 Project Scope

The primary goal of the Project is to construct a new WWTP that can effectively serve the entire Ganja, accommodate the current and projected population growth, and ensure:

I. a treated effluent that is EU-compliant as well as meeting national discharge standards, and standards for disposal to receiving waters.
II. a stabilized sludge suitable for reuse or final disposal.

The WWTP Project is crucial to modernizing and significantly improving wastewater management in Ganja. The existing municipal wastewater management system is inadequate and does not meet national and international standards, resulting in environmental pollution and human health risks. The WWTP forms part of the Priority Investment Project (PIP), aimed at improving water and sanitation for the city, including:

- 827 km water supply pipeline including house connections;
- 29,589 water meters;
- A Supervisory Control and Data Acquisition (SCADA) system covering all water reservoirs;

[3] Sweco, 2024: Ganja Water and Wastewater Feasibility Study Update, Feasibility Study Report.
[4] Sweco, 2024: Ganja Wastewater Treatment Plan – ESIA Scoping Report.

- 75,000 $m^3$ water storage on nine locations;
- Completion of two of the reservoirs - landscaping, buildings and chlorination neutralization unit;
- 907 km wastewater collection pipes including house connections;
- Maintenance equipment and a new Water Supply and Sewerage Workshop serving ASWRA, including sewer cleaning vehicles, trucks for sludge transport, and specialist maintenance equipment;
- Stormwater management in 3,620 ha of the city– approx. 225 km of pipe and channels.

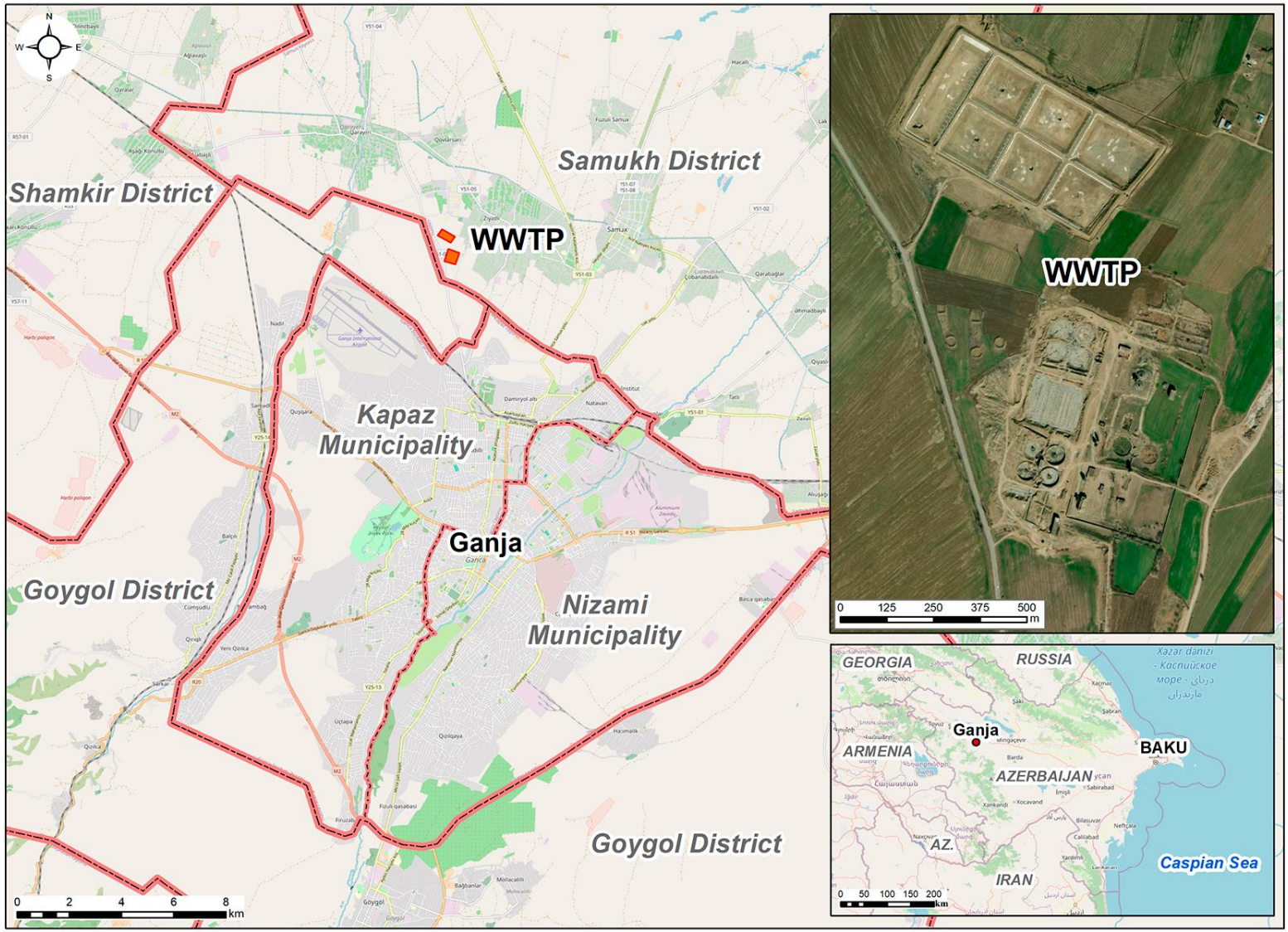
### 2.2.1 Feasibility study

In 2024, a Feasibility Study Update Report was completed for the wider Ganja Water and Wastewater Project, including the current WWTP Project[5]. Earlier, in 2016, a national Environmental Impact Assessment (EIA) was completed[6] for the WWTP project and a positive statement (EIA approval) was issued by the Environmental Expertise body of the Ministry of Ecology and Natural Resources in 2016.

The Feasibility Study Report (Sweco, 2024) recommends single stage construction (not phased), with a nominal capacity of 400,000 Population Equivalent (PE) in 2040. Construction, including detailed design, is expected to take three years. The proposed location for the WWTP is shown on a map relative to Ganja (**Figure 1**).

[5] SWECO, 2024. Ganja Water and Wastewater Feasibility Study Update, Feasibility Study Report.

[6] Dornier-Schneider Consulting. 2016. Additional Investigation Study for the Wastewater Treatment Plants in Ganja and Sheki-Programme Phase 3. Part 1.3 Ganja Wastewater Treatment Plant. Volume 3: Environmental Impact Assessment Report.




*Source: Prepared by the ESIA Consultant.*

**Figure 1. Proposed location of the Ganja WWTP**

As the effluent ponds were renovated under the KfW project in 2020, they are not part of the Project. There is a main sewage collector constructed under the KfW project and running from Ganja to the WWTP site, thus this collector is also not part of the Project. The existing sewerage network constructed by the state and KfW financing covers the city centre on both sides of Ganja River and the design is prepared for connecting the remaining areas of the city[7].

## 2.3 The Strategic Environmental Assessment (SEA) for the new Ganja City Master Plan

The SEA[8] took place during the preparation of the new Master Plan of the City of Ganja in 2022 – 2023, supported by the UNECE, in cooperation with the Ministry of Ecology and Natural Resources of the Republic of Azerbaijan (RA) and the State Committee on Urban Planning and Architecture. The lack of functional wastewater treatment system was acknowledged as one of the key environmental concerns and a major hinderance for the city´s further development, and the construction of the new WWTP became one of the key priorities of the environmental component of the new Master Plan. The SEA conclusions in that respect emphasized a need for urgent progress in preparation of the WWT investment (including the initiation of an EIA process), and formulated a few general recommendations for the project preparation:

- Sewage collection pipelines routing should aim to minimize negative environmental and socio-economic impacts of the construction (disruption of natural ecosystems and/or businesses etc.)
- Establish air quality control measures on the WWTP site to treat odours and/or establish buffer zones to protect adjacent land users
- Establish wastewater treatment standards appropriate to receiving water body, implement the best available technology to achieve compliance with the EU standards for discharged waters
- Evaluate water reuse options (e.g. in agriculture, recreation, natural environment), including use of the cleaned effluent for the irrigation of the city public green areas.
- Development of suitable sludge management strategy while considering various management options (e.g. recovery of energy, composting and disposal at waste landfill).

## 2.4 Principles of Wastewater Treatment

Before presenting the project, the treatment principles used in wastewater treatment are outlined as a reference framework for the Project. Sewage is the inevitable waste product of human settlements of any kind. In a city, such as Ganja, it makes sense to convey the sewage to a central facility for treatment rather than at source. Water is used to transport the sewage so that it can be pumped through pipelines to the treatment facility. A WWTP, such as that proposed for Ganja, serves to essentially ‘recover’ the water and ensure that it does not threaten human health or the natural environment by neutralizing the hazardous components of the sewage. The basic steps in treating household sewage are:

[7] SWECO, 2024. Ganja Water and Wastewater Feasibility Study Update, Feasibility Study Report.

[8] SEA is internationally recognized as the key instrument for integrating environmental and health concerns into strategic planning and decision-making to prevent and mitigate possible damage from economic and regional development. SEA should be applied during the preparation of governmental strategic documents in order to ensure that the environmental and health implications of planned developments are analysed and considered early in decision-making processes, before the decisions are made.

### 2.4.1 Transporting

Wastewater is transported by connecting household toilets/bathrooms/kitchens to pipelines that convey the sewage to the WWTP and pumping where required.

### 2.4.2 Screening

Material that should not be in sewage in the first place such as stones, gravel, bricks and even bottles, as well as material that could block the pipes such as nappies, rags and so forth must be screened out before it can impact negatively on the operation. Such material can be brought into the WWTW where stormwater is channelled into the sewer, but people may also flush some of these materials down the toilet.

### 2.4.3 Primary Treatment

Organic solid matter (human waste) is separated out through settling the solids in large settlement tanks where the solids sink to the bottom and are pushed towards the centre of the tank where they are pumped away for further treatment. Provided that it is managed correctly the sludge has several potential benefits including use as a fertilizer and heat and power generation.

### 2.4.4 Secondary Treatment

Primary treatment only removes about 15% of the organic matter and so secondary treatment is required. Human waste contains multiple forms of bacteria, some of which feed on the human waste and break it down. Secondary treatment is based on enhancing conditions that promote the cultivation of these bacteria. For example, 'activated sludge' is a mechanism whereby sludge rich in 'good' bacteria is introduced together with aeration (air is blown through the effluent). Aerobic bacteria which feed off the oxygen added to the water via the process of aeration is thereby cultivated with excess bacteria being removed for reintroduction as 'activated' sludge.

It is also necessary to remove nutrients from the waste stream specifically nitrogen and phosphorous. If not removed these nutrients can result in toxic downstream algal blooms. Nitrogen can be removed by nitrification where ammonia ($NH_3$) is broken down by microorganisms under aerobic conditions to form nitrates ($NO_3$). Denitrification is then also used whereby other bacteria convert the nitrates to nitrogen gas (N) which is released to atmosphere removing nitrogen from the stream. In a similar manner, microbes (notably Phosphate Accumulating Organisms) take up the phosphorus in their cells, thereby removing the phosphorus from the water.

### 2.4.5 Tertiary Treatment

Although sewage treatment is aided by some forms of bacteria, there are other bacteria which are human pathogens (a source of disease) and these must be disinfected before the effluent is discharged. Chlorine is often used for disinfection and is typically 99% effective but chlorine is also hazardous to downstream aquatic life and so must be very carefully controlled. There are other forms of disinfection too including UV light and ozone. Further filtration may also occur during tertiary treatment removing suspended solids, bacteria, and other harmful substances that may remain after primary and secondary treatment. The filtration is a semi-permeable membrane with pores that are small enough to filter out particles, including pathogens like bacteria and viruses.

### 2.4.6 Other Considerations

There are added challenges too in operating WWTPs and these are a function of other forms of pollution that occurs in modern cities including heavy metals, petroleum products and pharmaceuticals, where anti-biotics, hormones and other active ingredients in modern medicines may be found in the sewage. In an arid country such as Namibia treated sewage

effluent is used as a source of potable water because of limited potable water sources. Such treatment requires significant additional investment; so using WWTP effluent for potable water must be based on the financial cost effectiveness of doing so and the scarcity of water. Effluent can also be treated for other forms of reuse that does not require potable water quality, for agricultural purposes for example.

### 2.4.7 WWTP Project Main Characteristics and Design

The new WWTP is designed to comply with discharge standards in the EU's Urban Wastewater Treatment Directive, which for large-scale WWTPs above 100,000 PE and for sensitive areas (Goshgar River) are[9]:

- BOD5: < 25 mg/l (or 70 - 90% reduction)
- COD: < 125 mg/l (or 75% reduction)
- Suspended Solids (SS): < 35 mg/l (for > 10,000 PE) (or 90% reduction for > 10,000 PE)
- Total Nitrogen (Total N): < 10 mg/l (for > 100,000 PE) (or 70 - 80% reduction)
- Total Phosphorus (Total P): < 1 mg/l (for > 100,000 PE) (or 80% reduction).

The main characteristics of the WWTP Project are summarized in **Table 1**.

**Table 1. The main characteristics of the WWTP Project[10]**

| | |
|---|---|
| Project proponent | Azerbaijan State Water Resources Agency (ASWRA)[11] |
| Estimated investment cost (CAPEX) | EUR 64,428 million, excl. VAT. |
| Design capacity for WW treatment | 400,000 PE.<br>Average dry weather flowrate of 95,540 m3/day. |
| Start and duration of construction phase | Planned construction starts in 2027. Duration of construction 36 months. |
| Estimated commission date of new WWTP | June 2029 |
| Design lifetime of new WWTP | 50 years (Civil works)<br>15 years (Mechanical works) |
| Estimated number of staff during construction | 100 |
| Estimated number of staff during operation | 21 |
| Estimated gross power consumption at full operation capacity (MWh/year) | 6,000 MWh/year |

It should be noted that the preliminary design on which the feasibility study was based, referenced a dated EU Urban Wastewater Management Directive. The Azerbaijan Ministry of Ecology will also need to define applicable treated effluent quality limits for the plant. It is assumed that between the two, the WWTP will be designed to comply with the most stringent quality limits.

[9] Annex 1 of the Directive.

[10] Sweco, 2024: Ganja Wastewater Treatment Plan – ESIA Scoping Report, updated based on the information from ASWRA as of April 2025.

[11] ASWRA replaced Azersu (i.e. the state company providing drinking water and sewage services) in 2024.

The proposed WWTP Project will utilise a three-step treatment process:

- Mechanical (Primary) Treatment: This initial stage will remove large debris using screens, settle out sand, and separate grease from the wastewater.
- Biological (Secondary) Treatment: The preferred technology for this stage is Extended Aeration using Oxidation Ditches. This biological process utilizes microorganisms to break down the organic pollution, including nutrients.
- Tertiary Treatment: The biologically treated effluent then undergoes tertiary treatment, potentially including disc filters and UV disinfection.

**Box 1: What is meant by Extended Aeration, Oxidation Ditches, Disinfection including Disc Filters and UV Disinfection**

***Extended aeration*** means a longer aeration period – i.e. longer time the wastewater stays in the aeration tank. This extended time facilitates a more complete breakdown of organic matter and supports the nitrification process (conversion of ammonia to nitrates). This type of technology leads to a more stabilized sludge and reduced excess sludge that requires disposal.

An ***oxidation ditch*** is a type of wastewater treatment system that uses a modified activated sludge process, also using microorganisms (bacteria) to break down organic pollutants and nutrients in wastewater. The 'ditch' is typically an oval-shaped channel, designed for continuous circulation of wastewater. This circulation is facilitated by aerators, which also introduce oxygen into the water.

Both extended aeration and oxidation ditches are variations of the activated sludge process. The extended aeration typically involves a series of rectangular tanks or compartmentalized package plants with generally linear flow, progressing through different treatment stages. In comparison, the oxidation ditches can be characterized by a continuous loop channel, where the flow is circular, with continuous circulation of the wastewater. There are also differences in the approach to aeration and mixing the wastewater, as well as in nutrient removal.

In tertiary treatment ***disc filters*** that are covered with filtration media (often a fine mesh fabric or a micro-screen) are used to further filter out remaining solids. When the wastewater flows through the filtration media on the discs, the particles are trapped on the surface of the media, while the filtered water passes through. Ensuring proper filtration is needed to enhance the effectiveness of the subsequent disinfection stage.

Disinfection is required to eliminate harmful microorganisms, such as bacteria, viruses, and protozoa, from the treated wastewater before the water is discharged back into the environment or reused. The disinfection proposed for the WWTP Project will primarily rely on ultraviolet (UV) radiation. Ultraviolet light, produced by UV lamps, penetrates the microorganism cell walls, is absorbed by their genetic material, preventing microorganism reproduction. UV disinfection primarily inactivates microorganisms, rather than killing them but avoids the need for chlorine, for example, which also has potentially negative downstream consequences.

The WWTP Project proposed for Ganja has the following process stages:

- Preliminary Treatment Stage
  - Coarse screens which serve to screen hard material such as sand, gravel and stones, that would otherwise inhibit the operation.
  - Inlet Pump Station; dry well arrangement (4 duty + 1 standby).

- Plant bypass will be designed for discharging inlet wastewater flow exceeding 3 times dry weather flowrate during storm situations – this is to manage the quantity of stormwater that goes through the system and ensure that the operation is not swamped.
- Fine screens.
- Aerated Grit (and grease) Removal.

- Secondary Treatment Stage
  - Primary effluent will be treated in an Anaerobic[12] Zone to facilitate biological phosphorus removal (1 hour retention time).
  - "Racetrack" shaped oxidation ditches to provide Aerobic Zones (oxidation of organics and for ammonia removal) as well as Anoxic Zones (for nitrogen removal – denitrification).
  - Secondary Settling Tanks for separation of activated sludge from treated effluent.
  - Treated effluent flow will have a simplified micro-filtration and UV disinfection system prior to discharge to Effluent Ponds for further tertiary treatment and further disinfection. Final effluent flowrate is to be measured and discharged to the effluent channel, and subsequently to the irrigation canal (where further dilution occurs) or the river. For local effluent re-use, an effluent manhole should be considered on the effluent line, where farmers can extract treated effluent via a pump.
  - Secondary Sludge Pump Station for transport of waste activated sludge to be thickened (water removed).
  - Picket Fence Thickener for thickening secondary sludge.
  - Although Biological Phosphorus Removal is included in the process design, chemical phosphorus removal will be provided as a back-up to meet the strict discharge quality standards.

The WWTP Project will also include:

- Buildings:
  - Administration Building;
  - Control Room with SCADA (Supervisory Control and Data Acquisition) system that provides for managing, monitoring, and controlling the WWTP;
  - Chemical Laboratory;
  - Maintenance Workshop;
  - Sludge Management Building;
  - Power Supply and Control.
- Standby generator for power supply.
- Instrumentation and control system, including local Programmable Logic Controllers and central SCADA system for monitoring and control.

[12] In the absence of oxygen.

- Site drainage to limit the amount of stormwater that can enter the WWTP.

No wastewater monitoring was included in the Feasibility Study (Sweco, 2024) and limited wastewater quality data are available. Effluent quality is based on the EU's Urban Wastewater Treatment Directive for projects >100,000 PE discharging to sensitive waters. The design criteria proposed in the 2024 Feasibility Study are set to meet EU Discharge Standards[13] (**Table 2**). The Goshgar River and the Irrigation Canal are receiving waters for the WWTP Project during the agricultural growth season. The new WWTP should have at least two separate parallel processing lines to facilitate maintenance, and the main elements of the mechanical equipment must have relevant capacities.

**Table 2. Design criteria as per the 2024 Feasibility Study[14]**

| Parameter | Design of 2024 | | Discharge Standard |
|---|---|---|---|
| | DWF Flow, Q | Conc. | |
| | $m^3/d$ | mg/L | mg/L |
| BOD5 | 95,564 | 243 | 25 |
| COD | 95,564 | 486 | 125 |
| TSS | 95,564 | 283 | 35 |
| Total-N | 95,564 | 59 | 10 |
| Total-P | 95,564 | 10 | 1 |

The pollution load to the river without the WWTP is shown in **Table 3** together with the anticipated percentage pollutant removal by the WWTP (designed for approx. 90% removal of organic pollution (BOD5) and nutrients (nitrogen and phosphorus)):

**Table 3. Reduction in pollution load to receiving waters[15]**

| Para-meter | Design Horizon: Year 2040 | | | Effluent Load (2040) | | | Improvement | |
|---|---|---|---|---|---|---|---|---|
| | Concentration | Flowrate | Load | Concentration | Flowrate | Load | % | kg/year |
| | mg/L | $m^3$/day | kg/d | mg/L | $m^3$/day | kg/d | | |
| BOD5 | 243 | 95,564 | 23,211 | 25 | 95,564 | 2,389 | 90% | 7,624,813.5 |
| COD | 486 | | 46,422 | 125 | | 11,946 | 74% | 12,547,495.5 |
| SS | 283 | | 27,080 | 35 | | 3,345 | 88% | 8,698,096 |
| Total-N | 59 | | 5,674 | 10 | | 956 | 83% | 1,718,938.3 |
| Total-P | 10 | | 928 | 1 | | 96 | 90% | 304,848 |

The WWTP infrastructure should have a green buffer zone surrounding the site, including planted trees and grass areas to limit visual and odour impacts (Sweco, 2024). This is normal good practice for WWTP design. Areas within the WWTP which potentially produce odours

[13] Note that the IFC has also published Indicative Values for Treated Sanitary Sewage Discharges in their general EHS Guidelines (www.ifc.org/ehsguidelines), incl.: BOD of 30mg/L; COD of 125mg/L; Suspended Solids of 50mg/L; Total Nitrogen of 10mg/L; Total Phosphorus of 2mg/L. These are similar to those published in the EU Urban Wastewater Treatment Directive (https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A31991L0271).

[14] Sweco, 2024: Ganja Water and Wastewater Feasibility Study Update, Feasibility Study Report.

[15] *Ibid.*

should be covered and gases collected and treated, e.g. at the inlet works (screens) and sludge dewatering equipment.

***Effluent Disinfection***

Cereal crops (processed crops, e.g. wheat, sunflower seeds) are grown in the region (Sweco, 2024). If the WWTP discharge were to be used for irrigation of these crops, secondary Treatment and Disinfection must meet EU Re-use Regulation, namely the strict effluent coliform concentration of 100 MPN/100mL. Assuming the existing effluent lagoons are operated as Maturation Ponds, the estimated coliforms in the effluent range from 100 MPN/100mL (in summer at 25$^{O}$C) to 30,000 MPN/100mL (in winter at 10$^{O}$C). Dilution in the Irrigation Canal of nominally a factor of 5 would further reduce the coliform content. Although the disinfection standard would be met at summer temperatures of 25$^{O}$C, it would not be met at lower temperatures, hence a simplified micro-sieving and UV disinfection system is required.

***Treated effluent polishing ponds***

The effluent ponds at the old WWTP reconstructed in 2020, will be used for final polishing of the treated effluent. In the treated effluent polishing ponds, treated effluent undergoes further purification through sunlight (UV inactivation), algae photosynthesis (oxygen release), bacterial action (consuming remaining organics), and sedimentation, significantly reducing pathogens, residual organic matter, and suspended solids for safer discharge or reuse. They are shallow, aerobic (freely available oxygen) and with long retention times, allowing sunlight penetration and high dissolved oxygen to kill bacteria and improve water quality.

### 2.4.8 WWTP Project Location

The WWTP Project will be located on an existing site where construction commenced in the 1980s but was never completed (**Figure 1** and **Figure 2**). There are three main components to the WWTP namely the mechanical plant itself, treated effluent polishing ponds and a sludge disposal area. The conceptual design presented by ASWRA (2024), and which will underpin the detailed design, with a capacity of 400,000 PE is shown in **Figure 3.**


**Figure 2. Layout of the proposed WWTP showing the mechanical plant itself, the treated effluent polishing ponds and the remaining part of the property that will be used for sludge disposal.**

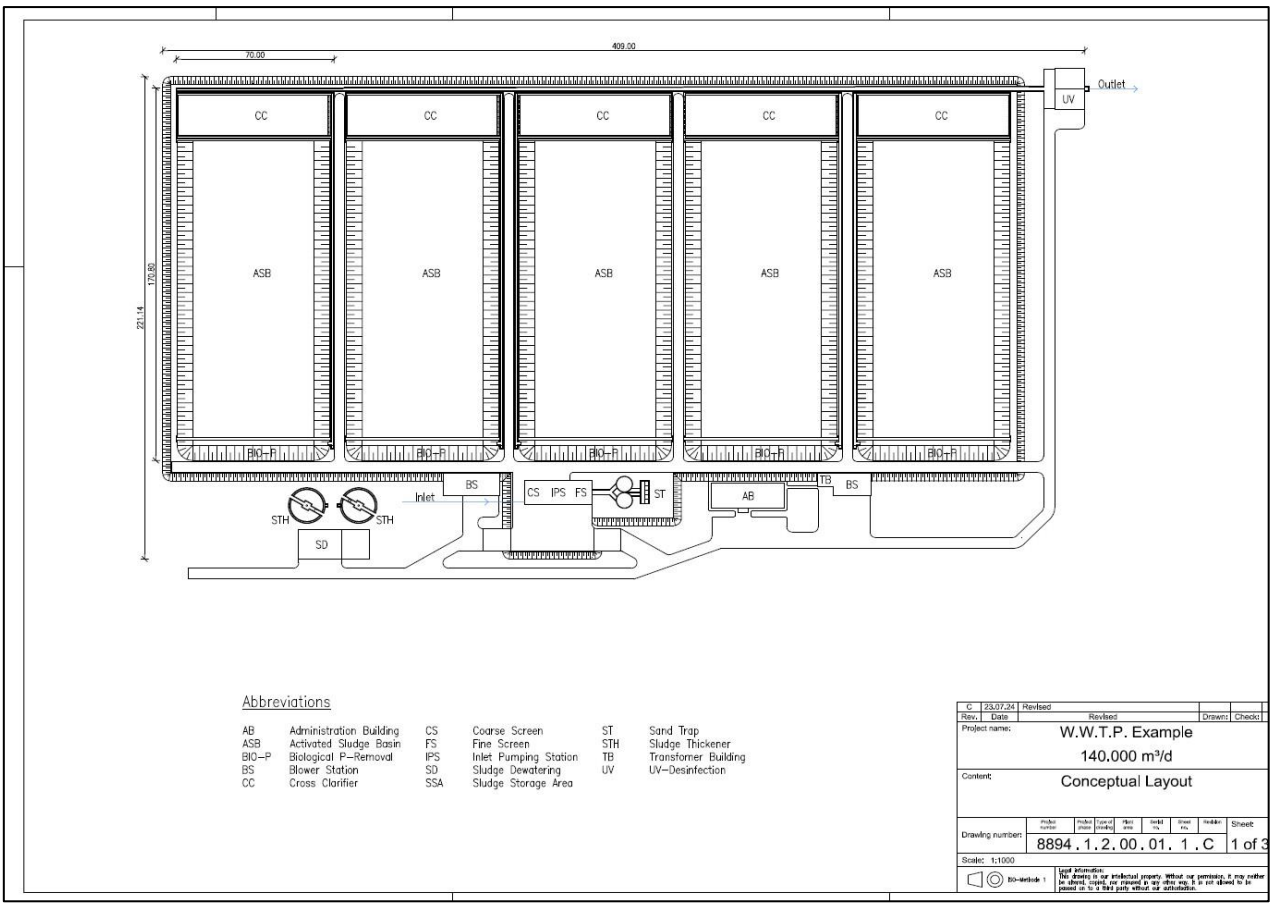



**Figure 3. Conceptual layout provided by ASWRA (2024)[16]**

### 2.4.9 On-site sludge storage

The overall land area that belongs to ASWRA is approximately 32-33 ha. The area required for the mechanical wastewater treatment works is 10 ha or (101,000 $m^2$). The area to the north of the WWTP for the treated effluent polishing ponds is some 11 ha (109,000 $m^2$), leaving about 7.5 ha (or 75,000 $m^2$) for sludge disposal. The sludge disposal wind rows[17] are likely to be 20 m long, 6 m wide and 3 m high implying the area required for sludge storage would be approximately 3.2 ha (32,000 $m^2$) given annual sludge production of 21,180 $m^3$ with 40% dry solids. The storage capacity translates into about 2 years' worth of sludge storage from the operational plant.

Once the storage area is exhausted sludge would need to be disposed so that there is ongoing storage capacity. An area north of the WWTP mechanical works has been identified as an additional potential sludge storage area (Figure 4). This land must be acquired, as it is not currently owned by ASWRA. Both storage areas will require leachate management infrastructure to ensure that there is no off-site discharge of stormwater that may be contaminated by contact with the sludge. Such captured leachate would likely be fed back into

[16] Sweco, 2024: Ganja Water and Wastewater Feasibility Study Update, Feasibility Study Report.

[17] 'Wind-rowed' sludge" refers to a method of drying sludge that has already undergone initial dewatering. In this process, the dewatered sludge, typically at a solid content of around 20-25%, is stored on-site in wind rows. The primary purpose of windrowing is to increase the dry solids content of the sludge, aiming for approximately 40%. This drying occurs naturally, exploiting the natural heat production from the biological degradation of the sludge and letting it dry in normal weather.

the mechanical treatment works of the WWTP. Provision must also be made to prevent off site stormwater from flowing into the sludge storage area.

No information is presented in the FS on closure and rehabilitation of the sludge storage area. And ensuring the closed site posed no future risk to public health or the environment. Such planning would need to be completed prior to the decommissioning of the plant and include a detailed site assessment, remediation of contaminated soil and water, proper disposal of residual sludge, and ongoing monitoring.

### 2.4.10 Sludge disposal

The sludge cannot be stored indefinitely and so there will need to be a mechanism for sludge disposal. A definitive arrangement for medium to long term sludge disposal has not been finalised and this introduces environmental and social risks. The use of the sludge for biogas production, thereby reducing energy requirements and associated GHG emissions is not included in the current WWTP planning.

The preferred option for sludge disposal is agriculture application as a fertiliser especially for the proposed WWTP because of widespread agriculture near the plant, low capital costs, and low operating costs (mostly sludge transport). Agriculture re-use is limited by the risk of the sludge introducing pollutants, especially heavy metals and for the WWTP that risk would derive from industrial sources of effluent. Given that the only industrial operation that could introduce heavy metals does not discharge to sewer, the risk of such contamination in the sewage sludge is considered low.

For agriculture application, sludge must be stored long enough for hygienization, the natural heat production of the sludge biological degradation which further sterilises the sludge. Sludge quality must be monitored to ensure it is suitable for re-use (i.e. agricultural application). ASWRA must also control industrial polluters to meet discharge standards, so pollutants are not concentrated in the WWTP sludge, precluding agricultural application. The importance fo controlling the pollution load must also be seen considering landfill as an alternative disposal option.

The Ganja landfill does not comply with EU standards and so pollutant accumulation in the sludge, would potentially preclude such disposal. There is no hazardous waste disposal facility and finally, landfilling is sub-optimal because the landfill capacity would be precluded prematurely. Incineration can also be used for sludge disposal but the capital and operating costs are very high, especially where agriculture re-use is a potentially viable option. As such ensuring agriculture application is a key imperative for ASWRA in respect of associated benefits and low capital and operating costs.


**Figure 4. Proposed additional sludge storage area. Note that this land would have to be acquired by ASWRA.**

### 2.4.11 Access Road to WWTP

An access road is required for vehicles to enter and exit the facility for operations and maintenance without obstruction. The proposed WWTP site is accessible via two options as outlined below (**Figure 5**):

1. Direct access from the paved highway R21 to the WWTP is cheaper, and although the road carries little traffic, for safety reasons easy access off the highway to avoid traffic congestion would be required – viz. road widening (cost is included in the budget);
2. Access via an existing unpaved road from Ziyadli Road (which branches off the R21 main road). This more expensive option would require construction of a paved access road of approx. 300m and width of 5m.

No other options were considered in the 2024 Feasibility Study due to the existing possibility to access the site through public roads.


**Figure 5. Proposed access road routes off the R21 to the WWTP site layout[18]**

## 2.5 Project Alternatives

### 2.5.1 WWTP location

No WWTP site location alternatives are considered as the WWTP is planned to be located at a site where construction of a WWTP was initiated during Soviet times but never completed. The choice of location has been researched for the ESIA, but there seems to be no clear criteria on why that location for the original construction site other than possibly proximity to agricultural activities. The 2016 EIA refers to 'two other sites' but no details are provided on those 'other' sites. In the JV Dornier-Schneider Consulting / Stucky. May 2014 - the old WWTP site is simply deemed suitable and no alternative sites were investigated. Two potential sites are mentioned in the Joint Venture DAR – MACS - undated FS for Ganja, but there is no mention of how the sites were assessed and no maps were provided. In the absence of more definitive information, the following benefits can be attributed to the site selected:

[18] Sweco, 2024: Ganja Water and Wastewater Feasibility Study Update, Feasibility Study Report.

- The site belongs to ASWRA and so there is no involuntary resettlement required and no direct, material impact on agricultural land.
- Some of the existing infrastructure is available for use as part of the new WWTP, notably the treated effluent polishing ponds.
- The area is heavily transformed meaning the low risk of loss of habitat.
- A buffer area around the plant has been maintained, despite the proximity of some residential areas (to the east).

### 2.5.2 Treatment & Sludge Management Options

The two main options for consideration of the treatment process for WWTP Project were addressed in the Feasibility Study (Sweco, 2024):

- Option 1: *Conventional Activated Sludge with biogas production but replacing the Secondary Stage with Oxidation Ditches*. Primary Treatment with anaerobic sludge digestion with production of biogas for combustion in a Combined Heat and Power plant (CHP) for production of electricity. Sludge would be thickened and dewatered to 25% solids, dried in windrows, stored on-site prior to long- term disposal for agricultural re-use.
- Option 2: *Secondary Treatment only via the application of Oxidation Ditches* (as proposed in the Conceptual Design Report[19]). Sludge thickening and dewatering of aerobically digested sludge (to 25% solids), however *no biogas production for electricity generation*. Final sludge disposal would be agricultural re-use, or at the municipal landfill.

The advantages and disadvantages of both options are provided in **Table 4**.

**Table 4. Advantages and disadvantages of treatment options[20]**

| Issue | Option 1: Activated Sludge (Anaerobic Digestion and Oxidation Ditch) | Option 2: Oxidation Ditch (no Anaerobic Digestion) |
|---|---|---|
| Operations | Process is more complicated due to Primary Treatment stage and Secondary Treatment stage. | Process is simpler (only Secondary treatment), hence operations easier. |
| Maintenance | Primary Treatment has less requirements for equipment maintenance (limited to mixing and heating in digesters). | Secondary treatment has more equipment for maintenance (blowers, fine bubble diffusers, valves and instrumentation). |
| Power consumption | Primary treatment reduces power consumption, and biogas process recovers power. OPEX reduced due to lower power costs. | High electricity consumption, with no opportunity to recover power. Consequently, OPEX is higher. |
| Climate Impacts | Climate impact reduced due to reduced power consumption. | Climate change impact is higher due to higher power consumption. |
| Sludge management | Primary sludge is easier to dewater (25% dry solids), hence a reduction in volume of sludge for disposal. | Secondary sludge is less easy to dewater (15-20% dry solids), hence modestly more sludge for disposal. |

[19] Dornier-Schneider Consulting, 2017: Conceptual Design Report for the WWTP in Ganja.

[20] Sweco, 2024: Ganja Water and Wastewater Feasibility Study Update, Feasibility Study Report.

| Issue | Option 1: Activated Sludge (Anaerobic Digestion and Oxidation Ditch) | Option 2: Oxidation Ditch (no Anaerobic Digestion) |
|---|---|---|
| | Economically, anaerobic digestion of the sludge with biogas production and combustion, is preferred. For dealing with the digested sludge from the Anaerobic Digestion (AD) process, in order of preference | This alternative option is also acceptable (higher electricity consumption +but simpler and thus more likely that plant will be operated correctly and achieve required treatment performance. |

Both options were discussed with ASWRA during the feasibility stage (Sweco, 2024), and according to the current information, the decision on the technological option has been made and the ASWRA will proceed with Option 2, i.e. with an extended aeration process with nutrient removal. This choice has been based on several key factors, including operational simplicity, robustness, and alignment with the technical and human resource capacities available for long-term plant operation.

For dealing with the digested sludge from the Anaerobic Digestion (AD) process, in order of preference:

- Sludge re-use for agricultural consistent with the EU Sewage Sludge Directive[21] and management requirements and exploits the benefit of low-grade fertilizer value. The available land adjacent to the WWTP would be for long term sludge disposal.
- Sludge storage on-site (at the WWTP site) or at a long-term storage facility. Although feasible due to available land there are no economic benefits. There might be opportunity for re- using some of the sludge for horticulture or land rehabilitation uses.
- Long-term disposal at landfill but this reduces the municipal landfill lifetime with no economic benefits.
- Sludge disposal via incineration is not viable due to high Capital Expenditure (CAPEX) and OPEX.

The treated sludge disposal options will be further discussed and assessed in the impact assessment phase.

### 2.5.3 Alternative Options of Effluent Discharge Pipeline

There are also two alternatives of the effluent discharge pipeline, i.e. discharging to the river at 8.2km (*Route 1*), and 4.5km (*Route 2*), respectively (**Figure 6**).

ASWRA proposes to discharge treated effluent to the Irrigation canal during the growing season and to the river during the non-growing season[22]. The Conceptual Design Report (Dornier-Schneider Consulting, 2017) proposed an 8.2km pipeline, a 4.5km route parallel to the Irrigation Canal is also possible mostly through agricultural land (**Figure 6**). This shorter route was also recommended by the State Environmental Expertise in 2016.

These alternatives were compared according to:

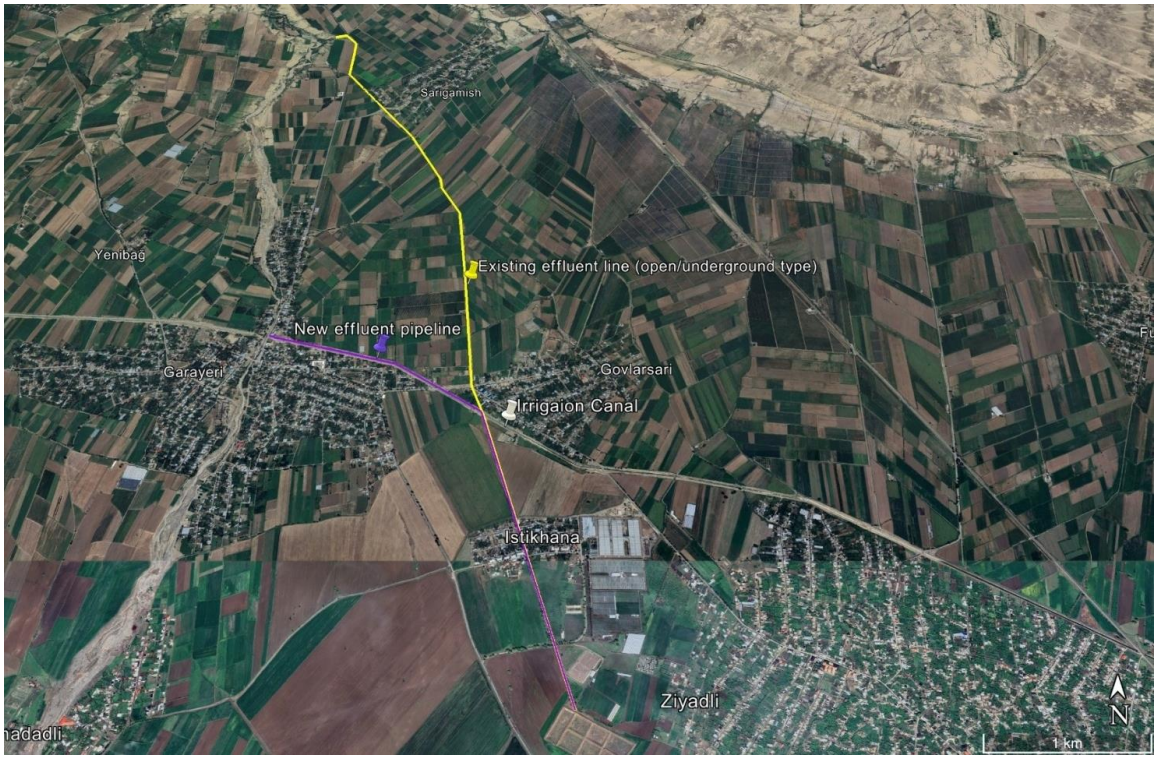
1. National and local government restrictions;

[21] Council Directive 86/278/EEC on the protection of the environment, and in particular of the soil, when sewage sludge is used in agriculture.

[22] Dornier-Schneider Consulting, 2017: Conceptual Design Report for the WWTP in Ganja.

2. Use of existing corridors of other linear facilities whenever possible, while maintaining safe distances between facilities;
3. Access to the route during construction;
4. Avoiding/minimizing direct negative impacts of treated effluent on population, including land acquisition and resettlement/economic displacement;
5. Locating the pipeline so that it crosses other infrastructure facilities at angles greater than 70°.
6. Possibility to connect to the irrigation canal.

The analysis of these alternatives is presented in **Table 5**.




*Prepared by the ESIA Consultant*

**Figure 6. Proposed alternative effluent discharge pipeline routes from Ganja WWTP to the irrigation canal and river[23]**

**Table 5. Evaluation of the Alternative Options of the Effluent Discharge Pipeline**

| # | Criteria | Route 1. Discharge to the river at 8km | Route 2. Discharge to the river at 4.5 km |
|---|---|---|---|
| 1 | National and local government restrictions:<br>• Shortest overall distance to discharge point;<br>• Effluent line: open or closed | The State Environmental Expertise body rejected the possibility of using this option, based on the following criteria:<br>• Route 1 is almost twice the | The State Environmental Expertise approved the implementation of Route 2 (4.5km) based on the following criteria: |

[23] Sweco, 2024: Ganja Water and Wastewater Feasibility Study Update, Feasibility Study Report.

| # | Criteria | Route 1. Discharge to the river at 8km | Route 2. Discharge to the river at 4.5 km |
|---|---|---|---|
| | type? | length of Route 2<br>• An open channel cannot be used for transport of treated wastewater, especially nearby settlements. | • shortest overall distance to a discharge point;<br>• closed channel has been suggested in two technical designed (concrete channel or pipe) |
| 2 | Use existing corridors of other linear facilities whenever possible, while maintaining safe distances between facilities | In an existing channel | In the corridor of an existing irrigation channel |
| 3 | Access to the route during construction | Yes | Yes |
| 4 | Avoid/minimize direct negative impacts of treated effluent on local communities, including land acquisition and resettlement/economic displacement; | Being open - could affect nearby houses in Istikhana, Govlarsari and Sarigamish | Being closed-type will not affect the local community |
| 5 | Locate the pipeline so that it crosses other infrastructure facilities at angles greater than 70°. | Yes | Yes |
| 6 | Possibility to connect to the irrigation canal | Yes, Shyamkir Canal is 2.4km from the WWTP and both routes overlap at this section. | |

The effluent line would run from the existing effluent ponds, traverse the adjacent fields (agricultural area) via the existing route of the old discharge line (the first 2.4 km). Then, Route 2 pipeline would follow an existing road to the border of Istixana village and continue along the existing road to the Shyamkir Irrigation Canal to the main road (and tunnel under the main road to the river) (**Figure** 7).


**Figure 7. Effluent pipeline route 2 from WWTP to the Goshgar River[24]**

### 2.5.4 Electricity supply

A new electrical transmission line and substation to connect the WWTP to the national electrical grid will be required for the project. Electricity in Azerbaijan is supplied by Azerenerji OJSC and Azerishiq OJSC. Technical conditions for the connection were previously defined, although these expired in 2019.[25]

The power line routing is unknown currently as the previous Connection Conditions are no longer valid and power loads have changed in the system. The connection point will be indicated by the Ministry of Energy together with Technical Connection Conditions. The Contractor will be required to prepare power management and consumption documentation and acquire all needed permits, including approval for the routes. Power will be established early in the construction process, for use in construction.

### 2.5.5 Alternative Energy Supply

Solar power panels (PV) could be installed to ensure energy-neutral operations of the WWTP, but this is not in ASWRA's current planning.

### 2.5.6 Access to treated wastewater

Given the agricultural activities in the area there is considerable interest from locals in sourcing the treated water for irrigation purposes. Currently, the planning is for discharge into the Goshgar River via a pipeline, but there is also the option of discharge into the Shamkir Machine

[24] Sweco, 2024: Ganja Water and Wastewater Feasibility Study Update, Feasibility Study Report.

[25] Sweco, 2024: Ganja Wastewater Treatment Plan – ESIA Scoping Report.

Canal, followed by irrigation of agricultural lands. Once, the detailed design of the WWTP is completed (2027), a final decision will be made by ASWRA on whether to discharge into the river or into the canal. It is instructive to note treated water from a reconstructed facility in Baku being used to irrigate thousands of hectares of gardens under a contract with ASWRA, on the Absheron Peninsula. The role of local water users' associations in managing such arrangements and collaboration between ASWRA and the local population, will be crucial for implementing a similar solution in Samukh should that ultimately be decided.

## 2.6 Associated Facilities[26]

There are no associated facilities for the proposed WWTP.

[26] "These are new facilities or activities: i) without which the project would not be viable, and ii) would not be constructed, expanded, carried out or planned to be constructed or carried out" (EBRD E&S Policy. 2019. Section II. Definitions).

# 3 LEGAL, REGULATORY AND LENDER FRAMEWORK

## 3.1 Azerbaijan

**Environmental (and social) impact assessment:**

- **Environmental Protection Law (1999)** provides the overarching legal, economic, and social framework for environmental protection. It aims to preserve ecological balance, protect biodiversity, and regulate interactions between society and nature.
- **EIA Law (2018)** implements Article 54.2 of the Environmental Protection Law. Mandates EIA for public and private projects, including consultation with the Ministry of Ecology. Defines scope, alternatives, and mitigation measures.
- **EIA Regulations (2022**) requires developers to submit project applications and consult with the State Environmental Review Agency during the pre-design phase. Requires public participation and official publication of the scoping phase.

**Surface Water & Wastewater Management:**

- **Water Code (1997)** regulates the use and protection of water bodies and that drinking water must meet sanitary norms. Municipalities designate sources in consultation with national agencies.
- **Wastewater Law (1998)** governs water supply and effluent discharge, emphasising cost recovery, rational water use, and establishment of purification systems. Requires zoning for utility services.

**Air Quality: Law on Protecting the Atmosphere (2001)** governs emissions, air quality standards, and inventory of pollution sources.

**Noise: Noise Decree (2008)** establishes maximum permissible limits for indoor and outdoor noise and vibration in residential areas.

**Conservation: Fauna Law (1999), Green Belts Law (2014), and Protected Areas Law (2000)** establish biodiversity conservation, management of reserves, and use for research and recreation.

**Sanitary Protection Zones (SPZ): Building rules and regulations "Planning and construction renovation of city, town and rural settlement" AzDTN 2.6.1** define buffer zones (100–1000m) between WWTPs and residential zones, modifiable based on technical assessments.

**Occupational Health and Safety (OHS): Labour Code (No. 618-IQ)** establishes safety obligations for employers, mandates protective equipment, and regulates working/resting hours.

**Labour and Human Rights:**

- **Constitution (1995), Labour Code (1999) and the Employment Law (2018)** guarantee equal work rights, gender equity, and freedom of profession.
- **Gender Law (2006) and Unemployment Insurance (2017)** outline gender-based protections and compensation for job loss.
- **ILO Conventions**: Azerbaijan is party to all core conventions including freedom of association, equal pay, minimum age, and forced labour prohibition.

**Land Acquisition and Social Safeguards:**

- **Land Code (1999), Civil Code (1999) and Land Acquisition Law (2010)** ensure full compensation for compulsory acquisition. Covers informal users and requires court registration of state need.

- **Resettlement Plans (Cabinet Decree 2012)** required for projects affecting 200+ people. Include compensation, options, and legal remedies.
- **Law on Right to Information (2005)** ensures public access to information related to environmental decisions.
- **Grievances Law (2015)** formal mechanism for citizens to raise issues with public decisions.

**International Conventions and Treaties:** Azerbaijan has ratified key conventions including the Aarhus Convention (access to environmental information), UN Conventions on Human Rights, Child Rights, Women's Rights, and the Convention on Intangible Cultural Heritage.

## 3.2 EBRD

The main requirements of the EBRD for its own activities are formulated in the Bank's ESP (2019), and the requirements for the E&S aspects of the Client's activities are set out in the Performance Requirements (PRs)[27]. The ESP sets E&S requirements for the EBRD clients' activities to achieve sustainable results. The following is a summary of the requirements applicable to this Project[28]:

- **PR 1: Assessment and Management of Environmental and Social Risks and Impacts** requires the EBRD client to conduct an E&S assessment and / or audit. Assessment is carried out for all stages of the project (construction, operation, decommissioning). Based on the assessment and audit, an Environmental and Social Action Plan (ESAP), an Environmental and Social Management Plan (ESMP), and other plans are developed. An important feature of the EBRD's requirements is the *concept of associated facilities* that are not financed by the Bank, and therefore are not part of the project, but which are significant in determining the success of the project. These associated facilities may be carried out by both the client of the Bank and other parties. However, they should be part of the E&S assessment. PR 1 is also applicable to contractors involved in project implementation. EBRD requires borrowers to implement an E&S Management System (ESMS) appropriate to the nature of the project, as well as reporting to EBRD on the project's E&S performance, including compliance with the relevant PRs and the approved ESMS, ESMP, ESAP, SEP and other documents or commitments.
- **PR 2: Labour and Working Conditions** establishes requirements in terms of labour and working conditions, including the prohibition of forced and child labour in the project. The PR 2 requirements are based on the conventions of the ILO.
- **PR 3: Resource Efficiency and Pollution Prevention and Control** requires efficient use of energy, water and resources, and minimisation of waste, as well as compliance with good international practice (GIP), and application of a mitigation hierarchy. This PR is based on the principles of the EU Industrial Emissions Directive (Integrated Pollution Prevention and Control)[29] and calls for the implementation of EU requirements on the use of Best Available Techniques (BAT) and related standards for emissions and discharges.

[27] EBRD. 2019. ESP. https://www.ebrd.com/news/publications/policies/environmental-and-social-policy-esp.html.

[28] PR 7: Indigenous peoples and PR 9: Financial Intermediaries are not applicable to this Project.

[29] Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on Industrial Emissions (Integrated Pollution Prevention and Control). https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32010L0075.

- **PR 4: Health, Safety and Security** requires the client (borrower) to identify and assess community and occupational health and safety risks and implement preventive measures. The focus is on preventing and eliminating risks rather than reducing and minimising them.
- **PR 5: Land Acquisition, Restrictions on Land Use and Involuntary Resettlement** defines requirements related to project-induced land acquisition, including restrictions on land use and access to assets and natural resources, which may cause physical displacement (relocation, loss of land or shelter), and/or economic displacement (loss of land, assets or restrictions on land use, assets and natural resources leading to loss of income sources or other means of livelihood). The key requirement of PR5 is to avoid or, when unavoidable, minimise, involuntary resettlement via feasible alternative project designs/sites. A resettlement framework, including livelihood restoration where needed, is developed in an early stage of the project to detail resettlement principles and organisational arrangements.
- **PR 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources** determines the requirements for the conservation of biological and landscape diversity in the development area. PR 6 requires the borrower to characterise the state of biodiversity, identifying sensitive species and habitats, and developing measures to avoid / reduce impacts. PR 6 defines criteria for critical habitat screening and requires developing a Biodiversity Action Plan (BAP) or Biodiversity Management Plan (BMP) where significant adverse impacts on biodiversity are expected.
- **PR 8: Cultural Heritage** defines the requirements for the preservation of both tangible and intangible cultural heritage. PR 8 requires exploring the presence / possibility of the presence of objects of cultural heritage in the project's area of influence. Where the assessment identifies that the project may have material impacts on cultural heritage, the client is required to develop a cultural heritage management plan.
- **PR 10: Information Disclosure and Stakeholder Engagement**. The EBRD requires careful and systematic stakeholder identification, including communities that may be affected by project impacts (affected groups) and groups whose vital interests may be affected by projects (vulnerable groups). The EBRD requirements for organising stakeholder engagement are also set out in its Access to Information Directive[30]. Meaningful stakeholder consultations are viewed by the EBRD as an ongoing process throughout the project lifecycle. The EBRD's stakeholder engagement requirements are detailed in the draft Stakeholder engagement Plan (SEP) for the Project.

## 3.3 EU Environmental Directives

At the outset it must be recognised that Azerbaijan is not a member of the EU. At the same time, the EBRD is compelled to promote compliance with EU directives, however, in the projects they finance. The Directives are listed and described below. Of the directives listed below, the EU Habitats and Birds Directives have not been implemented in Azerbaijan and so the assessment framework for Critical Habitats assessment does not exist in the country.

[30] EBRD. 2019. Access to Information Directive. www.ebrd.com/documents/strategy-and-policy-coordination/access-to-information-policy-directive.pdf?blobnocache=true.

**Environmental and social impact assessment: EIA Directive (2014/52/EU)** requires impact assessment for projects likely to cause significant environmental effects, and emphasizes public involvement, transparency, and mitigation.

**Water and waste:**

- **Water Framework Directive (2000/60/EC)** introduces River Basin Management Plans, quality status categories, and an objective to achieve at least 'good status' for all EU waters. **Urban Wastewater Directive (2024/3019)**[31] requires secondary treatment of all wastewater in settlements >2,000 PE. Sensitive areas need more advanced treatment. The new revision expands monitoring, sustainability, and energy recovery. This Directive concerns the collection, treatment and discharge of urban wastewater and the treatment and discharge of wastewater from certain industrial sectors. Its objective is to protect the environment from adverse effects of wastewater discharges.
- Council Directive (91/271/EEC) concerning urban wastewater treatment was superseded by the above Urban Wastewater Directive but is still relevant because the WWTP Feasibility Study was conducted within the requirements of this directive, notably complying with the discharge standards in the directive. In the Feasibility Study is noted that discharge standards will be agreed with the Ministry of Ecology and incorporated as performance criteria in the detailed design.
- **Sewage Sludge Directive (86/278/EEC)** limits heavy metals in soil, mandates sludge analysis, and requires record-keeping.
- **Water Reuse Regulation (2020/741)** establishes EU-wide minimum quality and monitoring standards for irrigation reuse.
- **Waste Framework Directive (2008/98/EC)** introduces waste hierarchy, polluter pays, and extended producer responsibility.

**Noise Regulations: EU Noise Directive (2002/49/EC)** requires mapping of environmental noise, public information, and mitigation planning.

**Air Quality: Ambient Air Quality Directive (2008/50/EC)** sets pollutant limits (e.g., $PM_{2.5}$, $NO_2$, $SO_2$, $O_3$) and targets long-term protection of human health and vegetation.

**Conservation: EU Habitats and Birds Directives** create the Natura 2000 network and enforce protection of sensitive species and ecosystems.

**Occupational Health and Safety (OHS):**

- **OHS Framework Directive (89/391/EEC)** requires risk assessment, training, and worker participation in workplace safety.
- **Construction Safety Directive (92/57/EEC)** sets up coordination roles for safety in projects with multiple contractors, mandates a pre-construction health and safety plan.

## 3.4 The National EIA processes

Project developers must consult with the State Ecology Expertise (SEE) Agency within the Ministry of Ecology and Natural Resources (MENR) during the pre-design phase for determining the scope of the EIA. As such, for the Ganja WWTP, ASWRA must:

[31] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=OJ:L_202403019

1. Engage an EIA practitioner and then apply for pre-design consultations with the SEE. The application must include a project description and proposed scope of the assessment.
2. Within 3 days of receipt, the application, project description, and assessment scope, will be published by the Agency on its official website for public review and comment.
3. Following the submission, there is consultation between the developer and the SEE to define the exact scope of the required EIA.
4. The EIA practitioner then conducts the assessment based on the agreed scope. The assessment includes identifying and assessing potential impacts and mitigation.
5. A final EIA report, including project impacts, alternatives, mitigation measures and monitoring plans, is submitted to the SEE for approval, which is a prerequisite for a construction permit.
6. Public consultation during detailed design will be conducted in accordance with the national EIA (OVOS) process including public hearings (expected in 2027). National legislation provides for access to information and public participation during this process.

## 3.5 SPZ Requirements

SPZs around WWTPs are regulated by state building rules and regulations "*Planning and construction renovation of city, town and rural settlement*" AzDTN 2.6.1. (2001) and AzDTN 2.11-2 "Sewerage. External network and facilities".[32]

These zones serve to mitigate health risks by ensuring a buffer between WWTPs and residential or sensitive areas (such as public facilities and food industry areas). The size of the SPZ depends on the capacity and type of the facility, to prevent contamination and odour issues. AzDTN 2.11-2 sets a 500 m normative SPZ for WWTPs with a capacity of over 50,000 $m^3$/day (which is a case for Ganja WWTP).

The size of SPZ for the planned WWTP facility will be determined by ASWRA during detailed design, in consultation with the authorized bodies. As per AzDTN 2.11-2, the SPZ "may be increased by up to 2 times in cases where residential buildings are located in areas where the wind blows from the direction of the treatment facilities or reduced by up to 25% in the event of a favourable wind schedule". No / limited agricultural production will be permitted in the SPZ.

A protection buffer strip is to be arranged for the effluent discharge pipeline. This buffer is set at 10 m strips to both sides of the pipeline and ensures access to the facility during operations and maintenance.

[32] AzDTN 2.11-2 Kanalizasiya. Xarici şəbəkə və qurğular. https://arxkom.gov.az/qanunvericilik/normativler/muhendis-sistemleri/kanalizasiya-xarici-sebeke-ve-qurgular [NB: this standards superseded SNiP 2.04.03-85 "Sewerage. External networks and structures"].

# 4 ESIA METHODOLODY

## 4.1 General information

Environmental and Social Impact Assessment (ESIA) is the process of identifying potential E&S impacts of a proposed activity, assessing the magnitude and significance of those impacts, and developing measures to avoid and/or mitigate negative impacts and enhance positive effects. A key element of the ESIA is stakeholder engagement.

## 4.2 ESIA Process

The key elements of the ESIA are:

- **Scoping** - Preliminary assessment and identification of key issues.
- **Detailed assessment** - collection and analysis of information on E&S baseline conditions; analysis of alternatives; assessment of impacts and risks, and defining mitigation of negative impacts and enhancing benefits together with monitoring and management activities (this document),
- **Consultation** with stakeholders throughout the process.

The scheme for conducting the ESIA is presented below (**Figure 8**).

### 4.2.1 Scoping - Preliminary assessment and identification of key issues

Scoping (this document) serves to scope the assessment required. The approach used here is to identify all project **activities** (for both construction and operations) and for each activity to determine the E&S **aspects**. Aspects are defined as 'elements of an organization's activities that *interact* with the environment' and perhaps the best way of thinking about aspects is the inputs (resources) required by a project and the associated outputs (products, waste and pollution). Social aspects include jobs, spending and skills development. An E&S baseline is also described, highlighting sensitive or vulnerable **E&S receptors**[33]**.** Potential impacts are identified and preliminarily assessed as possible changes to those receptors brought about by the aspects. Scoping is concluded by defining what needs to be assessed and how, in the detailed impact assessment phase.

### 4.2.2 Detailed assessment

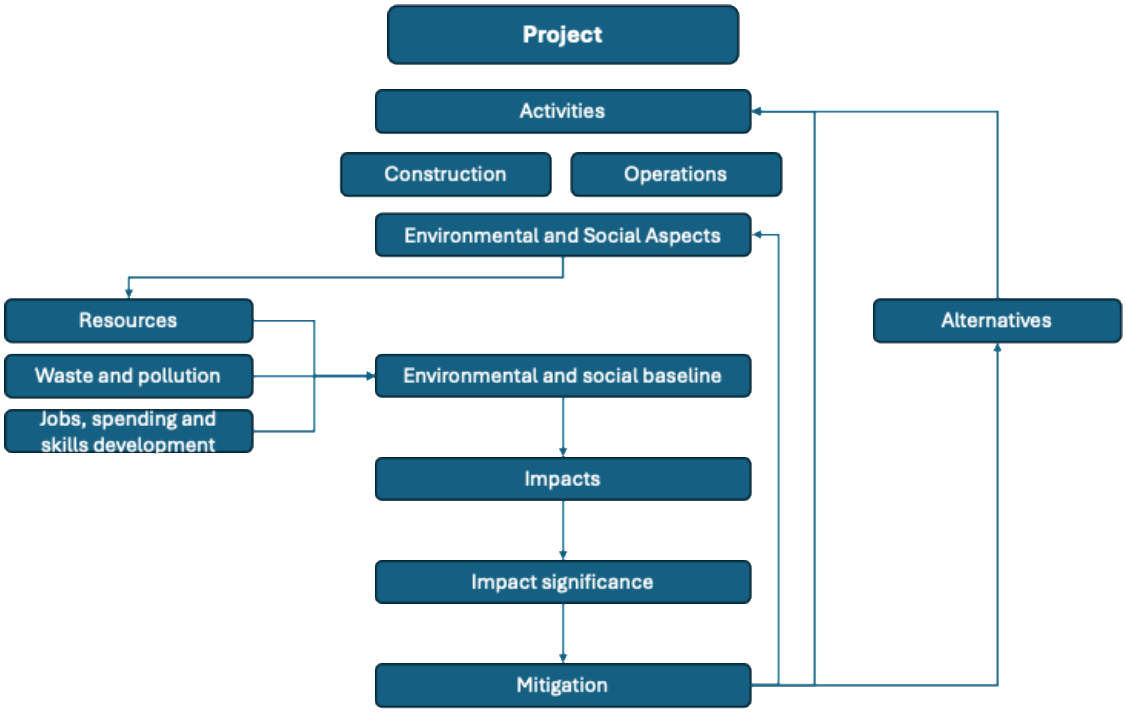
The following types of Project impacts are considered:

- **Direct impacts**: Project impacts arising directly from Project activities and associated E&S aspects. These impacts are typically realized at the same place and time as where and when the Project is implemented. They are also referred to as primary impacts because they have direct consequences for the natural or social environment; for example, wastewater discharge from the operation into an adjacent river.
- **Indirect impacts**: may be caused by activities not included in the Project but related to it and/or caused by its implementation. Such impacts often occur over time, affect a wider area, but are reasonably predictable; For example, off-site power generation, that provides electricity to the project.
- **Cumulative impacts**: may result from the combination of the various impacts of the project itself and/or several projects/activities in the same area. Cumulative

[33]An example of ecological receptors are habitats disturbed as a result of excavation/construction works; an example of social receptors are residents of the district centre who may be employed as construction workers or workers at the planned mining and processing plant.

impacts may also result from the gradual build-up of the impacts of one activity when they add up to the impacts of other past, present and reasonably foreseeable future activities.

While it is the changes to receptors, that are defined as impacts, it is the consequence of those changes that is used to define impact significance. Impact significance is a function of receptor sensitivity and the magnitude of the change (impact).




*Source: Prepared by the ESIA Consultant*

**Figure 8. Conceptual presentation of the ESIA process**

#### 4.2.2.1 Assessment of receptor sensitivity

The proposed descriptors and criteria for the sensitivity of a receptor are given in **Table 6**.

**Table 6. Criteria for assessing receptor sensitivity**

| Sensitivity | Main Criteria Descriptors |
|---|---|
| High | High or very high importance and rarity, international or national scale and very limited to no potential for substitution |
| Medium | Medium importance and rarity, regional scale, limited potential for substitution |
| Low | Low importance and rarity, local scale |
| Very low | Very low importance and rarity, local scale |

#### 4.2.2.2 Assessment of impact magnitude

The proposed descriptors and criteria for impact magnitude are given in **Table 7.**

**Table 7. Criteria for determining the magnitude of impacts**

| Magnitude category | Main criteria |
|---|---|
| High | Loss of the resource and/or its quality and functional condition; severe damage to its key characteristics, permanent / irreversible change of its properties or components (Adverse impact) |
| | Large-scale or substantial improvement in the quality of the resource; major restoration or |

| Magnitude category | Main criteria |
|---|---|
| | improvement, permanent change in the form of significant improvement in quality characteristics (Positive Impact) |
| Medium | Loss of a resource that does not lead to a deterioration in its functional condition, partial loss or deterioration of key characteristics, properties or constituent elements (Negative impact) |
| | Improvement or addition of key characteristics, properties or constituent elements; qualitative improvement (Positive impact) |
| Low | Some measurable change in parameters, quality or vulnerability, minor loss or alteration to one (or more) key characteristics, properties or constituent elements (Adverse Impact) |
| | Minor improvement or addition to one (or more) key characteristics, properties or elements, some positive effect on resource parameters, or a reduced risk of a negative impact (Positive Impact) |
| Negligible | Very minor loss or deterioration of one or more characteristics, properties or constituent elements (Adverse Impact) |
| | Very minor improvement or addition of one or more characteristics, properties or constituent elements (Beneficial Impact) |
| No change | No loss or alteration of characteristics, properties or constituent elements, no noticeable impact in either direction. |

#### 5.2.2.1 Assessment of impact significance

Impact significance is based on a matrix that combines receptor sensitivity and impact magnitude (**Table 8**).

**Table 8. Impact Significance Matrix**

| Impact Magnitude | Receptor Sensitivity / Value | | | |
|---|---|---|---|---|
| | High | Medium | Low | Very Low |
| High | Major | Major | Moderate | Minor |
| Medium | Major | Moderate | Minor | Minor |
| Low | Moderate | Moderate | Minor | Negligible |
| Negligible | Moderate | Minor | Negligible | Negligible |

The significance of impacts is based on reasoning and professional judgment and considers stakeholder views. In some cases, impact significance may be quantified using thresholds and scoring criteria but generally significance is expressed qualitatively. The four impact significance categories are summarized in **Table 9**.

**Table 9. Criteria for determining the significance of impacts**

| Significance category | Main Criteria Descriptors |
|---|---|
| Major | Very large or large magnitude of change in environmental or socio-economic conditions. Impacts, both adverse and beneficial, which are likely to be important considerations at a national and regional level or could result in violation of statutory environmental regulations. |
| Moderate | Intermediate magnitude of change in environmental or socio-economic conditions. Impacts that are likely to be important considerations at a regional and local level. |
| Minor | Small magnitude of change in environmental or socio-economic conditions. Impacts may be raised as local issues but are unlikely to be of importance in the project's permitting and approval process. |
| Negligible | No discernible change in environmental or socio-economic conditions. Impacts that are likely to have a negligible or neutral influence, irrespective of other impacts. |

#### 4.2.2.3 Assessment of Residual Impacts

Residual impacts are those likely to occur after mitigation and enhancement of positive impacts and other management measures. Stated differently the residual impacts are what must be 'lived with' if the project goes ahead. Residual impacts must be environmentally and socially acceptable.

#### 4.2.2.4 Assessment of Cumulative Impacts

Impacts from the project will be assessed in combination with the impacts of other existing or reasonably anticipated future projects recognising:

- Summative impacts - a combination of several similar impacts, from multiple sources to a single receptor.
- Interacting impacts - a combination of several different impacts on the same receptor).

Cumulative impacts will be assessed following the IFC's Good Practice Guidance.

### 4.2.3 E&S Management and Monitoring

Based on the assessment, mitigation will be identified to avoid, reduce or manage potential negative impacts and enhance benefits. Mitigation measures will be clear, feasible and applicable to local conditions and based on Good International Industrial Practise (GIIP).

Mitigation, monitoring and management requirements identified in the impact assessment will be detailed in an ESMP divided into construction and operations. The ESMP will also contain a management framework, that will ensure E&S risks are included in decision-making and day-to-day operations and track, evaluate, and communicate E&S performance. The ESMP will detail roles and responsibilities for all project parties, including the Construction Contractor.

### 4.2.4 Stakeholder Engagement and Public Consultation

A Stakeholder Engagement Plan (SEP) has been developed for this ESIA, including stakeholder identification and analysis, engagement and grievance mechanisms.

### 4.2.5 Data Availability, Assumptions and Limitations

Assessment limitations include:

- Limited E&S information on the project area. Open sources have limited local data on environmental components (in particular, on the availability and quality of surface and groundwater, air and soil quality, and the state of biodiversity).
- The approaches to source data and information are specified in the baseline chapters for each environmental and socio-economic issue.

# 5 ENVIRONMENTAL AND SOCIO-ECONOMIC BASELINE

## 5.1 Environmental baseline

The environmental baseline is drawn from the EIA report, prepared by Dornier-Schneider Consulting in 2016[34], the ESIA Scoping report (Sweco, 2024), the ESIA Scoping Report (Ecoline International et al. 2025)[35], information and data from scientific articles and from relevant authorities during the site visits and reconnaissance, as well as a brief biodiversity survey. Information from the SEA for the Ganja Master Plan [36] has also been used. Photographs were taken by the ESIA Consultant to illustrate the current state of the site.

In general, the project site and surrounding area:

- Has an arid to semi-arid climate with a high average temperature, low annual precipitation, and a high potential evaporation.
- Experiences westerly (54%) and easterly (33%). prevailing wind direction. The regional wind pattern is plain-mountain during the day mountain-plain at night driven by topographic differences.
- Has relics of unfinished construction of a WWTP, which was launched in the 1980's,
- Is topographically flat, besides old buildings and other parts of the unfinished WWTP. The visual landscape is strongly affected by a high voltage transmission line.
- Has residential areas relatively close to the proposed WWTP site (Ziyadli village is the closest, with its nearest structure being 300m northeast from the WWTP site and 125m from the effluent ponds).
- Is mainly irrigated arable land around the site, and anthropogenically dominated flora, fauna and habitats.

[34] Dornier-Schneider Consulting, 2016: Additional Investigation Study for the Wastewater Treatment Plants in Ganja and Sheki-Programme Phase 3, Part 1.3 Ganja Wastewater Treatment Plant Volume 3: Environmental Impact Assessment Report

[35] Ecoline International Ltd. Integra Consulting Ltd. and ABAK-Az Crowe Ltd. 2025. Ganja Wastewater Project. ESIA Scoping Report.

[36] European Union for Environment, 2024: Strategic Environmental Assessment (SEA) Final Report on Ganja Master Plan

*Source: ESIA Consultant, March 2025*

**Figure 9. The Project area with a local road highlighting the flat landscape and aridity of the area**

*Source: ESIA Consultant, March 2025*

**Figure 10. Unfinished buildings from the original uncompleted WWTP**

*Source: ESIA Consultant, March 2025*

**Figure 11. Unfinished oxidation pools of the original uncompleted WWTP**

## 5.2 Climatic and meteorological characteristics of the area

### 5.2.1 Overview

The climate is mild semi-arid and dry arid. Ganja is on the western plains of Azerbaijan, with local climate strongly influenced by terrain, and with strong winds throughout the year. The key climate characteristics are[37]:

- Mean annual air temperature is approximately 14.8°C. In January, February, and December, minimum temperatures can occasionally be -5°C to -12°C, although monthly averages typically remain above 3°C to 4°C. In summer, absolute maximum temperatures can reach 36°C to 38°C, but monthly averages generally do not exceed 26.2°C to 27.0°C.
- Little annual precipitation of approximately 235 mm/a. Most precipitation occurs in spring and early summer, with only about 15% during winter. The potential evaporation rate is high at 1,057 mm/a.
- Westerly and easterly winds occur for 54% and 33% respectively. Stronger winds prevail towards the west and north-west.
- Mean annual relative humidity is 68%.
- Snow cover lasts for about 11 days per year, and hail occurs on average 0.2 days per year.

[37] Ganja, Azerbaijan Climate, https://weatherandclimate.com/azerbaijan/ganja

**Table 10. Key climate characteristics for Ganja (2010-2020)**

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Year |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Avg. temperature (°C)** | 3 | 4 | 9 | 13 | 20 | 25 | 27 | 26 | 21 | 15 | 8 | 5 | 15 |
| **Min. temperature (°C)** | 0 | 0 | 4 | 8 | 14 | 18 | 21 | 20 | 16 | 11 | 5 | 1 | 10 |
| **Max. temperature (°C)** | 5 | 6 | 12 | 16 | 22 | 28 | 30 | 30 | 24 | 18 | 11 | 7 | 17 |
| **Precipitation (mm)** | 21 | 19 | 31 | 48 | 71 | 53 | 33 | 31 | 32 | 29 | 16 | 14 | 33 |
| **Avg. sun hours (hr)** | 8 | 10 | 10 | 11 | 14 | 14 | 14 | 12 | 11 | 10 | 8 | 8 | 11 |

**Table 11. Distribution of the Wind directions in Ganja (%)**

| North | North-East | East | South- East | South | South-West | West | North-West | Calm |
|---|---|---|---|---|---|---|---|---|
| 7 | 6 | 14 | 13 | 6 | 8 | 20 | 26 | 10 |

### 5.2.2 Climate change

A continuous increase in temperature in Azerbaijan is projected throughout the 21st century[38] (Figure 12). Climate is predicted to change in the Ganja region in several possible ways[39]:

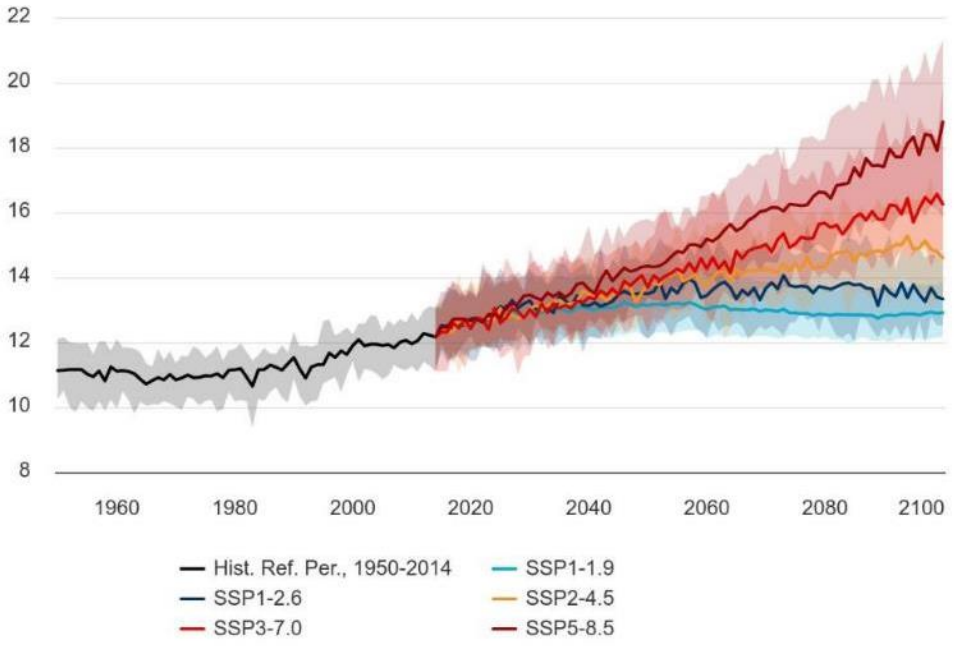



**Figure 12. Projected Average Mean Surface Air Temperature in Ganja**

The most pessimistic scenario - RCP8.5 (assumes large populations and relatively slow income growth with moderate rates of technological change and improved energy intensity) sees an average increase in temperature of 1.3 °C by 2040, 2.5 °C by 2060, 4°C by 2080 and

[38] Fourth National Communication to the United Nations Framework Convention on Climate Change from the Republic of Azerbaijan (2021).

[39] The Project Feasibility study by SWECO (2024) based on the World Bank Climate Change Knowledge Portal

5.6 °C by 2100. Such changes will also see significant increases in occurrence of hot days (heat index >35°C) (Figure 13).

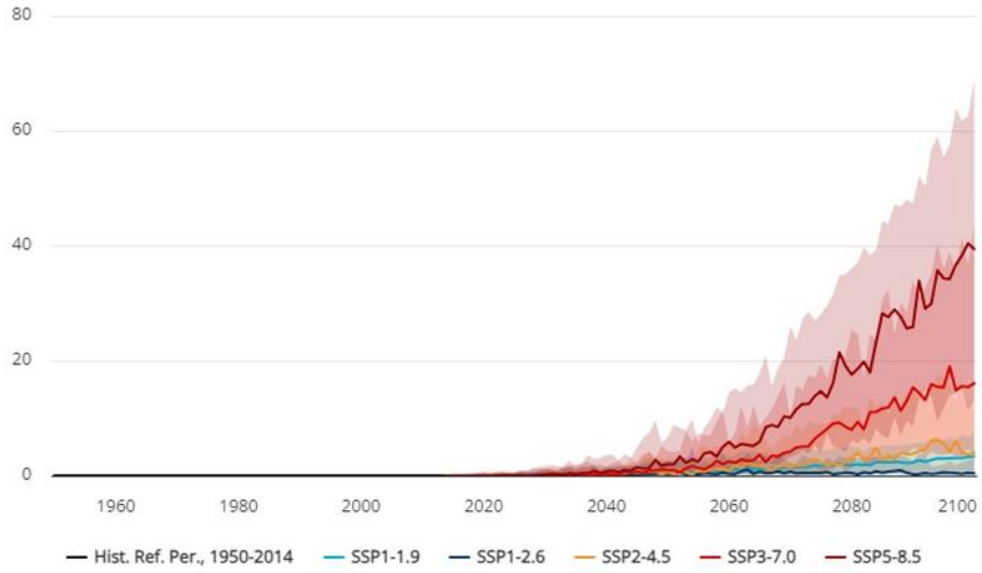



**Figure 13. Projected number of days with heat index > 35°C in the Ganja region**

The RCP8.5 scenario includes an average of 0.2 such days per annum between 2020-2040 while 2.4 annual days are expected between 2040-2060. In 2100 29 such days per year are expected. The elevated heat index days will be highly problematic in future but not materially within the lifespan of the Project.

Precipitation trends are less pronounced, with models predicting varying changes depending on location. The World Bank's multi-model ensemble for the RCP8.5 scenario suggests a general decrease in rainfall. Adjusting for local relief, a slight annual reduction in precipitation is expected in the Ganja region.

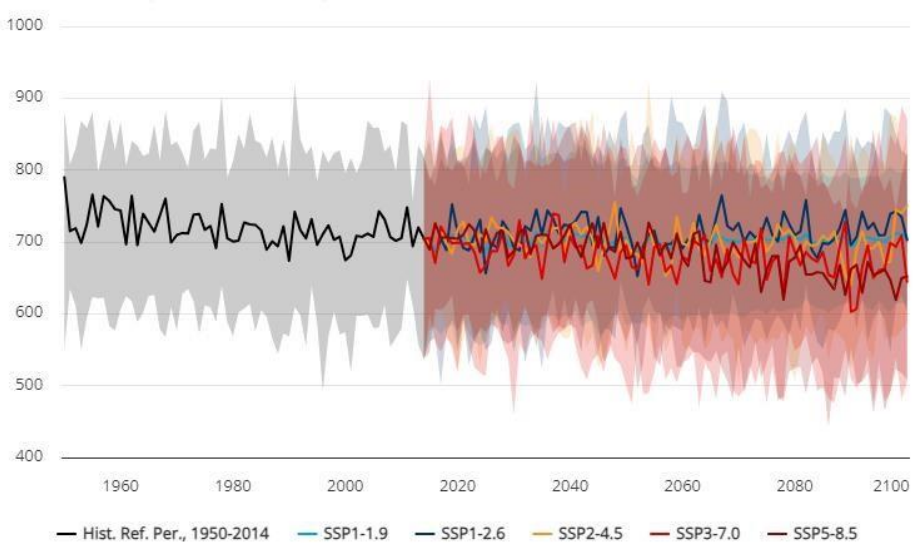



**Figure 14. Projected Average precipitation in Ganja region**

### 5.2.3 Climate risks

Floods and droughts are considered the most relevant climate risks to the Project.

Floods

Flooding in Azerbaijan mainly affects the Caucasus slopes and rivers near Nakhchivan. Despite ongoing floods, projections indicate no significant increase in heavy rainfall or extreme precipitation events[40].

Droughts

Under the RCP8.5 scenario, Azerbaijan's average maximum consecutive dry days is expected to increase from 18.9 currently to 19.4 in 2020-2040 and 23.3 in 2080-2100.

The country's water resources are expected to decrease significantly:

- 10-15% between 2020-2040
- 15-25% between 2041-2070
- 30-35% between 2071-2098

This trend indicates ever increasing risk of drought and water scarcity, though it is not anticipated to be materially different to the current climate, within the project timeframe.

### 5.2.4 Greenhouse Gases emissions

In 2016 GHG emissions in the Republic of Azerbaijan was estimated at 61.257 Mt of $CO_2$ equivalent, and net emissions, considering sequestration, were estimated at 54.033 Mt of $CO_2$ equivalent[41].

Per capita emissions in Azerbaijan were 6.3 tons of $CO_2$ equivalent, and net emissions, 5.6 tons of $CO_2$ equivalent. The GHG inventory for 1990-2016, saw a decrease of 31.6% in emissions compared to the base year (1990). Key sources of GHG emissions in the country are shown in Table 12.

**Table 12. Key sources of GHG emissions by IPCC categories in Azerbaijan in 2016[42]**

| | IPCC Category code | IPCC Category | Greenhouse gas | 2016 Ex,t (Gg $CO_2$ Eq) |
|---|---|---|---|---|
| 1 | 1.A.1 | Energy Industries - Gaseous Fuels | Carbon Dioxide ($CO_2$) | 12914.726 |
| 2 | 1.A.4 | Other Sectors - Gaseous Fuels | Carbon Dioxide ($CO_2$) | 7478.5676 |
| 3 | 1.A.3.b | Road Transportation | Carbon Dioxide ($CO_2$) | 5689.2627 |
| 4 | 3.A.1 | Enteric Fermentation | Methane ($CH_4$) | 5170.62 |
| 5 | 1.B.2.b | Natural Gas | Methane ($CH_4$) | 5168.9711 |
| 6 | 1.B.2.a | Oil | Carbon Dioxide ($CO_2$) | 5145.3171 |
| 7 | 1.A.1 | Energy Industries - Liquid Fuels | Carbon Dioxide ($CO_2$) | 3368.1317 |
| 8 | 1.B.2.a | Oil | Methane ($CH_4$) | 2963.5414 |
| 9 | 1.A.2 | Manufacturing Industries and Construction - Gaseous Fuels | Carbon Dioxide ($CO_2$) | 2646.1753 |
| 10 | 3.C.7 | Rice cultivation | Methane ($CH_4$) | 1961.61 |
| 11 | 4.A | Solid Waste Disposal | Methane ($CH_4$) | 1233.33 |
| 12 | 2.F.1 | Refrigeration and Air Conditioning | HFCs, PFCs | 1206.66 |
| 13 | 1.A.4 | Other Sectors - Liquid Fuels | Carbon Dioxide ($CO_2$) | 1007.0343 |
| 14 | 3.A.2 | Manure Management | Nitrous Oxide ($N_2O$) | 871.1 |
| 15 | 1.A.3.a | Civil Aviation | Carbon Dioxide ($CO_2$) | 697.96155 |
| 16 | 2.A.1 | Cement production | Carbon Dioxide ($CO_2$) | 666.796 |

[40] Fourth National Communication to the United Nations Framework Convention on Climate Change from the Republic of Azerbaijan (2021),

[41] Ibid.

[42] Ibid)

Azerbaijan has signed and ratified the Paris Climate Agreement but has not announced a net-zero target. Its Nationally Determined Contribution (NDC+) is a reduction of 35 % by 2030 and 40 % by 2050 compared to 1990 levels; however, current policies indicate these targets are unlikely to be met. Transport emissions increased over threefold between 2000 and 2019, while emissions from electricity and heat remained largely unchanged during this period, making them the second largest source of emissions.

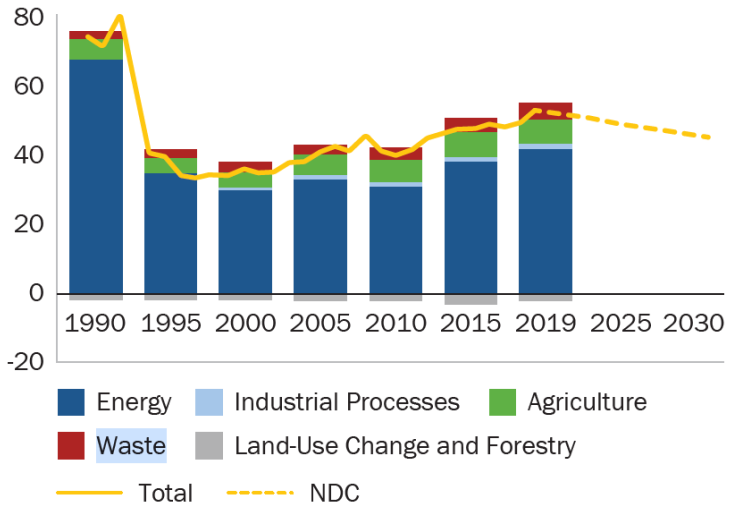



**Figure 15. Historic GHG emissions by sector and path to NDC, total emissions (World Bank)**

Methane emissions, primarily fugitive releases from fossil fuel production and transportation, comprise approximately 30 percent of Azerbaijan's total net GHG emissions. The national GHG inventory for 2016 indicates methane emissions at 17.1 $MtCO_2eq$. Of these, over 50 percent originated from fugitive sources related to fossil fuel activities, while the agriculture and waste sectors contributed 40 percent and 8 percent, respectively.

GHG emissions from the waste sector amounted to 1.238 million tons of $CO_2$ eq. and accounted for about 2.07 percent of total national emissions (excluding removals) in 2014. 1.251 million tons of $CO_2$ eq. and approximately 2.04 percent in 2015 and decreased slightly to 1.233 million tons of $CO_2$ eq. accounting for approximately 2.02 percent of total emissions in 2016. In 1990, however, waste accounted for only 0.091 percent in 1990.[43] Importantly for the Project, GHG emissions from wastewater in Azerbaijan is presently less than 0.2%.[44]

## 5.3 Geological and Seismic Characteristics

### 5.3.1 Geological Characteristics

The project area lies in Azerbaijan's distinctive geological and topographical zone. Ganja city is located at the base of the Lesser Caucasus Mountains, within the dry steppe and lowland intermountain plain.

Ganja's geological base consists of quaternary alluvial sediments from the Caucasus Mountains, 100–250 m thick above the basement rock. These include gravel, sand, and clay

[43] Fourth National Communication to the United Nations Framework Convention on Climate Change from the Republic of Azerbaijan (2021), page 199.

[44] Ibid, p. 200

derived from limestone, chalk, and gypsum. Within this high-permeability layer are small, low-permeability clay lenses, creating an effective semi-permeable cover typical of the region.

The project area's topography generally slopes gradually from south to north, with an elevation between 287 m and 276 m above sea level, a slope of 10 to 12 m/km.

The project area has two geomorphological units:

- The intensively dissected low mountain plain (where the WWTP site is located); and
- Alluvial-proluvial weakly dissected plain.

### 5.3.2 Seismic Characteristics

The Republic of Azerbaijan is one of the most seismically active regions of the Alpine fold belt. Historical data shows repeated occurrence of powerful, destructive earthquakes. The earthquake in 427 AD was felt across the country and destroyed numerous towns and villages. Seismic activity in Azerbaijan was monitored from the beginning of 20$^{th}$ century, when the first seismic station was established in Shamakhi after the 1902 Shamakhi earthquake.

Ganja sits on a fault line in Azerbaijan's intermountain plains, making it the region's highest seismic zone. Seismogenic layers are found at 5-15 km and 40 km depths. Weak earthquake absorption causes widespread effects even from small quakes. The area's maximum energy class is 16-17, intensity reaches 9-10 points, average activity is 0.8, with a recurrence graph angle coefficient of 0.44. Major earthquakes recur every 30-40 years.

Between 424 and 1308, earthquakes up to magnitude 7.3 and intensity 9.2 struck this region, including a major 1139 event that destroyed Ganja and led to Lake Gey-gel's formation. The 1139 earthquake had an elliptical energy distribution. The latest earthquake in Ganja, in 2012, caused minor damage and injuries.

Azerbaijan's Seismic Design Code, officially issued in 2009, includes national standards for earthquake-resistant buildings.

## 5.4 Landscape

The city's landscape consists largely of human-made features alongside natural semi-desert areas. The surrounding region near Ganja includes mountainous terrain, which is managed under government environmental regulations and not considered part of the city's administrative zone. The SEA report states that Ganja's landscape has limited ecological capacity and exhibits considerable human impact.

Ganja features green spaces near parks, businesses, and offices, with several small parks such as Khamsa garden, Istiklal park, H.Z. Taghiyev Park, and Jens new boulevard. While the city centre, left bank of the Ganjachay River, and Yeni Ganja area are well-landscaped, the southern and southeastern sections have few recreational areas.

The project site lies north of Ganja's urban area on arable land typically irrigated with wastewater. It features fields, remnants from 1980s WWTP construction, settlements along the outfall channel, tree-lined streets, and a nearby high-voltage transmission line. A small settlement is located about 300 m to the north, and roughly 1 km away is a greenhouse farming area that uses groundwater for irrigation and focuses on early-season vegetables.

*Source: ESIA Consultant, March 2025*

**Figure 16. The nearby area, picture taken from the Project site**

*Source: ESIA Consultant, March 2025*

**Figure 17. The closest residential area to the Project site and high-voltage electricity transmission line**

*Source: ESIA Consultant, March 2025*

**Figure 18. Old ruined fence at the Project site**

## 5.5 Hydrology

### 5.5.1 Surface water

Ganja has a semi-arid climate with limited water resources. The primary water source is the Ganjachay River, which provides irrigation and energy, with flow rates varying throughout the year. From March to June, snowmelt increases flow, while in winter the river relies on groundwater sources, with decreased flow. The river's annual flow derives from snow (38%), rainfall (15%), and groundwater (47%), averaging 4 m³/sec, with spring floods occurring from late March to early June. Between 1961 and 1990, the annual water flow of the Ganjachay River decreased by 14%.

The area has a semi-arid climate with no permanent natural surface water. The Goshgar River, which receives WWTP effluent via a pipeline, is fed by overflow from the Shemkir canal at Qarayeri village, around 4.5 km upstream of the discharge point. Monthly average flows vary greatly throughout the year (see the tables and figure below), and the river can dry up during August–September. There is also a wastewater ditch at the project site (**Figure 20**). The Goshgar River has semi-natural riverbed structures and distinctive water dynamics, which contribute to its ecological value. It is classified as a sensitive area according to the EU Urban Wastewater Treatment Directive (91/271/EEC).

**Table 13. Water flow in Goshgar River (National Hydrometeorological Service, June 2025)**

| Year | Monthly average flow ($m^3/s$) | | | | | | | | | | | | Annual average flow ($m^3/s$) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | I | II | III | IV | V | VI | VII | VIII | IX | X | XI | XII | |
| **2015** | 0.25 | 0.28 | 0.40 | 1.76 | 1.69 | 0.62 | 0.24 | 0.20 | 0.47 | 0.89 | 1.38 | 0.60 | 0.73 |
| **2016** | 0.77 | 1.14 | 1.72 | 1.82 | 2.24 | 2.36 | 0.70 | 0.57 | 0.53 | 1.07 | 1.67 | 1.27 | 1.32 |
| **2017** | 1.07 | 1.13 | 1.41 | 1.40 | 1.45 | 1.30 | 0.55 | 0.18 | 0.18 | 0.74 | 0.76 | 0.68 | 0.90 |
| **2018** | 0.72 | 0.68 | 0.93 | 1.18 | 1.50 | 1.36 | 0.68 | 0.33 | 0.26 | 0.29 | 0.46 | 0.63 | 0.75 |
| **2019** | 1.02 | 1.15 | 1.30 | 1.80 | 2.15 | 1.97 | 0.59 | 0.18 | 0.37 | 0.36 | 0.39 | 0.49 | 0.98 |
| **2020** | 0.76 | 0.86 | 1.00 | 1.36 | 1.61 | 0.72 | 0.98 | 1.68 | 0.79 | 0.68 | 0.69 | 0.69 | 0.99 |
| **2021** | 0.52 | 0.55 | 2.48 | 2.62 | 3.73 | 0.70 | 0.47 | 0.47 | 0.66 | 0.48 | 0.48 | 0.48 | 1.14 |
| **2022** | 0.20 | 0.18 | 0.19 | 0.20 | 2.00 | 1.23 | 0.50 | 0.28 | 0.21 | 0.21 | 0.20 | 0.21 | 0.47 |
| **2023** | 0.62 | 0.62 | 0.62 | 0.63 | 0.93 | 1.87 | 1.45 | 0.57 | 0.60 | 0.62 | 0.62 | 0.62 | 0.81 |
| **2024** | 0.43 | 0.45 | 0.45 | 1.25 | 1.70 | 1.87 | 1.25 | 1.33 | 0.05 | 0.45 | 0.45 | 0.60 | 0.86 |

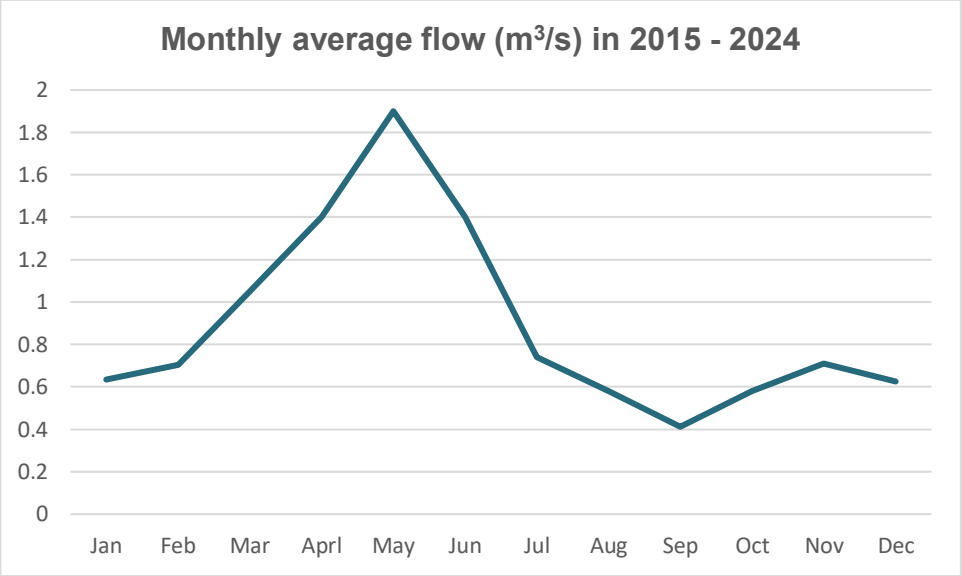



**Figure 19. Monthly average flow in Goshgar River in the period 2015 – 2016, based on the data provided by the National Hydrometeorological Service**

**Table 14. Maximum and minimum flow in Goshgar River (National Hydrometeorological Service, June 2025)**

| Year | Maximum flow ($m^3/s$) | Date | Minimum flow ($m^3/s$) | Date |
|---|---|---|---|---|
| **2015** | 7.60 | 01.09 | 0.16 | 05.08 |
| **2016** | 9.30 | 10.06 | 0.41 | 01.09 |
| **2017** | 6.45 | 20.06 | 0.16 | 06.09 |
| **2018** | 2.25 | 12.05 | 0.25 | 07.09 |
| **2019** | 2.36 | 12.05 | 0.16 | 18.07 |
| **2020** | 4.40 | 23.08 | 0.60 | 06.07 |
| **2021** | 10.5 | 06.05 | 0.42 | 02.07- 05.11 (altogether 27 days) |
| **2022** | 4.49 | 16.05 - 15.06 (altogether 13 days) | 0.16 | 02.03 - 07.05 (altogether 23 days) |
| **2023** | 5.20 | 25.05 - 23.06 (altogether 5 days) | 0.57 | 28.07 - 08.09 (altogether 43 days) |
| **2024** | 4.35 | 28.07 | 0.05 | 01.09 - 30.09 (altogether 30 days) |

Surface water in the project area is polluted. Untreated wastewater from settlements caused phenol, turbidity, and ammonium ion levels to exceed legal limits—by up to 1.3, 17.1, and 1.4 times, respectively[45]. The water is hydrocarbonate-calcium with moderate mineralization (150-250 mg/l). The Goshgar River likely faces similar contamination but lacks monitoring data.

[45] MENR's 2019-2020 report for Ganjachay.

*Source: ESIA Consultant, March 2025*

**Figure 20. A ditch for wastewater at the project site**

### 5.5.2 Groundwater

Ganja's groundwater is deeper in the north and northwest, but shallower in the south. Its mineralization ranges from 0.8 to 3 g/l, mainly hydrocarbonate-calcium, with 1.5–3.0 mg/l content. Groundwater is recharged by rainfall and streams, so its levels are closely linked to river hydrology.

The WWTP site generally sits above a deep, variable groundwater table (5–10 m), except in the Goshgar valley where it is higher (about 1–2 m). Groundwater flows south to north along the plain. Around 15 households source drinking water from several artesian wells within 3 km downstream of the proposed WWTP. Additionally, water is abstracted 8 km downstream from where the tributary meets the Kura River.

The Project area offers modest groundwater recharge; however, it plays an important role in supplying potable water. Drinking-water wells near the project site indicate a heightened sensitivity to potential water contamination.

## 5.6 Ambient Air Quality

MENR air quality data from 2020 to May 2025 show that most pollutants remained below permissible limits, except for sulphur dioxide, which was elevated due to heavy traffic and industrial activities.

**Table 15. Air quality in Ganja in 2020 – 2025[46] (Ganja City Executive Authority, 2025)**

| Emission/average annual concentration (µgm³) | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 (Jan – May) | Permissible threshold (µg/m³) |
|---|---|---|---|---|---|---|---|
| Nitrogen 4-oxide ($NO_2$) | 25 | 27 | 29 | 31 | 29 | 27 | 40 |
| Sulphur dioxide ($SO_2$) | 27 | 28 | 27 | 28 | 26 | 23 | 20 |
| Carbon monoxide (CO) | 6,711 | 7,017 | 8,116 | 7,804 | 7,416 | 5,523 | 10,000 |
| Dispersed dust (($PM_{2.5}$ and $PM_{10}$) | 19 | 28 | 26 | 17 | 26 | 15 | 25 |

Aside from an aluminium factory about 10 km southeast, there are no major emission sources near the project site. With light local traffic, $SO_4$ and $NO_x$ concentrations generally with defined limits. However, dust levels can exceed daily limits during harvests and prolonged dry spells in summer.

## 5.7 Noise

The permissible daytime noise level for residential zones in Azerbaijan is 60 dB(A). In Ganja, transportation and industrial activities constitute the primary sources of noise; however, specific data are not unavailable. certain locations in Ganja have recorded noise and vibration levels that exceed established limits[47]. Given that the Project site is situated at a considerable distance from major noise sources such as industrial facilities and main roads, ambient sound levels at the location are comparatively low

## 5.8 Soil

Ganja lies in the northeastern foothills of the Lesser Caucasus Mountains, with various fertile soils such as chestnut and alluvial-grass types, making the area valuable for agriculture. However, farming requires irrigation due to the semi-arid climate, and local soils have been affected by wind erosion, compaction, and wastewater irrigation. The region also includes semi-desert ecosystems.

[46] Republic of Azerbaijan. Ganja city executive authority. Letter to ASWRA. 24-th June, 2025

[47] According to correspondence from MENR, 10 June 2025,

*Source: ESIA Consultant, March 2025*

**Figure 21. Irrigated arable land in the project area**

*Source: ESIA Consultant, March 2025*

**Figure 22. Irrigated arable land, north-west of the project site**

### 5.8.1 Soil Quality in the Project Area

Research from 2017–2020 in the Ganja–Kazakh district showed a gradual decline in soil fertility. Humus levels dropped in ordinary grey-brown soils from 2.59% to 2.53% and in light grey-brown soils from 2.3% to 2.0%. Foothill soils were more degraded than those on the plains, with humus at 0.83% and a similar trend seen for nitrogen (down 0.03%). pH values gradually increased over the study period.

Research indicates that soil pollution by heavy metals—including lead (Pb), cadmium (Cd), chromium (Cr), zinc (Zn), copper (Cu), and arsenic (As)—is present in the Ganja-Gazakh region, with industrial activities such as those at the Ganja Aluminium Plant identified as

primary sources. Additionally, elevated levels of sulphate and nitrate are reported around Ganja City.

No data are available on soil pollution at the project site or nearby areas, as confirmed by the State Sanitary and Epidemiological Service in Ganja during the interview with the ESIA Consultant.

## 5.9 Waste Management

Waste management in Ganja faces considerable challenges, with current practices largely not meeting contemporary standards. The average annual solid waste generation per capita is 450 kg/capita/annum, which is less than typical international benchmarks.

The city primarily disposes of waste at a non-compliant dumpsite in the east, about 1.5 km from the Baku-Tbilisi motorway, covering 25 ha and now over four times its intended capacity. Waste is mainly burned or buried. Over 250 tonnes of household waste are collected daily, with approximately 470,000 m³ deposited at the landfill between January and August 2025.

The site lacks good waste disposal practices resulting in:

- Pollutant leaching into soils and groundwater.
- Odour affecting the population living in proximity to the site.
- Air pollution emissions when waste is burnt.

The dumpsite poses significant risks to both public health and the environment due to co-disposal of medical and general waste. Informal waste pickers face hazardous conditions and potential loss of livelihoods if the site is closed. Ganja lacks an EU-standard sanitary landfill, a hazardous waste management system, formal waste separation, and recycling facilities.

## 5.10 Biodiversity

This biodiversity baseline is based on literature sources and data obtained during field surveys conducted in June 2025. The study area embraced the Project area and surrounding agriculture fields and settlements (**Figure 23**). It can be seen from the figure that the area is heavily transformed by both agriculture and human settlement indicating limited likely biodiversity value.

### 5.10.1 The Project area

The Project area is characterized by a plain relief type subject to intensive anthropogenic influence. The area where the treatment plant will be constructed is fragmented. A mechanical sewage treatment plant was built in this area in the 1960s, which has not been operational for 35 years. Currently, only the ruined remains of the buildings exist, surrounded by disturbed lands (**Figure 24**).


**Figure 23. Google Earth image of the land use around the proposed WWTP. Note the extensive agricultural and residential land use.**

**Figure 24. Remains of the old WWTP buildings at the Project area.**

There is active agricultural activity and housing development. As such, the Project site lies in a transitional zone shaped by both agricultural activity and human settlement, both of which are key influences on its ecological stability and biodiversity.

### 5.10.2 Ecologically appropriate area of analysis (EAAA)

The fauna and flora survey areas include the Project area, AoI and adjoining territories. The choice is based on defining EAAA *as an area of ecological relevance*; in some cases, EAAA may exceed a project area and AoI. The Project area and adjoined areas are heavily transformed by roads, agriculture, grazing and other activities. Species habitats are preserved in small semi-natural parcels and tree/shrub strips between fields and along roads; such habitats are scattered throughout larger area including the Project area and AoI.

EAAAs of some species cover the larger area incorporating the parcels of semi-natural habitats. For example, both bird PBF species occur in tree strips along roads throughout the larger area and may potentially penetrate through these strips to the project area. The tortoise (Testudo graeca) was found during the field survey in a wormwood–grain formation near a wheat field. Given the heavily transformed nature of the area and the limited time in which to complete the assessment only one season was used for the survey. Additional surveys have also been proposed where needed in the impact assessment section of the ESIA.

### 5.10.3 Survey methods

Transects and count point methods were used in the field studies which are internationally recognised and broadly used in field biodiversity studies (see for example, Bartholomew and Mosyaftiani et al. (2024). The Global Biodiversity Standard: Manual for assessment and best practices. BGCI, Richmond, UK & SER, Washington, D.C. USA https://cdn.ymaws.com/www.ser.org/resource/resmgr/docs/25.07.2024_TGBS_-_The_Global.pdf)

### 5.10.4 Vegetation and flora

#### 5.10.4.1 Methods

Phytocenoses (entire plant communities) were assessed using transects to identify species composition.[48]. To identify plant species, literature, including Flora of Azerbaijan, Flora of the Caucasus, Systematics of Higher Plants, and Conspectus of the Flora of Azerbaijan was used. The categorization of endemic, rare, and endangered species was based on The Red Book of Azerbaijan and the Red List of Plants of the Caucasus. Additionally, the conservation status of rare species was derived from the IUCN Red Data List. The taxonomic names of species were provided in accordance with the International Code of Botanical Nomenclature and the Euro+Med PlantBase database.

#### 5.10.4.2 Vegetation types

Geobotanical zoning of Azerbaijan indicates a variety of vegetation types, including plain semi-desert vegetation, subtropical ephemeral vegetation, patchy bush-grass vegetation with salinity dominance, and foothill semi-deserts dominated by wormwood, in the natural areas surrounding Ganja. Vegetation is notably sparse in saline areas. Vegetation of the Project area is dry steppe formation groups of steppe vegetation type (**Figure 25**).

**Figure 25. Dry steppe formations vegetation**

This natural vegetation type covers only a limited area within the site with most of the Project area being disturbed (**Figure 26**).

[48] Methods developed by L.Q. Ramensky.

**Figure 26. Natural Vegetation Adjacent to Cultivated Fields and the Transition Zone to Natural Flora at the Boundary of Agricultural Lands**

The project area vegetation includes:

- Irrigated arable lands with sparse annual plants and grasses,
- Irrigated fields with species, which are adapted to the traditional land- use such as grasses, herbs and hemi-cryptophytes
- Fallow lands with annual plants and hemikryptophytes (*Sonchus, Artemisia*)
- Aquatic and bankside vegetation on riverbanks
- The existing discharge point is in a section of the river with shallow rocky riverbed, with riverbanks overgrown by shrubs and trees
- The proposed discharge point (in Garaeri) is a concrete riverbed.
- Poplars bordering the road to Qaryeri.

### 5.10.4.3 Flora

Across the Ganja-Gazakh eco-geographic region, 1,524 plant species, including high-spore, gymnosperm, and flowering plants from 114 families and 478 genera, have been identified. Researchers indicate the presence of 36 Caucasian and 21 Azerbaijani endemic species within the flora of the Ganja-Gazakh eco-geographic region. Some 37 species of higher vascular plants found during the field survey are listed in **Annex 1.**

Of the 37 identified species, five are classified as Priority Biodiversity Feature (PBF) under EBRD PR6:

- Two species (*Eriophorum latifolium Hoppe, Sternbergia vernalis (Miller) Gorer & J.H.Harvey* ) under Criterion 12(ii) as listed in the Red Book of Azerbaijan, category Endangered,
- Two species (*Pinus eldarica, Platanus orientalis L.*) under Criterion 12(ii) as endemic (range-restricted) species (the last one is also listed in the Red Book of Azerbaijan, category Vulnerable)
- One species (*Punica granatum*) under Criterion 12(iii) (significant biodiversity features identified by a broad set of stakeholders or governments) as listed in the Red Book of Azerbaijan, category Vulnerable.

*Sternbergia vernalis (Miller) Gorer & J.H.Harvey* was found in one location, with a density of 5-6 per 10 $m^2$.

Broad-leaved Cotton grass (*Eriophorum latifolium Hoppe)* was found in three locations, with a density of 6-7 per 10 $m^2$.

Three tree species were near the sewage system(channel), namely:

- Eldar pine (*Pinus eldarica)* – three locations, near the sewage channel, especially on dry and sunny slopes close to agricultural fields, in xerophytic, drought-resistant, slightly saline, and gravelly soil zones, the approximate number is 3–6 individuals,
- Oriental plane-tree (*Platanus orientalis L.*) – two locations, in moist zones near drainage channels, characterized as mesoxerophytic and shaded areas, as well as sections close to riverbeds or along old watercourses, the approximate number is 2–4 individuals,
- *Punica granatum L*. – four locations, primarily found along the edges of drainage channels, in gravelly, sunny, and open areas. This is xerophytic, wild-growing relict species, with an approximate number of 6–8 individuals.

PBF species occur in the study area (area indicated with dashed red line) sporadically –one to four locations of each and limited specimen numbers. The field study routes, research points and locations of priority species are presented in **Figure 30**.

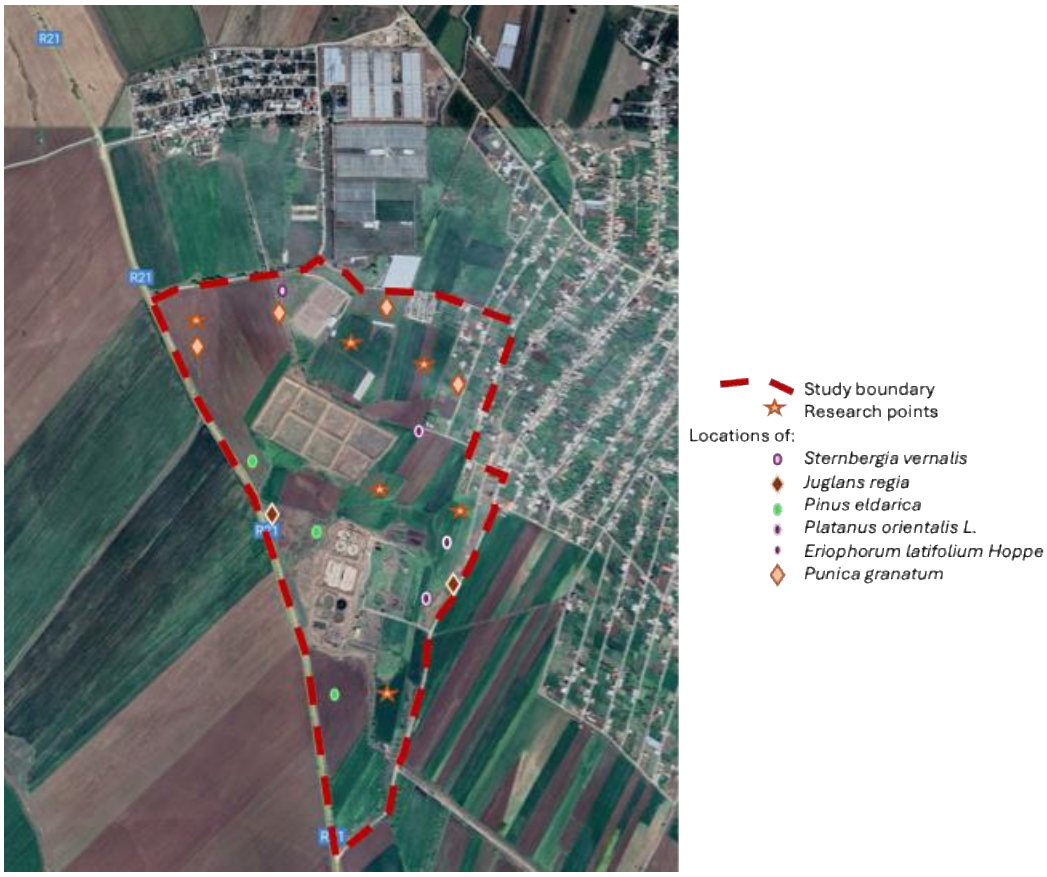



**Figure 27. Map of the study area with the field study routes, research points and locations of Priority Biodiversity Features (as well as relict species Juglans regia)**

### 5.10.5 Fauna (vertebrates)

#### 5.10.5.1 Methods

Amphibians and reptiles were studied through observations along selected pedestrian transects measuring 500–1000 meters in length and 1–2 meters in width, by recording encountered individuals. Information (photos and videos) from residents, of these faunal groups was also considered. The area studied is shown in Figure 28.

Avifauna was studied using binoculars and telescopes and recording observed bird species within the project area and in adjacent areas. Bird nests were also documented.

Mammalian fauna was studied by recording direct sightings of large mammals (predators) as well as their excrements, carcass remains, and tracks. Rodents were assessed using traps (15 per site) placed in various selected locations within the study area.

The surveys were conducted at different times of the day:

- early morning (7:00-9:00),
- morning (10:00-12:00),
- midday (13:00-16:00),
- evening (17:00-19:00) and
- at night (20:00-21:00).

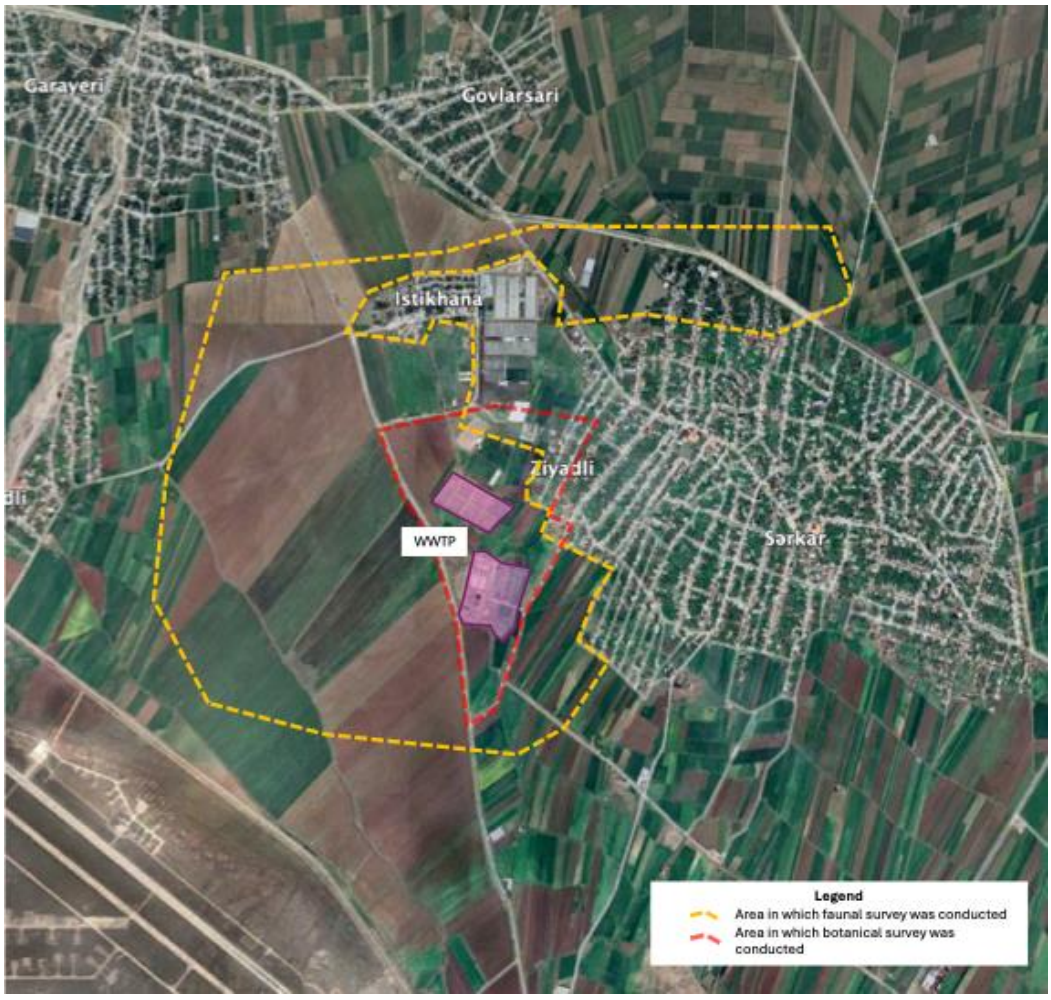



**Figure 28. Google Earth image of the land use around the proposed WWTP showing the area studied for fauna presence relative to the area studied for plant species.**

### 5.10.5.2 Results

Characteristic habitats for fauna in the study area include

- Fragments of dry steppe plains with ephemeral grass and saltwort shrublands;
- Small water bodies and irrigation canals discharging wastewater;
- Anthropogenic biotopes (cultivated fields, gardens, and yards).

Natural faunal habitats in the Project area have been transformed and replaced by anthropogenic biotopes (cultivated fields, residential areas, gardens, and yards, and so forth) resulting in low biodiversity value in the proposed WWTP footprint and surrounding area.

The old auxiliary building located on the site where the WWTP is to be constructed is currently used as a sheep pen and 10–15 guard dogs are kept protecting the flock. These protective dogs, either attack or drive fauna species of various sizes from the area, further limiting the low biodiversity value of the area in which the WWTP will be developed.


**Figure 29. Auxiliary building used as a sheep pen.**

Terrestrial animals found and potentially occurring in the study area during the field survey are listed in **Annex 2.** Some 36 species were identified, 9 species observed during the field survey, and 4 species described by residents. Normally these species would be assessed as triggers of Critical Habitats but because Azerbaijan is not a member of the EU the habitats directives do not apply.

**Figure 30. Greek (Mediterranean) tortoise (*Testudo graeca*) found in the study area within fragments of dry steppe plains closed to cultivated fields**

During the field research, only one tortoise was found in a wormwood–grain formation near a wheat field. Two European glass (legless) lizards were observed near the ruins of the old wastewater treatment station. The water (or dice) snake was observed in the irrigation canal.

A very small number of animals were observed, primarily due to anthropogenic changes in the landscape (most of the area is cultivated), and thickets of shrubs and blackberries in uncultivated areas, in which it is difficult to find anything.

*Ichthyofauna*

- The positions of the two major rivers that flow through Ganja are shown in Figure 31 together with the existing discharge point in the Goshkar River. That existing discharge point is in a section of the river that has a shallow rocky riverbed, with riverbanks overgrown by shrubs and trees. The water quality in both the Goshkar and the Ganja Rivers is poor and despite the single discharge point well north of Ganja City on the Goshkar, the reality is that untreated wastewater is entering both rivers from multiple diffuse sources within the city, and from settlements north of the sity because of the poor state of the wastewater recovery system. The quantity of untreated effluent observed entering the existing effluent ponds is a fraction of the total effluent generated, confirming the significant loss of untreated effluent into the two river systems.
- The aquatic biota of the Goshkar River through and north of Ganja has not been directly assessed because it is assumed that the impact of the WWTP will be overwhelmingly positive in improving the aquatic ecology. Limited water quality monitoring for the Ganja River indicates phenol, turbidity, and ammonium ion concentrations exceeding legal limits—by up to 1.3, 17.1, and 1.4 times, respectively (MENR 2019-2020 report for the Ganja River). It is assumed that water quality in the Goshkar is similarly poor. High turbidity prevents penetration of light, decreasing phytoplankton, phytobenthos and macrophyte production and drift of some zoobenthos species. River biota is also impacted significantly by reduced and even no river flow in the summer.

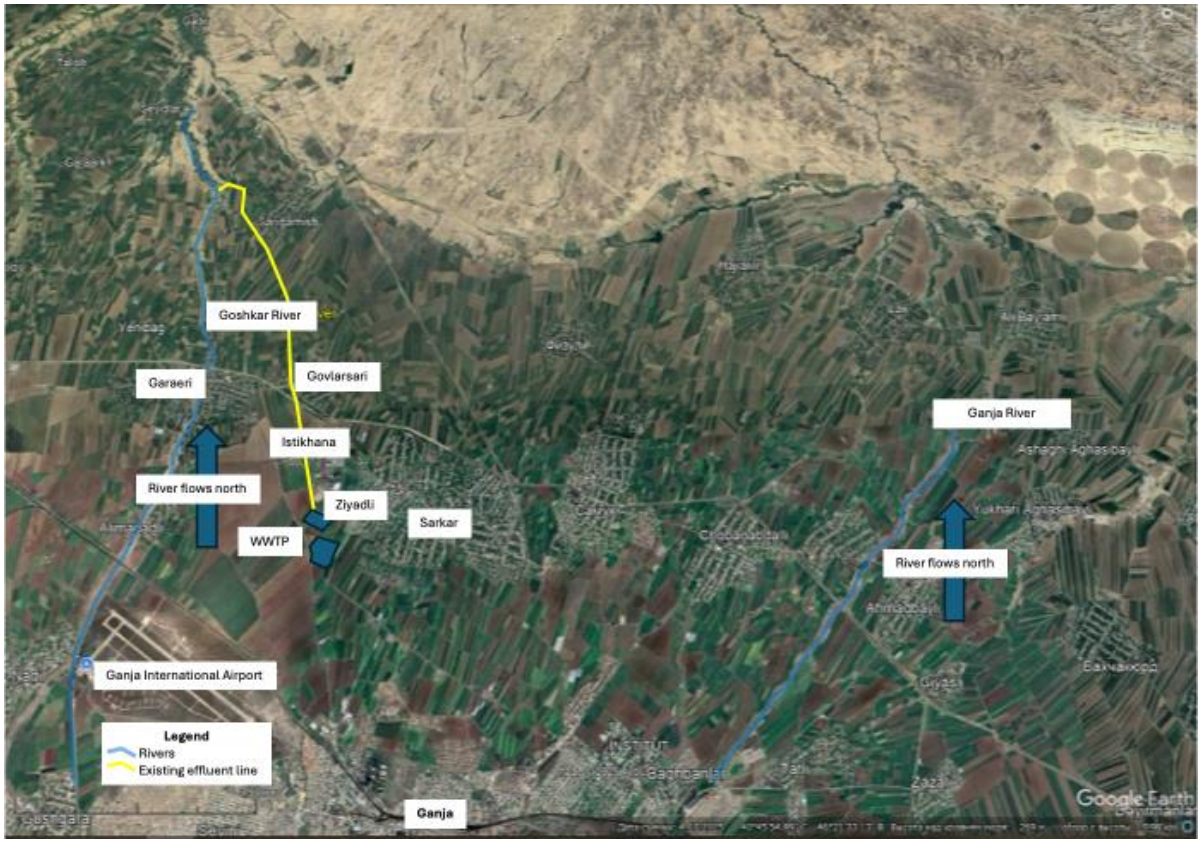



**Figure 31. Google Earth image showing the two major rivers that flow through Ganja. The yellow line indicates the current effluent line and discharge point into the Goshkar River**

Several fish species occur in the upper and lower reaches of the Ganja River including the European chub - *Leuciscus cephalus orientalis (Leuciscidae*), the Caucasian scraper - *Capoeta capoeta (Cyprinidae*), the Kura bleak - *Alburnus flippi (Cyprinidae*), the North Caucasian bleak - *Alburnus charusini hohenackeri (Cyprinidae*), the Kura loach - *Oxynoemacheilus brandtii (Nemacheilidae*), the Spined loach - *Cobitis taenia (Cobitidae*), the Golden spined loach - *Cobitis aurata*, Flashnout goby - *Neogobius platyrostris (Gobiidae)*.

Brook trout (*Salvelinus fontinalis) (Salmonidae*) are found in the foothill and mountainous parts of the Goshkar River. Once the river enters the plain near the village of Balchyly, no trout are observed. The fish are also small, 15-20 cm. The trout are permanent inhabitants of mountain rivers and spring origin lakes. Trout are also found in all foothill rivers with clear water and stony bottoms. In Azerbaijan, trout are common in spring-origin rivers flowing from the greater and Lesser Caucasus and Talysh mountains. The fish in each river differ from each other in color, and in some morphological features. All trout demand cold water and highly oxygenated water.

Of the 9 fish species, one species (*Cobitis taenia*) is a Priority Biodiversity Feature under EBRD PR6 Criterion 12 (ii) as listed in Resolution 6 of the Bern Convention. The species is not observed in the Goshkar River but because it occurs in the Mingechavir reservoir, it must be assumed that it may occur in the river.

*Invertebrates*

No information is available on invertebrates in the project AoI. There are invertebrates included in the Azerbaijan Red Book but their presence in the project AoI is simply unknown.

### 5.10.6 Habitats

The Project area (and surroundings of Ganja) include semi-desert and dry steppe ecosystems.

The following habitats occur:

- Arable lands which are the spatial dominating habitats with common species such as millet, *Convolvulus arvense, Amaranthus*,
- Fields with different kinds of grasses (*Sporghum*), different kinds of clover (*Trifolium spec.*), Plantain (Plantago major, P. lanceolata), and other species,
- Semi-wet fallow land with reeds (*Phragmites australis, Carex spec. Juncus spec*.) and herbs such as Mentha spec, Inula along the trenches and depressions,
- Alley, tree lines, groves and hedges with old trees such as poplar (*Populus nigra*), walnut (*Juglans regia* (dominating), mulberry (Morus spec.).
- The Goshgar River and its banks are characterized by a rare reed vegetation and perennial herb vegetation with typical specialized species such as *Typha latifolia, Carex spec. Salix spec, Pragmites australis, Arundodonax, Lythrum salicaria, Juncus spec. Equisetum spec. Lycopus europaeus*, and on the flat banks tamarisk (*Tamarisk spec.*)
- Fallow land with a xerophytic weedy vegetation widespread in the Project area.

There is no national habitat classification that accords with the Bern Convention (EUNIS) classification[49].

### 5.10.6. Priority Biodiversity Features

Among 37 flora species and 45 fauna species identified during the biodiversity surveys, 5 plant species, 1 fish species, 1 reptile species and 2 bird species were identified as Priority Biodiversity Features (PBF) according to the EBRD PR6 and Guidance Notes to PR 6 (March, 2023). These species are listed in **Table 16**.

**Table 16. Priority Biodiversity Features Identified in the Project area and adjoined areas**

| | Criterion | Features (Habitats/species) |
|---|---|---|
| **Priority Biodiversity Features as per EBRD PR6 (§12)** | | |
| ii | 12.ii.a EAAA for species and their habitats listed in Resolution 6 of Bern Convention | Fish (x1)<br>*Cobitis taenia*<br>Reptilia (x1)<br>*Testudo graeca* |
| ii | 12.ii.c EAAA support Vulnerable species | Reptilia (x1)<br>*Testudo graeca (already triggering cr.12 ii a)* |
| ii | 12.ii.d EAAA [50] for regularly occurring nationally or regionally listed EN or CR species | Plants (x2)<br>*Eriophorum latifolium Hoppe (EN)*<br>*Sternbergia vernalis (Miller) Gorer & J.H.Harvey (EN)* |

[49] Azerbaijan ratified the Bern Convention in 2000 https://www.coe.int/en/web/conventions/full-list?module=signatures-by-treaty&treatynum=104

[50] EAAA – ecologically appropriate area of analysis

| | Criterion | Features (Habitats/species) |
|---|---|---|
| ii | 12.ii.e EAAA for regularly occurring range-restricted species | Plants (x2)<br>*Pinus eldarica,*<br>*Platanus orientalis L.* |
| iii | 12.iii Significant biodiversity features identified by a broad set of stakeholders or governments | Plants (x2, listed in the Red Book of Azerbaijan, category Vulnerable)<br>*Punica granatum*<br>*Platanus orientalis L. (already triggering cr.12 ii e)*<br><br>Birds (x2, listed in the Red Book of Azerbaijan)<br>*Francolinus francolinus (category Near Threatened)*<br>*Perdix perdix (category Vulnerable)* |

PR6 also contains a requirement that *where assessment has identified potential project-related impacts on biodiversity, including those features that are not considered "critical habitat" or "priority biodiversity features", the client will, as a priority, avoid adverse impacts on biodiversity.* Neither the dice snake nor the European glass lizard are PBFs but still need to be protected.

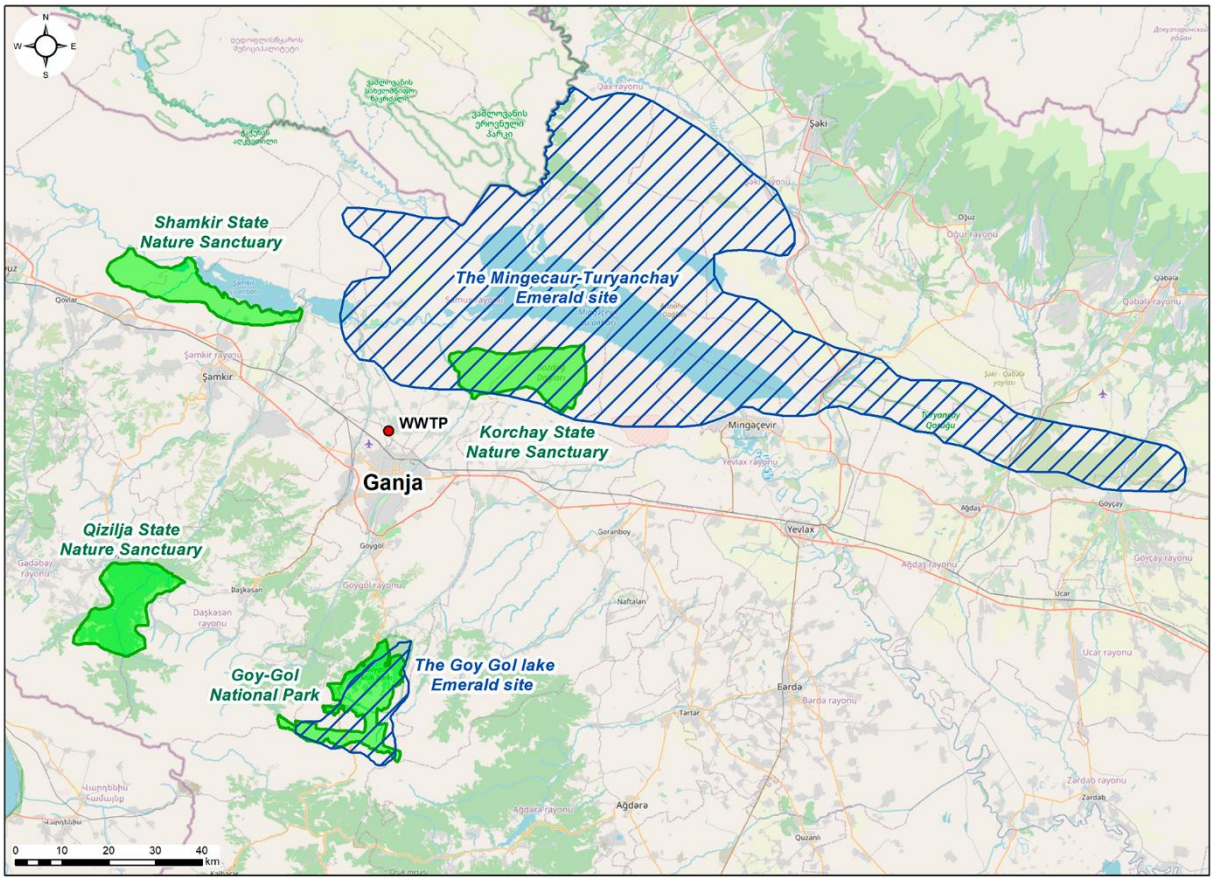
### 5.10.7 Nationally Protected and Internationally Designated Areas

*Nationally Protected Areas*

There are no nationally protected areas (NPAs) in the administrative area of Ganja but there are some NPAs nearby[51] (**Figure 32**):

- Korchay State Nature Sanctuary (including Korchay Strict Nature Reserve) is located approximately 6,5 km north-east from the Project area (the nearest NPA),
- Shamkir State Nature Sanctuary is located about 22 km north-west from the Project area,
- Goy-Gol National Park is located approximately 35 km south from the Project area,
- Qizilja State Nature Sanctuary is located about 40 km south-west from the Project area.

[51] https://www.protectedplanet.net/country/AZE




*Source: Prepared by the ESIA Consultant basing on the Protected Planet data source: https://www.protectedplanet.net/country/AZE*

**Figure 32. Nationally protected and internationally designated areas nearest to the WWTP site**

*Internationally Designated Areas*

In Azerbaijan, 17 sites are candidates for Emerald Network inclusion covering a general area of 1,679,533 hectares (approximately 19.4 percent of the country's terrestrial surface[52]). The Mingecaur-Turyanchay Emerald site of 326,358 ha is the closest site to the Project area. The site covers, among other, NPA Korchay State Nature Sanctuary; south borders of this NPA and the Emerald site almost coincide (**Figure 32**). Accordingly, the distance from this Emerald Site is about 6,5 km (the same as from the NPA).

The Goygol lake Emerald site covering 17,488 ha almost overlaps with NPA Goy-Gol National Park but some larger (**Figure 32**). The distance from this Emerald Site to the Project area is about 34 km.

## 5.11 Socio-Economic Baseline

Socio-economic conditions at regional, municipal and local levels, including demography, ethnicity, gender, economy, employment, public utilities, population health, employment, income and expenditures and education are described in this chapter. Data from regional and

[52] Guidelines for Developing Emerald Sites Management Plans in Azerbaijan. 2024, International Bank for Reconstruction and Development / The World Bank. https://www.eu4environment.org/app/uploads/2024/07/Guidelines-for-Developing-Emerald-Sites-Management-Plans-in-Azerbaijan.pdf

municipal levels is compared to national averages to highlight specific differences and trends. Information from the focus group discussions and interviews held for the purpose of the ESIA is integrated into the below section, where relevant.

## 5.12 Ganja City

### 5.12.1 Demography

#### 5.12.1.1 Population

Ganja is the third-largest city in Azerbaijan, and is a major cultural, economic, and historical center. The population of Ganja is 330.7 thousand people (early 2024 estimates)[53] (**Table 17**). Ganja's population has grown slightly, by 5.1 % (from 314.6 people in 2010 to 330.7 people in 2024), over the past decade. Since 2010, Ganja's growth and birth rates have been lower than the national urban averages, while the mortality rate was slightly higher in 2021–2024 **(Table 17**). Overall, the city population indicators show a slower growth compared to the national ones.

**Table 17. Key demographic indicators of Ganja, 2015-2023 [54]**

| | 2010 | 2015 | 2021 | 2022 | 2023 | 2024 |
|---|---|---|---|---|---|---|
| **Total population of Ganja** (thousand) | 314.6 | 328.4 | 329.4 | 329.4 | 330.3 | 330.7 |
| per 1,000 person: | | | | | | |
| Growth rate | 3.9 | 6.4 | 0.2 | -0.6 | 2.2 | 1.6 |
| Birth rate | 9.5 | 12.2 | 9.0 | 7.8 | 8.7 | 8.0 |
| Death rate | 5.6 | 5.8 | 8.8 | 8.4 | 6.5 | 6.4 |
| **Republic of Azerbaijan** (only urban areas)[55]: | | | | | | |
| per 1,000 person: | | | | | | |
| Growth rate | 11.2 | 10.1 | 1.6 | 4.6 | 3.7 | 2.9 |
| Birth rate | 17.2 | 16.0 | 9.8 | 10.8 | 9.8 | 8.9 |
| Death rate | 6.0 | 5.9 | 8.2 | 6.2 | 6.1 | 6.0 |

The Feasibility Study assumed a slightly larger annual population growth over the next 25 years. Three population growth rates are shown in **Table 18**. The expected growth scenario, with an annual increase of 1%, gives a population of approximately 354,126 people in 2030 (end of the PIP), and 361,244 people in 2032 (the PIP plus 2 years).

**Table 18. Updated population growth scenarios for Ganja [56]**

| Year | Scenario 1 – Low | Scenario 2 – Expected | Scenario 3 – High |
|---|---|---|---|
| | Population with 0% annual increase | Population with 1% annual increase | Population with 2% annual increase |
| 2023 | 330,300 | 330,300 | 330,300 |
| 2030 | | 354,126 | 379,411 |

[53] RA State Statistical Committee. 2024. Demography. https://www.stat.gov.az/source/demography/?lang=en

[54] RA State Statistical Committee. 2024. Demographic indicators of Azerbaijan. https://www.stat.gov.az/menu/6/statistical_yearbooks/?lang=en

[55] RA State Statistical Committee. 2024. Demography. https://www.stat.gov.az/source/demography/

[56] Ganja Water and Wastewater Feasibility Study Update. April 2024.

| Year | Scenario 1 – Low | Scenario 2 – Expected | Scenario 3 – High |
|---|---|---|---|
| | Population with 0% annual increase | Population with 1% annual increase | Population with 2% annual increase |
| 2032 | | 361,244 | 394,739 |
| 2035 | | 372,190 | 418,900 |
| 2040 | | 391,176 | 462,500 |
| 2045 | | 411,130 | 510,637 |
| 2050 | | 432,101 | 563,785 |

The Ganja population density increased from 2,875 people per km² in 2011 to 3,006 people per km² in 2024[57]. In 2024, the sex structure of Ganja's population was slightly more female-dominated compared to the national average (**Table 19**).

**Table 19. Population distribution by sex in Ganja (as of 01.01.2024)** [58]

| Administrative units | Total | | Male | | Female | |
|---|---|---|---|---|---|---|
| | person | % | person | % | person | % |
| **Republic of Azerbaijan**, total (thousand)[59] | 10,180.8 | 100.0 | 5,067.2 | 49.8 | 5,113.6 | 50.2 |
| **Ganja**, total | 330,663 | 100.0 | 161,159 | 48.7 | 169,504 | 51.3 |
| *Including:* | | | | | | |
| Hajıkend settlement | 458 | 100.0 | 231 | 50.4 | 227 | 49.6 |

### 5.12.1.2 Ethnic composition

Most of the Ganja population are Azerbaijanis (99.93%). Russians form the largest minority (0.04%), followed by Turks, Georgians, and Ukrainians, each accounting for only 0.01% or less.

### 5.12.1.3 Age structure

Ganja has a young population: in 2023, 41.3% were under 30, while the elderly (60+) form a smaller but growing group (**Figure 33**), (**Table 20**). Among younger age groups (0–24), the gender distribution is balanced, with only minor differences between men and women. Starting at age 25, women become the dominant percentage, becoming more pronounced in the 65+ age group. This can be explained by: labor out-migration of men, especially in the 25–44 and 45–64 age groups, and higher female life expectancy, especially in the 65+ age group.

[57] RA State Statistical Committee https://www.stat.gov.az/source/regions/

[58] RA State Statistical Committee. 2024. Demographic indicators of Azerbaijan. https://www.stat.gov.az/menu/6/statistical_yearbooks/?lang=en

[59] RA State Statistical Committee. Demographic indicators of Azerbaijan: https://www.stat.gov.az/source/demoqraphy/

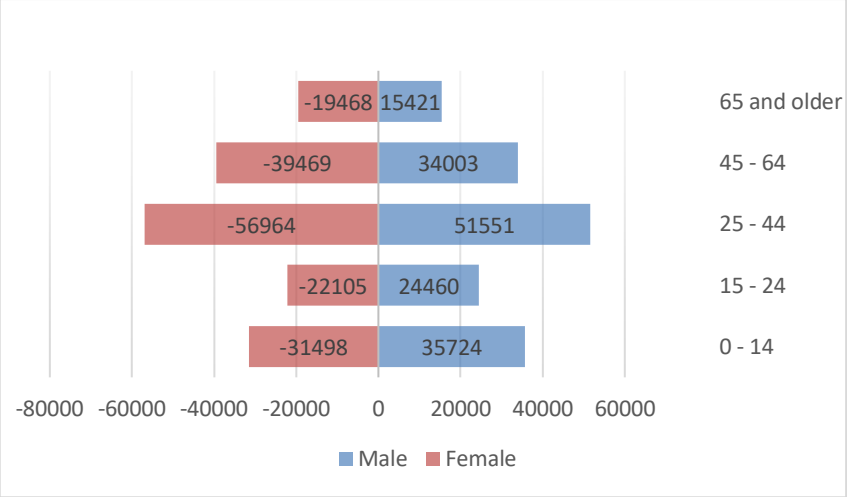



**Figure 33. Sex-age population in Ganja**

**Table 20. Distribution of women and men by main age groups, economic regions and administrative territorial units of the RA (1 January 2024)**

| Names of economic regions and administrative territorial units | Younger than working age | | At working age[1)] | | Older than working age | | Total |
|---|---|---|---|---|---|---|---|
| | women | men | women | men | women | men | |
| **Republic of Azerbaijan** | **1,010.7** | **1,150.3** | **3,486.5** | **3,508.9** | **616.4** | **408.0** | **10,180.8** |
| Share in a group | 46.8% | 53.2% | 49.8% | 50.2% | 60.2% | 39.8% | |
| Share in total population | 9.9% | 11.3% | 34.2% | 34.5% | 6.1% | 4.0% | 100.0% |
| **Baku city** | **197.3** | **221.7** | **832.7** | **812.3** | **164.9** | **116.0** | **2,344.9** |
| Share in a group | 47.1% | 52.9% | 50.6% | 49.4% | 58.7% | 41.3% | |
| Share in total population | 8.4% | 9.5% | 35.5% | 34.6% | 7.0% | 4.9% | 100.0% |
| **Ganja-Dashkasan economic region** | **57.7** | **67.4** | **204.1** | **203.6** | **39.2** | **25.8** | **597.8** |
| Share in a group | 46.1% | 53.9% | 50.1% | 49.9% | 60.3% | 39.7% | |
| Share in total population | 9.7% | 11.3% | 34.1% | 34.1% | 6.6% | 4.3% | 100.0% |
| **Ganja** | **31.5** | **35.7** | **115.2** | **110.0** | **22.8** | **15.5** | **330.7** |
| Share in a group | 46.9% | 53.1% | 51.2% | 48.8% | 59.5% | 40.5% | |
| Share in total population | 9.5% | 10.8% | 34.8% | 33.3% | 6.9% | 4.7% | 100.0% |

*[1)] for the beginning of 2024 - male at age 15-64, female at age 15-62,5*
*Source: AR State Statistical Committee.*

Nationally, children are 21% of the population, working-age adults 68.7%, and the elderly 10.1%. Ganja shows a similar pattern, but with a slightly higher share of elderly people (11.6%) compared to the national (10.1%) and regional (10.9%) averages.

### 5.12.2 Education

Ganja has a remarkably high literacy rate, estimated at over 99.8%, fully aligned to national level (2019 Census data[60]). The city hosts several esteemed universities, including Ganja State University, Azerbaijan Technology University, and Azerbaijan State Agricultural University, in

[60] Education, science and culture in Azerbaijan, 2025, https://www.stat.gov.az/menu/6/statistical_yearbooks/source/education_2025.pdf

addition to numerous schools and vocational institutions. The city's population education structure is shown in **Table 21**.

**Table 21. Education structure of the population in Ganja, 2019 Census data [61]**

| | Total | including | |
|---|---|---|---|
| | | male | female |
| Population aged 15 and above, **Ganja** | 248,894 | 117,922 | 130,972 |
| *including:* | | | |
| Higher education | 56,702 | 26,899 | 29,803 |
| Colleges | 21,596 | 9,167 | 12,429 |
| Professional schools | 8,904 | 4,737 | 4,167 |
| Complete secondary schools | 138,222 | 65,474 | 72,748 |
| Incomplete secondary schools | 19,022 | 9,418 | 9,604 |
| Primary schools | 3,908 | 1,997 | 1,911 |
| Beginner courses | 28 | 13 | 15 |
| Illiterate | 512 | 217 | 295 |

In Ganja, 55.5% of residents aged 15+ have completed secondary education, slightly below the national average (58.3%[62]), while 22.8% hold higher education, above the national level (16.8%). There are slightly more women than men in both secondary and higher education, reflecting the women to men ratio and thus an adequate access to education and opportunities to proceed to university.

The number of preschools remained stable at 43 between 2015 and 2023 (**Table 22**), but enrolment declined from 4,372 to 3,994, likely due to lower birth rates and out-migration. Focus group participants noted that both public and private kindergartens are accessible and affordable[63].

**Table 22. Educational infrastructure and enrolment in Ganja (2015-2023)[64]**

| Indicators | 2015 | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|---|
| Number of kindergartens | 43 | 43 | 43 | 43 | 43 |
| Number of kids in kindergartens | 4372 | 4367 | 4330 | 4316 | 3994 |
| Number of schools | 49 | 48 | 49 | 49 | 50 |
| Number of students in schools | 39,017 | 48,037 | 49,363 | 49,668 | 49,983 |
| Percentage of school graduates receiving diplomas and entering higher education institutions in the same year | 43.2 | 48.2 | 42.4 | 37.1 | 40.0 |

The number of schools also remained stable at 48-50, while student enrollment rose sharply from 39,017 in 2015 to 49,983 in 2023, suggesting larger class sizes. Women in the focus group expressed satisfaction with education quality, highlighting that outcomes depend on student motivation and involvement of parents.[65] While some parents invest in private tutoring, women stressed that successful learning is possible without it.

[61] https://www.stat.gov.az/source/regions

[62] Education, science and culture in Azerbaijan, 2025, https://www.stat.gov.az/menu/6/statistical_yearbooks/source/education_2025.pdf

[63] Minutes from the focus group of working age women in Ganja (01.08.2025)

[64] RA State Statistical Committee. 2025. Demographic indicators of Azerbaijan: https://stat.gov.az/source/regions/

[65] Minutes from the focus group of working age women in Ganja (01.08.2025)

The share of school graduates entering higher education directly after graduation fluctuated: peaked in 2020 at 48.2% but then dropped to 37.1% in 2022 and rose to 40.0% in 2023. Students cited entrance exam scores, job prospects, parental preferences, and financial constraints as key factors in career choice. Economic barriers, including costs of studying outside Ganja, make local universities more attractive. Ganja hosts universities with specialized programs, such as the Ganja Agrarian University, attracting students nationwide. Students noted that education is often too theoretical, with insufficient practical training and applied skills. Students mentioned that employers increasingly prefer candidates with university degrees, even when not required.[66]

### 5.12.3 Language and religion

Azerbaijani (Azeri) is the official language, spoken by most people. Russian is widely used, especially among older generations and in business. Minority languages like Talysh and Lezgin are spoken in their communities, where such exist across the country. In Ganja, ethnical Azerbaijanis (99.93% of the population) speak Azerbaijani. Most of Ganja's population practices Shia Islam, while a smaller portion follows Sunni Islam. There is also a small Russian Orthodox Christian community and other minor religious groups in the city.

### 5.12.4 Economy and employment

#### 5.12.4.1 Macroeconomic Context

Azerbaijan is rich in oil and gas, which dominates its economy, contributing 40% of GDP and 90% of exports over the past 20 years. Inflation in Azerbaijan has been moderate, fluctuating in response to exchange rates and global commodity prices. The Azerbaijan manat (AZN) has depreciated, impacting inflation and economic stability negatively. The government generates significant revenue from oil and gas but faces the challenge of managing these revenues to ensure long-term economic stability. Azerbaijan has a relatively low level of public debt and requires prudent management to prevent potential fiscal imbalances. The government is investing in infrastructure, tourism, and agriculture to diversify the economy. Reforms aimed at improving the business environment include reducing regulatory burdens and increasing transparency.

**Table 23. Macroeconomic indicators for Azerbaijan**

| Indicators | 2015 | 2020 | 2021 | 2022 | 2023 | 2024 |
|---|---|---|---|---|---|---|
| Nom. Gross development product (GDP) ($ per cap)[67] | 5,561.5 | 4,269.3 | 5,458.2 | 7,806.4 | 7,133 | 7,283.8 |
| Real GDP growth (%)[68] | 1.0 | -4.2 | 5.6 | 4.7 | 1.4 | 3.1 |
| Consumer price index (CPI) (% change, annual avg.)[69] | 4.03 | 2.76 | 6.65 | 13.85 | 8.79 | 2.21 |
| Local Currency Unit (LCU)/USD (annual avg.)[70] | 1.02 | 1.7 | 1.7 | 1.7 | 1.7 | 1.7 |
| LCU/Euro (annual avg.) | 0.59 | | | | | 1.9 |
| Nom. wages ($ per month)[71] | 455 | 416.3 | 430.6 | 494.1 | 549.4 | 594 |
| LCU wage growth (in % to previous year)[72] | 105.0 | 111.4 | 103.4 | 114.7 | 111.2 | |

[66] Minutes from the focus group of students in Ganja (02.08.2025)

[67] https://www.ceicdata.com/en/indicator/azerbaijan/gdp-per-capita

[68] https://data.worldbank.org/indicator/NY.GDP.MKTP.KD.ZG?end=2024&locations=AZ&start=1991&view=chart

[69] https://www.ceicdata.com/en/azerbaijan/consumer-and-producer-price-index-annual/az-consumer-price-index--change

[70] https://data.worldbank.org/indicator/PA.NUS.FCRF?locations=AZ

[71] https://stat.gov.az/source/labour/

[72] https://stat.gov.az/menu/6/statistical_yearbooks/source/emek_bazari_2024.pdf

| Indicators | 2015 | 2020 | 2021 | 2022 | 2023 | 2024 |
|---|---|---|---|---|---|---|
| Real LCU wage growth (in % to previous year)[73] | 101.0 | 108.4 | 96.9 | 100.7 | 102.2 | |

Ganja is one of the largest industrial cities in Azerbaijan and hosts a mix of heavy, light and food manufacturing. Some 271 large and medium-sized enterprises and 417 small enterprises operate in the city. The largest enterprises by employee numbers are "Azeraluminium" LLC (aluminium manufacturing), "Ganja Automobile Plant" PU (car/tractor production), "Ganja Sharab-2" OJSC (wine production).

Small and medium-sized enterprises (SMEs) in Ganja face challenges such as limited access to market, supply delays, workforce turnover, and low motivation among young employees. Entrepreneurs actively use the support programme to develop and expand their businesses. The Entrepreneurship Support Fund has proven an effective mechanism for stimulating SME development, helping not only to start businesses but also to support their expansion. Representatives of local business confirm the most promising economic sectors in Ganja are hospitality, restaurants, tourism, and wine production. Tourism in Ganja is increasing visitors numbers grew from 15,186 in 2015 to 28,712 in 2023, with peak tourist season in June-August. However, limited attractions, short festivals, and a lack of leisure infrastructure limit growth.[74]

The labor force and employment both declined from 2015 to 2023 (**Table 24**), with newly created jobs decreasing significantly from 3,660 to 935. Many residents work part-time, seasonally, or informally. The number of individual entrepreneurs grew from 25,032 to 40,974, signaling a shift toward self-employment and small businesses.[75]

**Table 24. Labor market in Ganja, 2015-2023** [76]

| | 2015 | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|---|
| Number of labor force, people | 175,388 | 154,776 | 155,626 | 156,321 | 157,021 |
| Number of employed population, people | 165,024 | 139,518 | 142,015 | 143,437 | 144,586 |
| Number of employees, people | 48,865 | 46,528 | 46,424 | 46,235 | 45,585 |
| Number of newly created jobs | 3,660 | 3,076 | 1,780 | 808 | 935 |
| Number of economic entities: | | | | | |
| legal entities | 2,170 | 2,821 | 2,888 | 3,061 | 3,215 |
| individuals | 25,032 | 36,370 | 38,136 | 38,585 | 40,974 |

Employment opportunities in Ganja are limited for all groups, but gender, age, and experience intensify inequalities. Respondents highlighted closure of factories and limited new business activity, which restricts available job opportunities. Men mentioned difficulties in accessing government jobs and young men struggle with the "*experience gap*".[77] Women face double discrimination: limited jobs overall and additional age-related restrictions. After age 35, employment opportunities are scarce.[78] Many women work in informal and low-paid sectors, despite having higher education. Pensioners often want to work due to low pensions, but face

[73] https://stat.gov.az/menu/6/statistical_yearbooks/source/emek_bazari_2024.pdf
[74] Minutes from the focus group in Ganja with representatives of small and medium-sized business (01.08.2025)
[75] Minutes of the focus group with men of working age in Ganja (01.08.2025)
[76] https://stat.gov.az/source/regions/
[77] Minutes from the focus group with working age men in Ganja (01.08.2025)
[78] Minutes from the focus group with working age women in Ganja (01.08.2025)

age discrimination and limited opportunities.[79] Students typically work in hospitality (waiters), as this is one of the few sectors hiring young people without experience. After graduation, it is rare for young people to find jobs that match their qualifications.[80]

#### 5.12.4.2 Unemployment level

Unemployment in Ganja is consistently higher than both the national and regional averages. In 2023, the rate was 7.9%, compared to 5.5% nationally and 6.5% in the Ganja–Dashkasan region (**Table 25**), driven by limited economic opportunities.[81]

**Table 25. Unemployment rate in Ganja and surrounding areas (%) [82]**

| | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|---|---|---|---|---|
| **Republic of Azerbaijan** | 5.0 | 5.0 | 5.0 | 4.9 | 5.0 | 7.2 | 6.0 | 5.6 | 5.5 |
| **Baku city** | 6.0 | 6.1 | 6.1 | 6.0 | 4.7 | 7.0 | 6.0 | 5.7 | 5.4 |
| **Ganja – Dashkasan region** | 5.3 | 5.4 | 5.4 | 5.4 | 5.9 | 8.6 | 7.3 | 6.8 | 6.5 |
| **Ganja** | 5.9 | 6.0 | 6.0 | 6.1 | 6.7 | 9.9 | 8.7 | 8.2 | 7.9 |
| *Ganja - number of unemployed population, person* | *10364* | *10751* | *10897* | *11086* | *10261* | *15258* | *13611* | *12884* | *12435* |

### 5.12.5 Urbanization

Ganja's population is predominantly urban, although some settlements were “annexed” in recent decades. The designation of these settlements is largely nominal: they have no official boundaries, no independent administrations, and are administratively integrated into two municipalities of Ganja. Residents do not own agricultural land and are regarded as part of the city’s urban population.

The only exception is Hajıkend, about 20 km from Ganja in Goygol district. During the soviet period, Hajıkend was a recreational area for Ganja’s workers, with sanatoriums, camps, and other facilities. In the 1990s, however, most of this infrastructure collapsed: only one sanatorium remains, while the rest of the facilities were privatized. Unlike rural communities, Hajıkend residents also do not have agricultural plots and are not engaged in farming.

### 5.12.6 Migration Trends

Ganja attracts migrants from rural regions of Azerbaijan due to its economic prospects and urban infrastructure, along with some expatriates and foreign workers. In 2024, 21,630 IDPs (6,318 households) were recorded, though some may have returned home.

Migration from Ganja to Russia is like broader Azerbaijani migration trends. Although city-specific data are lacking, key factors driving migration include limited local jobs, higher wages in Russia, strong community networks, cultural familiarity and remittances that support families (**Table 26**).

**Table 26. Personal remittances to Azerbaijan, received (% of GDP) [83]**

[79] Minutes from the focus group with pensioners in Ganja (01.08.2025)

[80] Minutes from the focus group with students in Ganja (02.08.2025)

[81] Azerbaijan's Labor Market in 2024: Balancing Progress and Youth Employment Challenges: https://www.thefreelibrary.com/Azerbaijan%27s%2BLabor%2BMarket%2Bin%2B2024%3A%2BBalancing%2BProgress%2Band%2BYouth...-a0822613312?utm_source

[82] https://www.stat.gov.az/source/labour/

[83] World Bank. 28.01.2025. World Development Indicators, https://data.worldbank.org/indicator/BX.TRF.PWKR.DT.GD.ZS

| 1995 | 2000 | 2005 | 2010 | 2015 | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|---|---|---|---|
| 0.1241 | 1.0836 | 4.7053 | 2.6655 | 2.3927 | 3.2865 | 2.7845 | 5.0122 | 2.6436 |

An estimated 600,000 – 1 million Azerbaijanis live in Russia, many from Ganja, Baku, and Sumgait.

While some are exploring destinations like Turkey and EU countries, Russia remains a primary choice. Trends suggest that migration will continue, though economic and political circumstances may influence the scale and nature in future.

### 5.12.7 Income and expenditure levels

#### 5.12.7.1 Income level

The main sources of household income are direct employment in manufacturing industrial and agricultural products, trade, and tourism and the public sector (Table 27).

**Table 27. Main sources of income of the population by gender in the Ganja-Dashkasan economic region in 2023[84]**

| Sources of income | Male | Female | Total |
|---|---|---|---|
| Total+ | 47.8 | 52.2 | 100.0 |
| Salary to hired persons | 17.9 | 12.8 | 30.6 |
| Self-employment | 15.9 | 3.8 | 19.7 |
| Production of goods for p\individual consumption | 0.5 | 1.8 | 2.3 |
| Property and other investments | - | - | - |
| Pension to retired persons | 4.5 | 8.8 | 13.3 |
| Labour pension on loss of family head | - | 0.1 | 0.1 |
| Labour pension on injury | 1.3 | 1.2 | 2.5 |
| Disability allowance and allowance for a child under 18 years of age with disability | 0.3 | 0.5 | 0.8 |
| Other allowances | - | 0.9 | 0.9 |
| Educational allowances | 0.3 | 0.4 | 0.7 |
| Other pensions | 0.0 | 0.0 | 0.1 |
| Unemployment insurance payments | - | - | - |
| Targeted state social assistance | - | 0.1 | 0.1 |
| Borrowings, aid, sales of assets | - | - | - |
| Transfers from abroad | 0.3 | 0.3 | 0.6 |
| Other persons governance (patronage) | 6.8 | 21.5 | 28.2 |
| Other | 0.0 | 0.0 | 0.1 |

Average incomes per capita for the national and regional levels from 2021 to 2023, including comparisons for Baku city, are shown in Table 28. Ganja's income levels may surpass the regional average.

**Table 28. Average income per capita in Ganja-Dashkasan region, Baku city, and Azerbaijan, 2021-2023 (AZN/capita/month)**

| Area | 2021 | 2022 | 2023 |
|---|---|---|---|
| Ganja-Dashkasan region | 286.30 | 337.30 | 350.60 |

[84] State Statistical Committee of Azerbaijan (AzStat), Report: "Household Income and Expenditure Survey" (latest: 2023). Table: "Structure of Income by Source and Gender". https://www.stat.gov.az → "Social Statistics" → "Household Surveys"

| | | | |
|---|---|---|---|
| Baku city | 327.00 | 346.80 | 351.30 |
| Republic of Azerbaijan | 300.60 | 327.60 | 343.20 |

Since 2015, the average nominal monthly wage in Ganja has more than doubled and is gradually catching up to the national average. However, the average wage is still about 25% lower than the national average in 2023 (**Table 29**).

**Table 29. Average monthly nominal wage in Ganja, 2015-2023[85]**

| Indicators | 2015 | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|---|
| Republic of Azerbaijan[86], AZN | 635.1 | 707.7 | 732.1 | 840.0 | 933.9 |
| Ganja, AZN | 321.0 | 526.1 | 548.9 | 622.3 | 694.3 |

In Ganja, income remains low across all groups, leaving many families unable to afford basic needs. Men increasingly recognize women as equal or main earners, with some wives earning double or triple their husbands' salaries. A "well-paid job" is 600-700 AZN per family member. [87] Many households rely on bank loans, sometimes pay most of their income to the bank, reflecting widespread financial vulnerability. Female-headed households and pensioners consider themselves to be at highest poverty risk.[88] Widows and single mothers survive on modest wages and social transfers, while pensions average 300–400 AZN [89], which is sufficient only to cover subsistence. Students largely depend on their families, because part-time work opportunities are scarce.[90]

### 5.12.7.2 Expenditure level

Average monthly expenditure per capita (**Table 30**) is slightly higher than income in Ganja Dashkasan region, Baku city, and at national level. Some households might be using savings to cover some expenditure, others may not have reported their full incomes, or both conditions might apply. No statistical data on household income and expenditure for Ganja are available.

**Table 30. Average consumption expenditure per capita in Ganja-Dashkasan region, Baku city, and Azerbaijan, 2021-2023 (AZN/capita/month)**

| Area | 2021 | 2022 | 2023 | 2024[91] |
|---|---|---|---|---|
| Republic of Azerbaijan | 308.60 | 333.40 | 348.10 | 363.5 |
| Baku city | 332.00 | 353.60 | 359.00 | 378.2 |
| Ganja-Dashkasan region | 301.30 | 344.70 | 358.10 | 369.10 |

Focus groups show that men prioritize food (≈70% of household spending) and utilities (15–20%).[92] Women manage broader expenses, including education and family needs, while also spending 60% (300-400 AZN) on food, which they note has become very expensive. [93] Pensioners' spending is limited to essentials, mainly food and utilities. Credit use is common

[85] https://stat.gov.az/source/regions/
[86] https://www.stat.gov.az/source/labour/
[87] Minutes from the focus group with working-age men in Ganja (01.08.2025)
[88] Minutes from the focus group with working-age women in Ganja (01.08.2025)
[89] Minutes from the focus group of pensioners in Ganja (01.08.2025)
[90] Minutes from the focus group with students in Ganja (02.08.2025)
[91] https://www.stat.gov.az/source/budget_households/
[92] Minutes from the focus group with men of working age in Ganja (01.08.2025)
[93] Minutes from the focus group with women of working age in Ganja (01.08.2025)

to cover urgent needs like repairs or social obligations.[94] Students' budgets are dominated by rent and daily subsistence.[95]

### 5.12.8 Poverty

Poverty data are available for urban and rural areas of Azerbaijan and separately for women and men (though not for Ganja) (**Table 31**).

**Table 31. Poverty levels for urban and rural areas of Azerbaijan, disaggregated by sex, 2021-2023**

| | 2021 | 2022 | 2023 |
|---|---|---|---|
| Poverty line (AZN/capita/month) | 204.70 AZN | 229.60 AZN | 247.10 AZN |
| Total national poverty level | 5.9% | 5.5% | 5.2% |
| National poverty level for men | 5.9% | 5.6% | 5.3% |
| National poverty level for women | 6.0% | 5.1% | 4.8% |
| Poverty level for urban areas | 4.3% | 2.9% | 3.9% |
| Poverty level for rural areas | 7.8% | 8.6% | 6.8% |

There has been a decrease in poverty from 2021 to 2023 with less poverty in urban areas than rural areas. Both in 2022 and 2023, the poverty level for women (5.1% and 4.8%, respectively) was less than that for men (5.6% and 5.3%, respectively).

### 5.12.9 Social assistance

Targeted state social assistance was provided to 2,165 low-income households or 8,840 persons in 2023 (**Table 32**).

**Table 32. Households and persons receiving targeted state social assistance in Ganja, 2015-2023**

| | 2015 | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|---|
| Number of households | 3,700 | 2,354 | 1,048 | 1,895 | 2,165 |
| Number of family members, people | 15,481 | 9,541 | 4,392 | 7,927 | 8,840 |

Other vulnerable groups in Ganja receiving different types of support in January 2024 were:

21,630 IDPs (internally displaced persons) in 6,318 families; 888 war-disabled persons; 445 martyrs; 669 families of martyrs; 5,527 persons with disabilities.

### 5.12.10 Public utilities infrastructure

#### 5.12.10.1 Access to water supply and wastewater services

Ganja ASWRA provides water supply and wastewater services within the city only and does not intend to provide such services outside of the city boundaries in future.

#### 5.12.10.2 Access to water supply services

Ganja ASWRA had 69,381 domestic water supply customers (households) in July 2024 (**Table 33**). Other customers include 2,309 commercial entities and 96 budget organisations. Around

[94] Minutes from the focus group with pensioners in Ganja (01.08.2025)

[95] Minutes from the focus group with students in Ganja (01.08.2025)

63% of household customers and 90% of commercial and budget organisation customers have water meters. Most are mechanical with a small number of smart meters operating with a pre-payments.

**Table 33. Water supply customers in Ganja, July 2024**

| Customer type | Number of customers |
|---|---|
| Households | 69,381 |
| Non-residential and commercial entities | 2,309 |
| Budget organisations | 96 |

ASWRA supplies piped water to approximately 196,898 people, or around 60% of the total Ganja population. This seems low compared to the maps showing the existing water supply network. Previous studies indicated that 65% of households had piped water, while the remaining 35% relied on private wells before the KfW project. Between 2004 and 2020, the German development bank KfW financed the planning and partial construction of water supply and sanitation infrastructure in Ganja, as well as in the nearby city of Sheki, under the projects *"Rehabilitation of the Water Supply"* and *"Wastewater Disposal."* Completed in 2020, the KfW project updated 40% of the city's water supply network. It is estimated that 65% of the remaining 60% of the city still has piped water, meaning a total coverage of 79%.

Given an average household size of 4.12 persons, some 285,800 people in 69,381 households have piped water (about 85% of the population). This aligns with ASWRA's data that 16% of Ganja's population lacks water network access. Many households, especially where water supply is still to be rehabilitated/replaced, have water storage tanks and they purchase water from Ganja ASWRA.

Water from special artesian wells (known as *"agsu"* – white water), the Goygol pipeline, and springs is used for drinking and cooking. The artesian wells and springs are operated by the local ASWRA branch. The water is distributed by private water trucks at least twice a week. The service costs 10 gapiks per 10 liters of water. This service covers nearly 98% of households.

The difference between water extracted from natural sources (12,578,495.00 m³) and water used (9,034,434.00 m³), is 3,544,061.00 m³ (28%). Such water loss which may include leaks, inefficient distribution, or unauthorized use exceeds the regulatory limit of 10%. To meet future demands both water conservation practices and infrastructure improvements will be necessary.

#### 5.12.10.3 Access to piped wastewater services

Ganja ASWRA provided piped wastewater services to 53,130 domestic (household) customers, 2,271 commercial entities and 96 budget organisations (July 2024) (**Table 34**).

**Table 34. Wastewater customers in Ganja, July 2024**

| Customer type | Number of customers |
|---|---|
| Households | 53,310 |
| Non-residential and commercial entities | 2,271 |
| Budget organisations | 96 |

Ganja's wastewater network covers about 67–70% of the population, leaving roughly a quarter unconnected. All groups support the new WWTP, seeing it as vital for public health, food

safety, and environmental protection. Women stress benefits for children, men highlight urgency, and pensioners call for modern, advanced technology.[96]

In addition, there is another issue that was raised by females: flooding during heavy rains is a widespread concern due to poor stormwater drainage and street planning.[97]

#### 5.12.10.4 Affordability and subsidies related to water supply and wastewater services

Ganja ASWRA manages 68 public "martyr" water points, honouring soldiers who perished in recent conflicts and providing free access to water. The Ganja Executive Authority pays for water consumption. Households without direct connections, and limited piped water supply, utilize these water points for their needs. IDPs are given 5,000 litres of water per person per month free of charge, equating to approximately 167 litres/person/day. The IDP Committee pays for that water.

Households not able to pay for water and wastewater can apply for debt instalments over a period of 2-12 months. In 2023, 257 households applied for payment instalments, with ASWRA approving 238 applications.

### 5.12.11 Land Use

Ganja has residential, commercial, and industrial land use, with surrounding agriculture. City management challenges include aging infrastructure, environmental issues and pressure on green spaces. Sustainable planning and modernization investments are crucial for the future of the city.

**Table 35. Summary: General Land Use in Ganja - Main indicators on land use and plans for 2027 and 2040 under the Master Plan**

| Indicator | 2020 | 2027 | 2040 |
|---|---|---|---|
| | ha (%) | ha (%) | ha (%) |
| Total area of Ganja | 12,387.0 (100.0) | 12,529.0 (100.0) | 13,406.0 (100.0) |
| *Including:* | | | |
| Residential areas | 5,180.5 (41.80) | 5,383,70 (42.97) | 5,781.85 (43.12) |
| Social-business | 412.09 (3.32) | 569.10 (4.54) | 860,70 (6.42) |
| Recreation | 576.60 (4.65) | 945.55 (7.55) | 1,630.75 (12.16) |
| Industrial zones | 1,482.53 (11.97) | 1,451.29 (11.58) | 1,395.34 (10.41) |
| Transport infrastructure | 776.09 (6.30) | 815.40 (6.51) | 888,37 (6.62) |
| Engineer-communication supply | 31.47 (0.25) | 29.50 (0.24) | 25,81 (0.19) |
| Agriculture | 904.84 (7.30) | 1,010.43 (8.06) | 603.16 (4.50) |
| Special appointment | 166.0 (1.34) | 10.09 (0.08) | 10.09 (0.08) |
| Military and other regimes | 342.92 (2.77) | 330.70 (2.64) | 307.97 (2.30) |
| Areas used under special requirement | 69.15 (0.56) | 419.54 (3.35) | 1.070.27 (7.98) |
| Specially protected | 686.67 (5.54) | 685.90 (5.47) | 685.90 (5.12) |
| Spare areas | 1,758.14 (14.20) | 877.80 (7.01) | 145.79 (1.10) |

*Source: The SEA for the Master Plan of the city of Ganja. April, 2024. P.69*

[96] Minutes of the focus group with working age women in Ganja (01.08.2025)

[97] Minutes of the focus group with women of working age in Ganja (01.08.2025)

### 5.12.12 Public Health and Safety

Public health and safety in Ganja, are important to the city's overall development. Despite advances in healthcare services and public safety measures, challenges persist.

#### 5.12.12.1 Healthcare Infrastructure

Ganja has a well-developed healthcare system (**Table 36**), including:

- **Central City Hospital**: The largest public hospital in the city, offering a wide range of medical services.
- **Specialized Clinics**: Include maternity hospitals, paediatric clinics, and diagnostic centres.
- **Private Healthcare Providers**: Offer specialized services and shorter wait times.
- **Primary Healthcare Centres**: Provide basic medical services and preventative care to residents.

**Table 36. Healthcare infrastructure of Ganja[98]**

| Indicators | 2015 | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|---|
| Number of hospitals | 19 | 19 | 13 | 13 | 13 |
| Number of beds in hospitals | 2,218 | 2,321 | 2,207 | 2,213 | 2,247 |
| Policlinics | 35 | 31 | 29 | 28 | 29 |
| Number of visitors per one shift | 5,080 | 4,892 | 5,039 | 5,024 | 5,054 |

#### 5.12.12.2 Key Health Indicators

The average life expectancy in Ganja is 75 years, which is slightly higher than in Ganja-Dashkasan region (74.8 years), yet remains below the national average of 78.5 years. In Ganja, women have a slightly higher life expectancy than men (**Table 37**).

**Table 37. Life expectancy at birth in Ganja, Ganja-Dashkasan region, and nationally in 2023, years**

| Names of economic regions and administrative territorial units | Total, including | | | Urban areas, including | | | Rural areas, including | | |
|---|---|---|---|---|---|---|---|---|---|
| | average | women | men | average | women | men | average | women | men |
| Republic of Azerbaijan | 76.0 | 78.4 | 73.5 | 78.5 | 78.3 | 73.4 | 76.0 | 78.5 | 73.5 |
| Ganja-Dashkasan economic region | 74.7 | 77.1 | 72.3 | 74.8 | 77.1 | 72.4 | 74.5 | 76.8 | 72.1 |
| Ganja city | | | | 75.0 | 76.8 | 73.1 | | - | - |

In Ganja, infectious and parasitic diseases rose sharply from 1,723 in 2015 to 13,889 in 2023 (**Table 38**). The increase in infectious diseases may be related to the quality of drinking water. However, there is no reliable research confirming this connection. During a meeting with representatives of Ganja's sanitary service, it was confirmed that the quality of the supplied water remains low, as it is drawn from artesian wells without additional treatment or

[98] https://stat.gov.az/source/regions/

disinfection. Nevertheless, the reconstruction of the water supply network, along with the installation of disinfection systems will help improve the situation.

Neoplasms remained low and stable, with a slight rise in 2023. Circulatory diseases peaked in 2020–2021 but declined in 2022–2023, while respiratory diseases fell from 21,313 in 2015 to 9,237 in 2023.

**Table 38. Trends in newly diagnosed diseases in Ganja, 2015-2023** [99]

| Indicators | 2015 | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|---|
| Diseases diagnosed for the first time | 67,932 | 58,002 | 73,956 | 62,563 | 73,287 |
| Including | | | | | |
| Infectious and parasitic diseases | 1,723 | 8,113 | 11,930 | 11,574 | 13,889 |
| Neoplasms | 366 | 274 | 203 | 339 | 407 |
| Diseases of the circulatory system | 7,941 | 8,834 | 8,740 | 3,719 | 4,468 |
| Respiratory diseases | 21,313 | 12,117 | 16,437 | 8,165 | 9,237 |

The focus group participants have stated that healthcare in Ganja has improved in the recent years, with better medical facilities and a growing number of doctors compared to the past. However, for complex diagnostics and specialized treatment, residents often travel to Baku. While mandatory health insurance formally guarantees free services, in practice, long queues, informal payments, and systemic inefficiencies restrict effective access. Private clinics provide faster and better-organized services, but they are financially inaccessible for many, especially pensioners. Both women and pensioners highlight economic barriers to healthcare services, with pensioners being the most vulnerable group, facing both limited incomes and higher medical needs [100].

### 5.12.13 Gender

Azerbaijan's human development index was 0.760 in 2022, 95th out of 193 countries, and categorised as 'high human development' (UNDP, 2023/2024)[101]. The highest HDI was 0.762 in 2019, declined to 0.722 in 2020, likely due to COVID-19, but began improving in 2021. Azerbaijan is ranked 77th out of 193 countries in the gender inequality index, with a value of 0.329. Additionally, its gender development index stands at 0.961[102], positioning the nation within the group characterized by medium to high equality in human development index achievements between women and men.

Gender issues in Azerbaijan are a combination of cultural traditions, economic conditions, and social norms. Although Azerbaijan is making progress in achieving gender equality, particularly in education and political quotas, economic and cultural barriers persist. The government's 2024-2030 gender strategy aims to mitigate these disparities through enhanced enforcement and economic incentives.

The male to female ratio in Ganja is 49% to 51%[103]. Ganja has a significant number of working-age men migrating to Baku, Turkey, or Russia for employment in construction and oil industries, affecting gender ratios. Men's employment constitutes 68–70%, primarily in construction (30%), industry (25%), transport (20%), and services (25%). Women's

[99] https://stat.gov.az/source/regions/

[100] Minutes from the two working groups with working age women and pensioners in Ganja (01.08.2025)

[101] UNDP. 2023/3024. Human Development Report. Breaking the gridlock. https://hdr.undp.org/system/files/documents/global-report-document/hdr2023-24reporten.pdf

[102] *Ibid.*

[103] State Statistical Committee of Azerbaijan. 2024.

employment constitutes 50–53%, mainly in education (35%), healthcare (25%), textiles (20%), retail (15%), and informal work (5%)[104].

The official unemployment rate for men is approximately 5–6% and for women 8–10%, due to post-marriage dropout rates. Women earn approximately 30–35% less than men in formal sectors. Some 25% of employed women work unpaid in family businesses (e.g., small shops, agriculture)[105].

Ganja shows both progress and gaps in gender equality. Local initiatives include low-interest loans and training for women-led startups, co-working hubs for female freelancers, and state-funded courses prioritizing women in textiles, IT, and agriculture. Women's political participation is rising: 25% of candidates in the 2024 municipal elections were women (up from 18% in 2019), and one of five district mayors is female (compared to none in 2020).

### 5.12.14 Gender-based violence and harassment

Gender-based violence (GBV) and harassment remain concerns in Azerbaijan. Estimates suggest that 43% of women in Azerbaijan have experienced domestic violence, yet official reporting remains low due to cultural perceptions of violence as a private matter, fear of stigma, and limited access to victim-centred support services[106] (**Table 39**).

While the national number of domestic violence cases shows relatively stable, Ganja experienced a sharp decline after 2021 (**Table 39**). A decrease in domestic violence cases does not necessarily mean that the problem has decreased. It may reflect both the effectiveness of preventive measures and incomplete or selective reporting.

**Table 39. Number of victims of domestic violence in Ganja and at the national level, 2020-2023[107]**

| | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|
| Republic of Azerbaijan, people | 1,300 | 1,536 | 1,475 | 1,513 |
| Ganja, people | 52 | 45 | 9 | 9 |

Shelter capacity remains a serious challenge in Azerbaijan, with only two facilities (Baju and Ganja) accommodating about 175 survivors, far below the 1,300 – 1,500 domestic violence cases registered annually.[108] A municipal shelter in Ganja accommodates only 20–25 individuals, relying largely on donations.[109] Access to legal aid is also limited, as many NGOs providing free services to women have been closed due to a lack of funding.

The Law on Prevention of Domestic Violence (2010) and the National Action Plan provide a legal framework for prevention, protection, and victim support. Awareness campaigns and trainings have been implemented[110]. Support services include a 24/7 GBV hotline and the Women's Support Line [111]. Nevertheless, coverage outside major cities remains limited. NGOs

[104] State Statistical Committee of Azerbaijan. 2023. Labor Force Survey, available at https://www.stat.gov.az (Tables: "Labor Market Indicators by Region").

[105] State Statistical Committee of Azerbaijan. Report: "Labor Market Indicators by Region (2023)". Table: "Average Monthly Wages by Gender and Economic Activity (Gəncə-Gazakh Economic Region)"

[106] https://eu4azerbaijan.eu/combatting-domestic-violence-against-women-going-beyond-a-one-time-help-2/?utm_source

[107] https://stat.gov.az/source/regions/

[108] Presentation: Gender-based violence (ayna initiative group) (2023)

[109] Minutes of the scoping consultation with NGO, Ganja (05.06.2025)

[110] https://ombudsman.az/en/news/1160?utm_source

[111] https://unece.org/sites/default/files/2024-08/Azerbaijan-Report.pdf

like the Public Union “Tamas” in Ganja continue offering shelter, legal aid, and advocacy, but face severe resource constraints.

### 5.12.15 Cultural Heritage

Ganja is among the most ancient cities in Azerbaijan, with a history extending over 2,500 years. Throughout its history, it has served as a hub of culture, trade, and education. The city is renowned for its historical landmarks, including the Nizami Mausoleum, Juma Mosque, and Ganja Gate. Located on the Silk Road, Ganja played a key role in cultural and economic exchange. Goods from eastern countries were transported west through caravan routes passing this city. Merchants and traders of the Silk Road often stayed in caravanserais (a roadside inn) in Ganja before continuing their journeys.

Archaeological excavations in Ganja have uncovered ancient habitations from the 2nd century B.C. and Bronze Age artifacts. The city's history includes periods of destruction by invaders followed by revival. The Shah Abbas Mosque, built in 1606 and also known as the Juma Mosque, is a prime example of 17th-century Azerbaijani architecture. Located in Ganja, it has two minarets added in 1776 and includes a madrasa. Notable monuments in the city include the Mausoleum of Jomard Gasab, Sheikh Ibrahim Mausoleum, Sharafkhanly and Shahsevan Mosques, and old bathhouses. Ganjachay River divides the city, with the 12th-century Great and Small Bridges recognized for their unique architecture.

Ganja is the birthplace of poets Nizami Ganjavi, Mahsati Ganjavi, and Mirza Shafi Vazeh, known as the “sage of Ganja.” The Mausoleum of Nizami Ganjavi is situated at the entrance to the city. Nizami's tomb has been a site of pilgrimage for many centuries. Given its rich cultural and natural heritage, the city provides a unique platform for intercultural and inter-religious dialogue among diverse communities and civilizations. It remains a place where Christians and Muslims coexist peacefully and with mutual respect.

Alexander Nevsky Church, German Lutheran Church, Bagmanlar Church, Divankhana, Khan's Palace, Castle, Garden, Caravanserai, Sharafkhanli Mosque, Shahsevaner Mosque, Albanian Temple, Men's and Girls' Gymnasiums, Russian Orthodox Church, fortress walls and gates, Imamzade tomb, Nizami mausoleum, ancient bridge over Ganjachay River, and so forth are part of Ganja's legacy.

In the 17th century, Ganja was known as Abbasabad. It became a city in 1824, named Yelizavetpol from 1804 to 1918. After Azerbaijan gained independence in 1918, it was called Ganja until 1935. In 1918, Ganja served as the temporary capital of the Azerbaijan Democratic Republic, which was the first democratic and secular state in the Turkic and Islamic world. During the Soviet era (1935-1989), it was named Kirovabad but reverted to Ganja in 1989. Khan Baghi, a 3 ha recreation area in Ganja, is a historic garden and natural heritage site dating back to 1582. Despite some trees being cut down after the Russian occupation, it remains famous for its rich flora and serves as one of the oldest natural parks in the Caucasus and Azerbaijan.

Cultural sites can boost local economies and enhance Azerbaijan's national and international profile. For this, the surrounding areas must be well-presented, and sites maintained effectively. Resulting economic activity supports site maintenance by providing locals with tourism-related jobs. Current “conceptual alternatives” appear not to integrate cultural environments into strategic development plans.

## 5.13 Samukh District

Samukh District is in north-west Azerbaijan, within the Ganja-Dashkasan Economic Region. The area surrounding the proposed WWTP site and effluent channel lies within the following municipalities: Ziyadli, Sarkar and Garayeri of Samukh District. Samukh District covers an area of 1,450 km². The population density is approximately 40 people per square kilometre (January 1, 2024). Samukh District borders the city of Ganja, and Dashkasan, Shamkir, Agstafa, Yevlakh, and Goran districts of Azerbaijan. To the north, it borders Georgia.

### 5.13.1 Demography

#### 5.13.1.1 Population

The State Statistical Committee estimates the population of Samukh District at 58,587 people (as of 01.01.2024) (**Table 40**). Samukh District accounts for around 9.8% of the population of the Ganja-Dashkasan Economic Region and around 0.58% of Azerbaijan's total population.

***Table 40. Population distribution by sex in Samukh District[112]***

| Administrative units | Total | | Men | | Women | |
|---|---|---|---|---|---|---|
| | person | % | person | % | person | % |
| **Republic of Azerbaijan**, total (thousand)[113] | 10,180.8 | 100.0 | 5,067.2 | 49.8 | 5,113.6 | 50.2 |
| **Samukh District, total** | **58,587** | **100.0** | **29,700** | **50.7** | **28,887** | **49.3** |
| urban population | 22,774 | 100.0 | 11,429 | 50.2 | 11,345 | 49.8 |
| rural population | 35,813 | 100.0 | 18,271 | 51.0 | 17,542 | 49.0 |

Over the past decade, the population of Samukh District has experienced gradual growth. However, compared to 2015, the population growth rate has reduced from 12.4‰ to 5.5‰, possibly due to an increase in the death rate (from 6.7‰ in 2015 to 7.1‰ in 2023) and a decrease in the birth rate (from 19.1‰ in 2015 to 12.6‰ in 2023) (**Table 41**).

***Table 41. Key Demographic Indicators of Samukh District, 2015–2023[114]***

| Indicators | 2015 | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|---|
| **Population of Samukh District** (beginning of year, thousand) | 56.4 | 57.5 | 57.7 | 58.2 | 58.6 |
| Per 1,000 person: | | | | | |
| Growth rate | 12.4 | 4.1 | 2.6 | 6.4 | 5.5 |
| Birth rate | 19.1 | 13.8 | 12.1 | 14.2 | 12.6 |
| Death rate | 6.7 | 9.7 | 9.5 | 7.8 | 7.1 |
| **Republic of Azerbaijan** (urban and rural areas)[115]: | | | | | |
| per 1,000 person: | | | | | |
| Growth rate | 12.5 | 11.7 | 3.5 | 6.2 | 5.2 |
| Birth rate | 18.5 | 17.4 | 11.2 | 12.2 | 11.1 |
| Death rate | 6.0 | 5.7 | 7.7 | 6.0 | 5.9 |

The population growth rate in Samukh District has remained slightly higher than the national average in 2022–2023, for example 5.5‰ in 2023 compared to 5.2‰ nationally. Birth rates in Samukh are also consistently above the national level, reaching 12.6‰ in 2023 versus 11.1‰ across Azerbaijan. Mortality in the district, however, is higher than the national average (7.1‰ in Samukh District compared to 5.9‰ nationally in 2023).

The town of Samukh is the administrative center of Samukh District and the primary urban settlement. The region remains largely rural, with 61.13% of residents living in villages.

[112] RA State Statistical Committee. 2025. Demographic indicators of Azerbaijan: https://stat.gov.az/source/regions/
[113] RA State Statistical Committee. Demographic indicators of Azerbaijan: https://www.stat.gov.az/source/demography/
[114] RA State Statistical Committee. 2025. Demographic indicators of Azerbaijan: https://stat.gov.az/source/regions/
[115] RA State Statistical Committee. 2024. Demography. https://www.stat.gov.az/source/demography/

The Azerbaijan population in 2024 was 49.8% men and 50.2% women, showing a slight predominance of women. Samukh District displays the opposite pattern, with 50.7% men and 49.3% women overall. This tendenc is particularly visible in rural areas (51.0% men vs. 49.0% women), while the urban population the gender ratio is more balanced (50.2% men and 49.8% women).

### 5.13.1.2 Ethnic composition

According to the census data, 98.42% of the population are Azerbaijanis, with small minorities including Kurds (1.08%), Turks (0.35%), Russians (0.06%), and other ethnic groups.

### 5.13.1.3 Age structure

Samukh District has a relatively young population, with 41.8% of people under the age of 30 (including children (0-14 years) – 21.8% and young persons (15-29 years) – 20%). The elderly population (above 60) constitutes a smaller segment (15.7%). **Figure 34** and **Table 42** shows the sex-age distribution of the population of Samukh District.

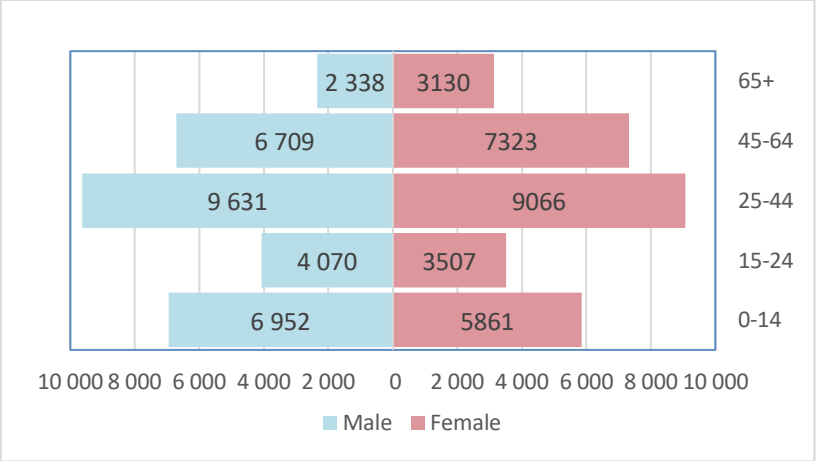



**Figure 34. Sex-age population in Samukh District**

**Table 42. Distribution of women and men by main age groups in Samukh District (1 January 2024)**

| Names of economic regions and administrative territorial units | Younger than working age | | At working age[1)] | | Older than working age | | Total |
|---|---|---|---|---|---|---|---|
| | women | men | women | men | women | men | |
| ***Republic of Azerbaijan**, total* | **1,010.7** | **1,150.3** | **3,486.5** | **3,508.9** | **616.4** | **408.0** | **10,180.8** |
| Share in a group | 46.8% | 53.2% | 49.8% | 50.2% | 60.2% | 39.8% | |
| Share in total population | 9.9% | 11.3% | 34.2% | 34.5% | 6.1% | 4.0% | 100.0% |
| ***Ganja-Dashkasan economic region**, total* | **57.7** | **67.4** | **204.1** | **203.6** | **39.2** | **25.8** | **597.8** |
| Share in a group | 46.1% | 53.9% | 50.1% | 49.9% | 60.3% | 39.7% | |
| Share in total population | 9.7% | 11.3% | 34.1% | 34.1% | 6.6% | 4.3% | 100.0% |
| ***Samukh District,** total* | **5.9** | **7.0** | **19.9** | **20.4** | **3.1** | **2.4** | **58.6** |
| Share in a group | 45.7% | 54.3% | 49.4% | 50.6% | 49.4% | 40.5% | |
| Share in total population | 10.0% | 11.9% | 34.0% | 34.8% | 5.3% | 4.0% | 100.0% |

*[1)]for the beginning of 2024 - male at age 15-64, female at age 15-62,5*

| Names of economic regions and administrative territorial units | Younger than working age | | At working age[1)] | | Older than working age | | Total |
|---|---|---|---|---|---|---|---|
| | women | men | women | men | women | men | |
| ***Republic of Azerbaijan**, total* | **1,010.7** | **1,150.3** | **3,486.5** | **3,508.9** | **616.4** | **408.0** | **10,180.8** |
| Share in a group | 46.8% | 53.2% | 49.8% | 50.2% | 60.2% | 39.8% | |
| Share in total population | 9.9% | 11.3% | 34.2% | 34.5% | 6.1% | 4.0% | 100.0% |
| ***Ganja-Dashkasan economic region**, total* | **57.7** | **67.4** | **204.1** | **203.6** | **39.2** | **25.8** | **597.8** |
| Share in a group | 46.1% | 53.9% | 50.1% | 49.9% | 60.3% | 39.7% | |
| Share in total population | 9.7% | 11.3% | 34.1% | 34.1% | 6.6% | 4.3% | 100.0% |

*Source: AR State Statistical Committee.*

The working-age group dominates in Samukh District, accounting for 68.8% of the district's population, which indicates a strong labour force potential. The proportion of elderly residents (9.3%) is lower than the national (10.1%) and regional (10.9%) averages. Children and youth represent 21.9% of the district's population (10.0% women, 11.9% men), slightly above the national average (21.2%) and the Ganja-Dashkasan region (21.0%). Therefore, Samukh District has a younger age structure than both the national and regional averages, with relatively fewer elderly residents.

### 5.13.2 Education

The literacy rate in Samukh district is exceptionally high, reaching approximately 99.3% in 2019. The district's population education structure is shown in **Table 43**. In the district, most adults have completed secondary education (49.4%), below the national average of 58.3%. The share of residents with higher education (13.1%) is also lower than the national level (16.8%), highlighting a more limited access to advanced education opportunities. Although illiteracy is very low overall (0.7% of the adult population), women account for nearly two-thirds of this group.

**Table 43. Education structure of the population of Samukh District, 2019, Census data**

| Indicators | Total | Including | |
|---|---|---|---|
| | | men | women |
| Population aged 15 and above | 43,875 | 21,644 | 22,231 |
| *Including:* | | | |
| Higher education | 5,765 | 2,817 | 2,948 |
| Colleges | 4,195 | 1,582 | 2,613 |
| Professional schools | 3,865 | 2,202 | 1,663 |
| Complete secondary schools | 21,669 | 11,134 | 10,535 |
| Incomplete secondary schools | 6,787 | 3,269 | 3,518 |
| Primary schools | 1,285 | 522 | 763 |
| Beginner courses | 9 | 6 | 3 |
| Illiterate | 300 | 112 | 188 |

Preschool education in Samukh District is for children, typically aged 3-6. The increase from 16 to 18 institutions between 2015 and 2023 reflects efforts to expand early childhood education (**Table 44**). Enrolment peaked in 2021 at 825 children but declined by 16.5% from 2021 to 2023. This decrease may reflect demographic trends (including a decline in the birth rate, see **Table 41**).

**Table 44. Educational infrastructure and enrolment in Samukh District (2015-2023)[116]**

| Indicators | 2015 | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|---|
| Number of kindergartens | 16 | 18 | 18 | 18 | 18 |
| Number of kids in kindergartens | 577 | 821 | 825 | 764 | 686 |
| Number of schools | 35 | 35 | 35 | 35 | 35 |
| Number of students in schools | 7,940 | 9,679 | 9,839 | 9,825 | 9,767 |
| Percentage of school graduates receiving diplomas and entering higher education institutions in the same year | 26.7 | 34.7 | 28.7 | 38.7 | 35.4 |

Samukh District has 35 general education schools serving both the town of Samukh and surrounding villages (**Table 44**). Student enrollment in general education schools increased from 2015 to 2021, peaking at 9,839 in 2021. The slight decline of 0.7% in 2021-2023, potentially due to demographic shifts or outmigration, mirrors trends observed in preschool education. The average number of students per school rose from 2015 to 2021 but slightly decreased to 279.1 students per school by 2023, indicating manageable class size (according to interview, class sizes do not exceed 30 students). The teaching staff is predominantly female and fully staffed. Teachers focus exclusively on their specialized subjects. Teachers must undergo periodic recertification to maintain their qualifications. Competitive hiring processes are in place from time to time for vacant teachers' positions[117]. There is a trend of school students returning to teach at their former school after graduating from university. The local administration could support young teachers. Measures include allocating land for housing construction to encourage retention.

The proportion of graduates entering higher education has risen from 26.7% in 2015 to 35.4% in 2023. Still, this is lower than in Ganja, where 40.0% of graduates entered higher education in 2023 (**Table 22**). This difference may mean that students in Ganja have better chances or resources for continuing their studies. Samukh District has no university, requiring students to relocate to Ganja, Baku, or abroad (European and American universities) for higher education. The need to relocate for university studies contributes to youth outmigration from the district.

### 5.13.3 Language and religion

Azerbaijani (Azeri) is the official language, spoken by most people. Russian is widely used, especially among older generations and in business. The 2019 population census shows that 97.8% of the Samukh district's population speaks Azerbaijani, about 1% speaks Russian, and around 2% speaks other languages[118]. The Samukh district is home to representatives of various religions. Most of the population is Muslim (91.0%), while a smaller percentage is Orthodox Christian (3.2%). The remaining 3% belong to other religions, including Catholicism, Jehovah's Witnesses, Yazidism, Protestantism, Judaism, and others[119].

### 5.13.4 Economy and employment

#### 5.13.4.1 Macroeconomic Context

The Samukh region is part of Ganja-Dashkasan economic region, established in 2021, as one of Azerbaijan's 14 economic regions. The economy of Samukh and the surrounding districts is

[116] RA State Statistical Committee. 2025. Demographic indicators of Azerbaijan: https://stat.gov.az/source/regions/

[117] Interview with the staff of the school in the village Ziyadli

[118] https://stat.gov.az/source/regions/

[119] https://stat.gov.az/source/regions/

primarily based on agriculture, including crop cultivation and livestock (**Table 45**). Large entrepreneurial farms such as "AQRO DAIRY" Limited Liability Company, "Boz Dag" livestock complex, "Ulduz 2011" LLC, "Qarabagh Region MKT" LLC, "Region Agro" LLC operate in the region[120]. The main crops cultivated in the Samukh district are grains, sunflowers, vegetables, and fruits. Livestock production is driven by dairy and poultry. Ganja's agricultural sector has undergone significant restructuring, with cereals, fruits, and dairy emerging as growth drivers, while traditional crops (cotton, sugar beet, potatoes) and wool production are receding (**Table 45**).

**Table 45. Agricultural production data in Samukh District, 2015-2023**

| | 2015 | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|---|
| **Agricultural crops production, tons** | | | | | |
| Cereals and grain legumes | 30,600 | 59,681.4 | 46,205.1 | 54,566.1 | 66,347.5 |
| including winter and spring wheat | 15,773 | 25,752.7 | 22,674.2 | 25,234.2 | 31,300.0 |
| Cotton | 43 | 173,2 | - | - | - |
| Sugar beet | 12,499 | 8,239.4 | 1,252.0 | - | 2,085.4 |
| Sunflower for grain | 2,732 | 4,684.0 | 4,513.4 | 5,701.0 | 5,376.6 |
| Potatoes | 4,361 | 2,164.5 | 1,976.4 | 1,930.6 | 2,153.2 |
| Vegetables | 8,018 | 16,444.5 | 16,351.1 | 16,010.4 | 15,514.8 |
| Melon-type crops | 4,317 | 5,271.4 | 3,527.5 | 3,177.0 | 2,262.3 |
| Fruits and berries | 14,422 | 18,184.3 | 18,484.6 | 19,636.7 | 20,537.5 |
| Grapes | 6,614 | 11,601.2 | 11,576.2 | 10,560.7 | 10,648.2 |
| **Livestock Production** | | | | | |
| Meat (slaughter), weight, tons | 2,928 | 3,129 | 3,130 | 3,138 | 3,140 |
| Milk, tons | 16,737 | 31,367 | 32,547 | 32,657 | 33,207 |
| Eggs, thousand pcs | 5,843 | 7,503 | 7,598 | 7,632 | 7,681 |
| Wool, tons (physical weight) | 341 | 261 | 260 | 250 | 249 |

The labor force steadily increased in the Samukh district, reflecting a 9.3% growth over the period (**Table 46**). The employed population also rose from 29,696 in 2015 to 32,689 in 2023, a growth of 10%. The number of newly created jobs was highest in 2015 (752), but sharply declined afterward, with especially low figures in 2022 (64) and 2023 (111). This demonstrates a slowdown in new employment opportunities, despite growth in the labor force.

**Table 46. Labor market in Samukh District (2015-2023)**

| | 2015 | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|---|
| Number of labor force, people | 31,095 | 31,907 | 32,772 | 33,276 | 33,984 |
| Number of employed population, people | 29,696 | 30,172 | 31,349 | 31,944 | 32,689 |
| Number of employees, people | 5,613 | 5,835 | 5,705 | 5,754 | 5,703 |
| Number of newly created jobs | 752 | 117 | 185 | 64 | 111 |
| Number of economic entities: | | | | | |
| legal entities | 326 | 420 | 437 | 450 | 475 |
| individuals | 2,866 | 8,214 | 9,010 | 9,323 | 10,249 |

[120] http://www.samux-ih.gov.az/az/page/14.html

The number of individual entrepreneurs rose significantly, from 2,866 in 2015 to 10,249 in 2023 (a 3.6-fold increase). This indicates a strong shift toward self-employment and micro-business activities.

### 5.13.5 Unemployment

In 2023, the unemployment rate in Samukh District (3.8%) remained consistently below the average for the Ganja–Dashkasan Economic Zone (6.5%) and national level (5.5%) (**Table 47**). Both regional and district-level figures, however, reveal a spike in 2020, reflecting the disruptive effects of the COVID-19 pandemic. Gender-disaggregated data is unavailable.

**Table 47. Unemployment rate in Samukh District, 2018-2023[121]**

| Names of economic regions and administrative territorial units | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|---|---|
| Republic of Azerbaijan, % | 4.9 | 5.0 | 7.2 | 6.0 | 5.6 | 5.5 |
| Ganja – Dashkasan economic region, % | 5.4 | 5.9 | 8.6 | 7.3 | 6.8 | 6.5 |
| Samukh District, % | 4.9 | 3.6 | 5.4 | 4.3 | 4.0 | 3.8 |
| *Samukh District - number of unemployed population, person* | *1,598* | *1,156* | *1,735* | *1,423* | *1,332* | *1,295* |

### 5.13.6 Urbanization

The population of the Samukh District is mostly rural (61.13%) (**Table 40**). There are several towns in Samukh District, including Samukh itself.

### 5.13.7 Migration Trends

Reliable and complete data on internal migration in Samukh District is not publicly available. The migration trends in the district are influenced by wider national and regional factors, such as economic disparities, urbanisation and conflicts.

Azerbaijan has experienced significant internal migration, particularly from rural areas to major urban centers such as Baku and the Absheron Peninsula[122]. This movement is largely driven by the search for better economic opportunities, improved infrastructure and greater employment prospects. Like many rural areas, Samukh District has also experienced out-migration to nearby cities such as Ganja, due to limited job prospects and lower levels of socio-economic development.

Young people, especially those with higher education qualifications, are particularly likely to leave rural communities due to a lack of social and cultural engagement, as well as professional opportunities.

### 5.13.8 Income and expenditure levels

#### 5.13.8.1 Income level

The socioeconomic trends observed in the Ganja-Dashkasan economic region are also applicable to Samukh District (see Section **5.2.1.8.**). In 2024, the national average household income per capita ranged from 360 to 380 AZN with 50% of the population earning less than 380 AZN per month. In rural areas, this figure was slightly lower at between 340 and 360 AZN,

[121] Statistical indicators of Samukh district, Samukh, 2024

[122] https://bakuresearchinstitute.org/en/internal-migration-in-azerbaijan-causes-consequences-and-main-trends/

whereas in urban areas it aligned with the national range. Given Samukh District's agricultural focus, incomes there are likely lower than in urban areas.

According to official data, 28.4% of the population's monthly income in 2024 came from paid employment, i.e. wages. The national average monthly wage was 933.9 AZN, whereas in Samukh District it was 611.6 AZN (**Table 48**). The average monthly salary in the Samukh district increased from approximately 248.6 manat in 2015 to 611.6 manat in 2023; however, it remains below the national average.

**Table 48. Average monthly nominal wage in Samukh District by economic activity, AZN**

| Names of economic regions and administrative territorial units | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|---|---|
| Republic of Azerbaijan[123] | 544.1 | 635.1 | 707.7 | 732.1 | 840.0 | 933.9 |
| Samukh District | 287.9 | 382.3 | 452.7 | 465.9 | 535.2 | 611.6 |

Significant variations are observed between economic sectors. Highest wages were in *financial and insurance activities* (1,473.7 AZN in 2023), *other services* (1,386.4 AZN), and *public administration and defense* (890.2 AZN). Lowest wages were in water supply, waste treatment (446.4 AZN), *tourism and catering* (290.6 AZN), and *manufacturing* (390.5 AZN). Despite agriculture being a dominant sector in Samukh district, wages in this field (670.4 AZN in 2023) remain lower than in most service-based and professional sectors. The most rapid wage increases between 2018-2023 occurred in professional, scientific and technical activities (+156%), healthcare and social services (+249%), and other services (+270%).

### 5.13.8.2 Expenditure level

In 2023-2024, rural households in Azerbaijan had lower per capita spending (347.66 AZN/month) compared to urban households (376.77 AZN/month), driven by lower incomes and access to self-produced agricultural goods. In the Ganja-Dashkasan region, average consumption expenditures exceed the national average. Households in this region allocate a significant portion of their budget to food, basic utilities, hotel, café, and restaurant services, and transportation (**Table 49**).

**Table 49. Average consumption expenditure in 2023-2024 (AZN/capita/month)** [124]

| | Total (at the national level) | | including | | | | Ganja-Dashkasan region |
|---|---|---|---|---|---|---|---|
| | | | Urban areas | | Rural areas | | |
| | 2023 | 2024 | 2023 | 2024 | 2023 | 2024 | 2024 |
| Expenditure, total | 348.11 | 363.52 | 362.17 | 376.77 | 331.93 | 347.66 | 369.1 |
| *including:* | | | | | | | |
| food | 154.76 | 158.11 | 160.53 | 162.91 | 147.80 | 152.37 | 153.3 |
| alcoholic beverages | 1.89 | 2.04 | 1.94 | 2.12 | 1.83 | 1.96 | 1.7 |
| tobacco products | 6.20 | 7.01 | 6.49 | 7.31 | 5.86 | 6.66 | 10.3 |
| clothing and footwear | 20.06 | 21.17 | 20.85 | 21.75 | 19.24 | 20.48 | 23.6 |
| water, electricity, gas and other fuels | 27.66 | 28.69 | 27.83 | 28.98 | 27.76 | 28.34 | 30.0 |

[123] https://www.stat.gov.az/source/labour/

[124] https://www.stat.gov.az/source/budget_households/

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| household goods, household appliances and daily household maintenance | 26.87 | 27.62 | 27.80 | 28.69 | 25.74 | 26.34 | 16.8 |
| health services | 17.81 | 19.00 | 18.86 | 19.94 | 16.58 | 17.87 | 22.1 |
| transportation services | 22.90 | 24.35 | 23.18 | 24.72 | 22.55 | 23.90 | 25.1 |
| communication services | 11.45 | 12.31 | 13.02 | 13.67 | 10.10 | 10.68 | 10.9 |
| recreational and cultural services | 13,60 | 14,69 | 14.39 | 15.66 | 12.55 | 13.53 | 13.9 |
| education expenses | 5,64 | 6,02 | 6.39 | 6.86 | 4.74 | 5.02 | 7.7 |
| hotel, café and restaurant services | 23,69 | 25,55 | 24.49 | 26.30 | 22.73 | 24.66 | 31.2 |
| other goods and services | 17,47 | 19,00 | 18.34 | 19.98 | 16.28 | 17.81 | 24.2 |

### 5.13.9 Poverty

Poverty data are not available for Samukh District, but are available for urban and rural areas of Azerbaijan and separately for women and men (see **Section 5.12.8**).

### 5.13.10 Social assistance

In 2023, targeted state social assistance was distributed to 466 low-income households, benefiting 1,940 individuals (**Table 50**). The number of households and individuals receiving this assistance increased during 2020-2023.

**Table 50. Households and persons receiving targeted state social assistance to low-income families in Samukh District, 2015-2023**

| Indicators | 2015 | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|---|
| Number of households | 809 | 433 | 178 | 319 | 466 |
| Number of family members, people | 3,480 | 1,903 | 782 | 1,390 | 1,940 |
| Average monthly targeted state social assistance amount per person, manat | 36.29 | 53.50 | 63.20 | 90.21 | 115.58 |

The average household size remained relatively stable at around 4.2–4.4 people, suggesting that changes in household numbers and individual numbers are closely correlated. Meanwhile, the average monthly social support amount per person increased from 36.29 manat in 2015 to 115.58 manat in 2023, reflecting an overall rise in financial support for each recipient.

As part of state support programs, 1,700 IDPs (internally displaced persons) from the Karabakh conflict were settled in Samukh District, including 203 people (46 households) in Ziyadly. They receive government benefits and, where eligible, social housing.

### 5.13.11 Public infrastructure and utilities

**Natural gas supply**. Gas in Samukh District is provided by the Azerbaijan Gas Supply Company Limited – the daughter company of SOCAR. The gas supply service covers almost all settlements. 98% of households are connected to the system.

**Table 51. Consumption of the main types of energy by the population in the Samukh District**[125]

| Indicators | 2015 | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|---|
| Natural gas, million cubic meters | 23.6 | 22.8 | 23.8 | 23.9 | 23.5 |
| Electricity, million kWh | 38.7 | 40.5 | 37.6 | 35.3 | 34.1 |

**Power supply**. Electricity is provided by "Azerishiq" Open Joint Stock Company. Households of the Samukh District are fully electrified. There are two transmission lines near the project sites: a 220 kV line (Samukh - Mingechevir) approximately 300 m southwest of the project area, a low-voltage line closer to Ziyadli - the effluent discharge pipeline will pass under it.

**Water supply and sewage systems**. 90% of the residents of Samukh and 68% of the villages of Samukh District are connected to the centralized water supply system. Sewage treatment is not available in the villages.

**Irrigation system**. The irrigation system of Samukh district includes the Shamkir (machine) canal, reservoirs, and distribution networks managed by the Regional Center "Vodokanal" of the State Agency for Water Resources of Azerbaijan. The municipality of Ziyadli contains 120 km of irrigation canals, including 48.5 km of the main canal and 71.5 km of internal networks. The municipality uses artesian wells (more than 100) to irrigate all crop areas.

**Waste disposal facilities/landfills**. There are 12 solid waste landfills in the Samukh district, but only one of them is legal: the Samukh landfill. The Samukh District master plan includes two key elements: the creation of a network of waste-sorting sites and the reconstruction of the Samukh landfill.

**Road, transport and street lighting**. The Samukh District has a relatively well-developed transport network, including international highways, national roads, and a single railway line (Tbilisi–Baku). The total length of municipal roads is 268 km. Within the Project area, the transport infrastructure comprises sections of the Baku–Tbilisi highway, the access road to Ganja Airport, secondary roads, and part of the railway line. While the main roads are generally in good condition, internal and village roads are of only average quality. Repair and maintenance projects are ongoing and planned, financed through state budget funds.

### 5.13.12 Land Use

The total area of the Samukh District is 1,450 km², with 45% (58,154 ha) used for agriculture. Key activities include viticulture, vegetable growing, and livestock. In 2023, crop areas were 14,289 ha of grains, 1,319 ha of sunflower, 157 ha of potatoes, 652 ha of vegetables, 2,333 ha of gardens, and 900 ha of vineyards[126] (Table 52).

**Table 52. Area under Agricultural Crops in Samukh District by Type, ha (2019–2023)**

| | 2015 | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|---|
| Cereals and grain legumes | 9,407 | 10,777.7 | 10,797.9 | 11,474.4 | 14,288.9 |
| including winter and spring wheat | 4,784 | 5,961.2 | 5,963.2 | 5,960.2 | 7,398.5 |
| Cotton | 26 | 80.5 | - | - | - |
| Sugar beets | 307 | 225.2 | 84.8 | - | 35.8 |
| Sunflowers for grain | 1,635 | 1,943.5 | 1,851.0 | 2,202.5 | 1,318.9 |
| Potatoes | 247 | 182.5 | 162.6 | 156.0 | 157.0 |

[125] https://stat.gov.az/source/regions/az/005_6.xlsx

[126] Statistical indicators of Samukh district, Samukh, 2024

| | | | | | |
|---|---|---|---|---|---|
| Vegetables | 726 | 741.7 | 708.5 | 671.0 | 651.4 |
| Mellow crops | 324 | 342.5 | 223.0 | 186.0 | 128.0 |
| Orchards and berry orchards | 1,384 | 2,043.5 | 2,137.2 | 2,234.0 | 2,333.0 |
| Vineyards | 1,089 | 1,023.8 | 1,013.3 | 922.7 | 900.2 |

The main problems of Samukh District include land degradation, overgrazing of animals, and—in some areas—a lack of water resources for agriculture. In some villages, the crop yield has reduced significantly over the last 10 years, and the vineyards have dried up. Farmers are switching from growing crops like grapes and vegetables to forage crops, mainly alfalfa. Livestock farming is primarily private, with almost every household owning sheep, goats, and cattle. The massive annual migration of up to a million sheep and cattle along long-established routes is a centuries-old tradition of sheep farming. The officially registered route for the movement of livestock passes through Goygol District, approximately 35 km south of the project site, and is not affected by the proposed project.

### 5.13.13 Public Health and Safety

#### 5.13.13.1 Healthcare Infrastructure

Samukh District has a well-developed healthcare system (**Table 53**), including:

- Primary Health Care Facilities, that includes Feldsher-Accoucheur Points. These facilities are the first point of contact for residents, particularly in rural areas, providing basic medical services such as general consultations, maternal and child health care, vaccinations, and minor treatments.
- Primary Health Care Centres or polyclinics in larger settlements within the district, offering slightly more advanced services, including diagnostics.
- The Samukh District has District Central Hospital which serves as the main healthcare hub, offering primary and some secondary care services. It includes departments for general medicine, paediatrics, and obstetrics. The re-construction of the Samukh District Central Hospital started in 2019 and ended in August, 2023. The hospital is supplied with state-of-the-art equipment[127].

Specialized services, such as oncology, cardiology, or neurosurgery, are not available in Samukh and require travel to Baku or Ganja. Pharmacies are available in Samukh's main settlement, Samukh city, and other larger villages.

**Table 53. Healthcare infrastructure of Samukh District**

| Indicators | 2015 | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|---|
| Number of hospitals | 3 | 3 | 1 | 1 | 1 |
| Number of beds in hospitals | 105 | 105 | 76 | 76 | 76 |
| Policlinics | 9 | 9 | 9 | 10 | 10 |
| Number of visitors per one shift | 253 | 253 | 253 | 268 | 268 |

Azerbaijan's healthcare system is transitioning to a mandatory health insurance model to improve access to free or subsidized health care services.

[127] https://president.az/en/articles/view/60794?utm

#### 5.13.13.2 Key Health Indicators

The life expectancy in the Samukh district is 74.3 years (**Table 54**), which is lower than the national average. Women consistently have a higher life expectancy than men, at 77.9 and 70.7 years respectively.

**Table 54. Life expectancy at birth in Samukh district, Ganja-Dashkasan region, and nationally in 2023, years**

| Names of economic regions and administrative territorial units | Total, including | | | Urban areas, including | | | Rural areas, including | | |
|---|---|---|---|---|---|---|---|---|---|
| | average | women | men | average | women | men | average | women | men |
| Republic of Azerbaijan | 76.0 | 78.4 | 73.5 | 78.5 | 78.3 | 73.4 | 76.0 | 78.5 | 73.5 |
| Ganja-Dashkasan economic region | 74.7 | 77.1 | 72.3 | 74.8 | 77.1 | 72.4 | 74.5 | 76.8 | 72.1 |
| Samukh district | 74.3 | 77.9 | 70.7 | 73.6 | 77.4 | 69.7 | 74.9 | 78.4 | 71.4 |

A significant increase in newly diagnosed diseases was observed in the Samukh district between 2015 and 2021, with cases rising from 3,864 to 6,583 (**Table 55**). The increase in disease cases during 2020–2021 was probably caused by the Covid pandemic. There has also been a gradual increase in neoplasms, infectious diseases, respiratory diseases, and circulatory system disorders.

**Table 55. Trends in newly diagnosed diseases in Samukh District**

| Indicators | 2015 | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|---|
| Diseases diagnosed for the first time | 3,864 | 4,739 | 6,583 | 4,379 | 4,750 |
| *including* | | | | | |
| Infectious and parasitic diseases | 394 | 951 | 428 | 397 | 476 |
| Neoplasms | - | 91 | 100 | 107 | 128 |
| Diseases of the circulatory system | 317 | 345 | 334 | 260 | 313 |
| Respiratory diseases | 1,150 | 1,238 | 3,481 | 1,279 | 1,535 |

### 5.13.14 Gender

The male to female ratio in Samukh District was 50.7% to 49.3% in 2024[128]. By the end of 2023, 3,108 women were employed in Samukh District, accounting for 54.5% of all hired workers. The public sector accounted for 87% of these positions. In the industrial sector in Samukh District, women accounted for 21.3% of employees (78 out of 365).

### 5.13.15 Gender-based violence and harassment

Gender-based violence continues to be a pressing issue in Samukh district, with domestic violence remaining the most widespread form of abuse. Over the period from 2020 to 2023, the number of officially registered victims of domestic violence has shown an upward trend, increasing from 61 victims in 2020 to 102 in 2023 (**Table 56**). While the national trend shows moderate fluctuations, Samukh District experienced a more pronounced increase, particularly in 2023. The increase in registered victims of domestic violence in Samukh district could be a concerning signal, but it may also indicate that the problem is finally coming to light with more victims reporting incidents.

[128] State Statistical Committee of Azerbaijan. 2024.

**Table 56. Number of victims of domestic violence in Samukh District, 2020-2023[129]**

| | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|
| Republic of Azerbaijan[130] | 1,300 | 1,536 | 1,475 | 1,513 |
| Samukh district, people | 61 | 78 | 75 | 102 |

### 5.13.16 Cultural Heritage

Samukh District has a rich cultural heritage, with historical, archaeological, natural and artistic objects reflecting the region's deep-rooted and diverse history. The district is home to several kurgans that date back to the late Bronze and Stone Ages. These archaeological sites provide valuable insights into the region's early human settlements and cultural traditions. Among the district's significant historical monuments are the Imamzadeh Tomb, dating to the 8th century[131] and "Koroglu Tower"[132]. Cultural preservation is also supported by institutions such as the Samukh Museum of History and Local Lore, which is active and open to the public (**Table 57**).

**Table 57. Number of Museums and Annual Visitor Attendance in Samukh District (2015–2023)**

| | 2015 | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|---|
| Number of museums | 1 | 1 | 1 | 1 | 1 |
| Attendance, thousand people | 14.5 | 2.0 | 2.3 | 6.3 | 6.2 |

The Samukh District is home to several unique natural monuments, including ancient trees estimated to be over 1,000 years old, such as the Eldar Pine. This species is protected within the Eldar Shamy Nature Reserve (41°10'20.770"N, 46°13'0.592"E), highlighting its ecological and cultural importance. Established in 2007, the Heydar Aliyev Centre promotes cultural development by supporting educational and artistic initiatives, as well as helping to preserve Azerbaijani traditions such as music, literature, and folk arts. The Children's Music School in Serkar Village was founded with the support of the Heydar Aliyev Foundation. Samukh District's villages also host annual local and harvest festivals featuring traditional crafts, folk music, and decorative arts. The proposed construction site for the Project has no tourist appeal.

## 5.14 Description of settlements located nearby proposed WWTP

### 5.14.1 Administrative arrangements and local land use

The proposed wastewater treatment plant (WWTP) and its effluent discharge pipeline will pass near several villages in Samukh District - Ziyadli, Istikhana, Garaeri, Sarkar, and Govlarsari – which are expected to be the most directly affected by the project. While each village has distinct social and economic characteristics (discussed below), their land use patterns are generally similar.

Settlements (located on settlement lands), as well as sites for the construction of treatment facilities (WWTPs, located on industrial lands) are surrounded by agricultural lands (**Figure**

[129] https://stat.gov.az/source/regions/

[130] https://www.stat.gov.az/source/crimes/

[131] https://eurasia.travel/azerbaijan/ganja/imamzadeh-mausoleum/

[132] https://en.wikipedia.org/wiki/Samukh_District

40) used by residents for crop cultivation and livestock grazing (**Figure 35; photos 8,9**). Part of the land is unirrigated and unused, forming wastelands.

Both WWTP sites are informally used by residents for livestock grazing, with traces of such use visible throughout. One of the unfinished facilities, which is currently crumbling, was found to be used by a local farmer as a sheepfold (**Figure 35, photo 4**).

The area is crossed by a channel for treated wastewater discharge (**Figure 35, photo 2**). In fact, untreated wastewater from the city of Ganja is currently flowing through this channel (collector is shown on **Figure 35, photo 1**.

The network of irrigation channels is fed by underground water through the wells and provides the irrigation of agricultural lands (**photo 6**, people name it “white water”). Also, as discussed above, a high-voltage power transmission line runs through the area, and its safety zone is widely used by locals for farming (**photo 9**).


Prepared by the ESIA Consultant

**Figure 35. WWTP land, two alternative effluent routes and nearby settlements**

### 5.14.2 Socio-economic profiles of settlements

Descriptions of each village, including demographic profiles, education levels, employment and income patterns, social services, agricultural activities, and access to water and sanitation are summarized in this section. A detailed description of villages is presented in **Annex 3**.

The villages vary significantly in total population. Istikhana has the smallest population, while Garayeri has the largest, with 6,484 residents. Population age structures also differ across the villages. Most villages have relatively young populations, particularly Ziyadli and Garayeri, where children account for 21–24% of residents and the share of elderly is low (3.9–6.9%). Istikhana is an exception, with an aging population and a low proportion of youth. Sarkar village has a balanced age distribution, containing an almost equal mix of youth, working-age adults, and elderly residents, suggesting a stable demographic profile.

Literacy level is generally high. Most residents have completed secondary education. This trend corresponds with the data for Samukh District (**Table 43**). Higher education remains limited across villages (2-13%). The share of residents with professional and college education varies between villages, with highest levels in Istikhana and Garayeri.

As a result of land reforms, households of the villages (except Istikhana) received individual plots of land, which they use for crop cultivation and livestock husbandry. Agricultural production is diverse and includes grain, vegetables, fruits, fodder, and oil crops, mainly alfalfa for cattle feed and sunflower. Households also raise poultry, cattle, sheep, goats and bees. Residents grow food for their own use and for sale. Around 35–45% of the produce is sold, primarily in Ganja and Baku. Key products include milk, cheese, yogurt, eggs, lamb, beef, and poultry.

Economic activity in the villages is mainly concentrated in small enterprises and self-employment. The village of Sarkar demonstrates economic diversification with two mineral water bottling plants, dried fruit processing facility, a poultry farm, a 300-ton refrigerated warehouse, and 36 retail shops.

Unemployment is highest in Istikhana (29%) and Ziyadli (15%) and lowest in Garayeri (5.4%) and Sarkar (6.5%), with rates higher than the Samukh district average. New job creation remains slow overall. Contract work is scarce, limiting social security and income stability. Part-time, seasonal and informal employment dominates.

Average household incomes generally range between 300–700 AZN, with agriculture and seasonal labor contributing substantially. Pensions play a key role in Istikhana due to high unemployment and older demographics. Household spending focuses on basic needs: food (45–50%), utilities and fuel (12%), agriculture and livestock (10%), with smaller shares for clothing, education, healthcare, and other expenses. Bank loans for farming or housing are common, indicating financial vulnerability.

Vulnerable groups include low-income families, pensioners, recipients of social assistance, large and single-parent families, persons with disabilities, and a small share of refugees/IDPs. Approximately 15–25% of households seek support from the municipality—most often for food, winter fuel, social assistance documents, housing and land issues, or medical certificates.

Access to electricity and gas is widespread. Main water sources include artesian/subartesian wells, centralized water supply system, springs and open sources, and rainwater or collected water as a backup. Drinking water mainly comes from artesian wells, supplied for 2 hours in the morning and 2–3 hours in the evening. Irrigation relies on both the Shamkir channel and artesian wells. On average, residents use 70–100 liters of water per day. None of the villages has a sewage treatment system.

Roads are generally in good condition, except in Istikhana and partially in Govlarsari. Public transport is available, with several bus routes connecting the villages to nearby urban centers, including Samukh, Ganja and Shamkir.

Social infrastructure is strongest in Garayeri and Sarkar, with schools, kindergartens, medical centers, cultural facilities, and markets. The social infrastructure in Istikhana is severely limited, as it lacks medical and community facilities.

# 6 ASSESSMENT OF POTENTIAL E&S IMPACTS AND RISKS AND MITIGATION MEASURES

## 6.1 Introduction

In this chapter potential E&S impacts are defined using the methodology described in **Section 4**. Impacts are defined as the changes that are likely to occur in the receiving environment and society, which together with the receptors and their sensitivity (as defined in the environmental and social baseline - **Section 5**), extent of impact and impact magnitude are then used to define impact and risk significance.

Potential impacts caused by various activities taking place within the Project area of influence during the construction and operational phases are considered in sections below. **Section 7** contains the identification and assessment of cumulative impacts from the Project and parallel or forthcoming projects or activities.

## 6.2 Impact on Soil

### 6.2.1 Construction Phase

*Activities*

The following activities will take place during construction which would result in potentially significant impacts on soils:

- Removal of trees and shrubs;
- Clearing and grubbing;
- Removal and temporary stockpiling of topsoil;
- Vehicle and machinery movement;
- Refuelling and regular maintenance of vehicles and machinery;
- Trench excavations and temporary stockpiling of excavated material;
- Corrosion protection for pipes and concrete structures; and
- Trench backfilling and topsoil reinstatement.

*Aspects*

Environmental aspects associated with construction activities include:

- Spillages of hazardous materials especially oils, fuels and lubricants but also paints and solvents, waste cement, anticorrosion substances, and others;
- Compaction of soils by the movement of heavy vehicles;
- Surface transformation through clearing and grubbing of all vegetation;
- Mechanical generation of dust, through vehicle movement and transport of excavated soils;
- Erosion of soil because of stormwater runoff and aeolian process; and
- Disruption of existing soil profiles because of excavations and subsequent backfilling.

*Impacts*

The above listed environmental aspects may result in soil pollution and its degradation, including increased susceptibility of soil to wind erosion.

*Receptor sensitivity*

The chestnut soils, which are common in Ganja City, are valuable for agriculture. However, the soil in the project area has been heavily impacted by wind erosion, compaction, and

irrigation with wastewater. In addition, although there are no data on soil contamination at the project site and surrounding areas, existing soil pollution can be expected from past activities.

*Impact magnitude*

The magnitude of the impact is limited by the spatial extent of the construction footprint for the WWTP and the pipeline, which represents only a minor area of the entire soil resource in the area. At the same time, given the reinstatement of the soil profile following the installation of the pipeline there would be some reinstatement of the soil in the construction footprint. For these reasons the impact magnitude is considered **low**.

*Impact significance*

Considering the receptor sensitivity and the impact magnitude, the significance of the likely impacts on soils during construction is assessed as **minor**.

*Management and mitigation*

The following mitigation must be implemented during construction phase:

- Develop and implement a Soil Rehabilitation Plan that includes *inter alia:*
  - Minimise disturbed land by using existing roads and avoiding side hill cuts;
  - Design the areas for soil (topsoil and subsoil), waste, oil, chemicals and other construction materials storage;
  - Store topsoil separately in a designated place, uncompressed and in such manner not to lose its fertile characteristics;
  - Manage the in a manner to avoid Prevent scouring and erosion of soil stock piles;
  - Record depth of topsoil / fertile soil (depending on land use) – use to plan depth of strip, soil protection risk mitigation and monitoring of soil replacement and rehabilitation;
  - Only strip across the work areas of the servitude – no need to strip the area under the stockpile itself;
  - Provide for drainage in and out of the project footprint and erosion protection at the toe of slopes;
  - Strip fertile soil over the excavations and the trench that need to be reinstated, stockpile separately adjacent to trench, making provision for battering back of trench sides, provide drainage and erosion protection;
  - Prevent mixing of subsoils or imported material with the in situ or stockpiled top and fertile soils especially getting stones into agricultural soils;
  - Prevent compaction where possible and apply mitigation to restore soil structure and function (such as ripping post construction and seeding);
  - During excavation check (record as evidence) characteristics of the soil profile and ID areas with impervious layers (rock, compact clays etc) reinstating such layers to ensure that their function in the landscape is largely reinstated;
  - Remove imported material / debris from the soil before landscaping and shaping;
  - Ensure decompaction of lower soil layers before topsoil is replaced;
  - Prevent unnecessary access to rehabilitated areas;
  - Apply soil amelioration where laboratory testing indicates a reduction in soil quality;
  - Cover soil stockpiles if and when, there is a significant risk of soil losses;
  - Weeds can help bind soils but these need to be cut short regularly to avoid seeding;
- Develop and implement a Spill Prevention Plan (SPP) that includes *inter alia:*

- Define the roles and responsibility of involved workers;
- Store the oil products and chemicals separately, in special drums / tanks laid on the secondary containments or trays,
- Conduct refilling of oil, fuel and other chemicals within impervious bunding;
- Equip the facilities designated for oil and chemicals storage and heavy trucks transporting the same materials with the relevant spill-kits and procedures for remediation of spills.

*Residual impact*

The residual impact will remain of **minor** significance.

### 6.2.2 Operation Phase

*Activities*

The main activities likely to affecting the soil during the WWTP operation are the management of the sludge and processing the sewage water.

*Aspects*

Environmental aspects associated with operations include:

- Sewage sludge;
- Treated effluent;
- Leakage or spills of untreated sewage
- Spillages of hazardous materials especially oils, fuels and lubricants but also paints and solvents, and others, during the regular operation and maintenance;

*Impacts*

The above listed environmental aspects may result in soil contamination and pollution, not only directly at the project site, but also at the agriculture land where the sludge may be used.

The above listed environmental aspects may result in direct and indirect soil contamination:

- Direct on-site contamination;
- Indirect pollution of agricultural land by fertilizers obtained from sewage sludge and treated wastewater used for irrigation in case of poor sludge and wastewater treatment.

*Receptor sensitivity*

The chestnut soils, which are common in Ganja City, are valuable for agriculture. Although there are no data regarding the soil pollution at the project site and surrounding areas, existing soil pollution can be expected because of the past activities in the area. Receptor sensitivity is therefore considered **medium**.

*Impact magnitude*

Soil pollution by hazardous materials and/or untreated sewage leakage or spills, would be limited to the spatial extent of the WWTP site, which represents only a minor area of the entire soil resource in the area. However, sludge may be used as fertilizer on agricultural lands over a wider area, which if inadequately treated could cause a **medium** impact magnitude.

*Impact significance*

Considering the receptor sensitivity and impact magnitude, the significance of potential soils impacts during operations is evaluated as **moderate**.

*Management and mitigation*

The following mitigation must be implemented during operations:

- Develop and implement a Sludge Management Strategy that includes *inter alia*:
  - Meeting conditions for use of treated sludge for agricultural purposes, compliant with the EU Directive 86/278/EEC on the protection of the environment, and in particular of the soil, when sewage sludge is used in agriculture, including prohibition of use of treated sludge for growing fruit and vegetable crops that are in direct contact with the soil and are normally eaten raw (e.g., lettuce, carrots), and so forth.
  - Implementation of a monitoring programme for treated effluent and sludge on agricultural land and green belts fertilised by sludge for pH, dissolved salts, heavy metals, and organic compounds, as well as regular chemical analyses of sludge before it is applied for agriculture purposes.
- Untreated water cannot be used for irrigation;
- Develop and implement a Spill Prevention Plan – see above.

*Residual impact*

The residual impact will reduce to **minor** significance, with implementation of the above mitigation.

## 6.3 Impact on Ground and surface water

### 6.3.1 Construction Phase

*Activities*

The following activities will take place during construction which could result in potentially significant impacts on surface and groundwater:

- Vehicle and machinery movement;
- Refuelling and regular maintenance of vehicles and machinery;
- Application of corrosion protection for pipes and concrete structure;

*Aspects*

Environmental aspects associated with construction activities include:

- Spillages of hazardous materials especially oils, fuels and lubricants but also paints and solvents, waste cement, anticorrosion substances, and others;
- Discharge of water used for pipeline pressure testing;

*Impacts*

The above activities and aspects could result in contamination of surface and groundwater, which may have effects on the aquatic habitat and biota (surface water) and on the public health (ground water).

*Receptor sensitivity*

Surface water in the project area is significantly degraded by pollution. Although there are no data on water quality, it can be assumed that the Goshgar River is highly polluted by wastewater. The WWTP site overlies a deep and varying groundwater table of more than 5-10 m depth, and the project area provides limited groundwater recharge, but is nevertheless relatively significant for drinking water supply. Drinking-water wells and their proximity to the project site denote high-sensitivity to water pollution. Therefore, the receptor sensitivity is considered **high**.

*Impact magnitude*

The likely impacts are not limited by the spatial extent of the construction footprint for the WWTP and the pipeline and may affect wider area, while the key areas of concern would be

any direct interfacing with surface or ground water. Therefore, the impact magnitude can be considered **medium**.

*Impact significance*

Considering receptor sensitivity and impact magnitude, the significance of the potential impacts on water resources during construction is evaluated as **moderate**.

*Management and mitigation*

The following mitigation must be implemented during construction to reduce the potential impact magnitude on surface and ground water:

- Develop and implement a Construction Hazardous Materials and Spill Prevention and Countermeasures Management Plan that includes *inter alia*:
  - Ensure that all hazardous materials are correctly stored, transferred, transported and used following good international practise;
  - Refuelling must be done in a manner that minimises the risk of spills such as cut off switches, use of drip trays, overfilling protection and so forth;
  - No manual syphoning or decanting of fuel products. Fuel products may only be transferred using a pump to transfer fuel from one container to another;
  - If there is a spill, it must be immediately stopped and countermeasures implemented to clean up the spill quickly and effectively;
  - All water courses are to be crossed using Horizontal Directional Drilling (HDD) only. No excavations of water course will be allowed on the project;
  - Water used for pressure testing must not contain any residual chemicals that would render the water contaminated. If water used for pressure testing is contaminated it must be disposed in a system that can be used to treat the water before it is discharged[133] to a surface water environment;
  - Identify materials that may not be used on the project including substances banned by the Montreal protocol and subsequent conventions, persistent organic pollutants and so forth and include this list in the environmental specification;
  - Determine quality and characteristics of ground and surface water that will be affected by trench excavation or river crossings to provide a baseline against which future changes can be assessed;
  - Determine water quality and flow targets appropriate to the sensitivity of the receiving water environment so that the effects of construction can be monitored, and corrective action implemented timeously;
  - Treat all pumped groundwater to remove sediment either through a settling pond, or filtration;
  - Manage surface drainage during construction to prevent scouring of backfill and topsoil and/or sedimentation of runoff water; and
  - Maintain downstream real-time water quality monitoring of those parameters that could be affected by the construction activities, and implement immediate corrective action implemented, including cessation of work if required should changes in water quality be detected.

[133] Relevant water discharge permits shall be obtained for this activity.

*Residual impact*

With the correct application of the mitigation the impact magnitude could be reduced to low implying **an overall residual significance rating of minor.**

### 6.3.2 Operation Phase

*Activities*

The activities likely to affect ground and surface water quality during WWTP operations are the management of sludge and the discharge of the treated effluent. General maintenance activities also need to be considered.

*Aspects*

Environmental aspects associated with operation activities include:

- Sewage sludge;
- Treated effluent;
- Leakage or spills of untreated sewage;
- Spillages of hazardous materials especially oils, fuels and lubricants but also paints and solvents, and others, during regular operation and maintenance.

*Impacts*

The above listed environmental aspects may result in direct and indirect contamination and pollution:

- Direct pollution of surface water and on-site contamination;
- Indirect pollution of agricultural land by fertilizers obtained from sewage sludge and treated wastewater used for irrigation in case of poor sludge and wastewater treatment.
- Percolation of hazardous materials from surface to groundwater.

*Receptor sensitivity*

Surface water in the project area is significantly degraded by pollution. Although there are no data on water quality, it can be assumed that the Goshgar River, which receives the WWTP effluent, is highly polluted by wastewater. Also, the Goshgaray River flow varies significantly during the year, and the river may run dry for parts of the year (August – September). The project will result, however, in a significant improvement through cessation of the discharge of untreated Ganja effluent into the Goshgar.

The WWTP site is overlies a deep and varying groundwater table of more than 5-10 m depth, and the project area provides limited groundwater recharge, but relatively significant for potable water supply. The drinking-water wells and their proximity to the project site imply high-sensitivity to water pollution. The use of sludge as fertilizer can be expected on the agriculture lands over a larger area than the project footprint meaning a **high** receptor sensitivity.

*Impact magnitude*

There will be a **high positive** impact magnitude on water quality in the Goshgar because of the WWTP.

There may be negative impacts on agricultural land, should sewage sludge be used for fertiliser without adequate treatment. Therefore, the impact magnitude is potentially **high**.

*Impact significance*

The discontinuation of untreated discharge to the Goshgar is a **positive** impact of **major** significance.

Given the sustained generation of the large volumes of sludge that can potentially contain various contaminants the impact is assessed as **major.** The potential impacts are exacerbated because there is no clear strategy for final disposal of sludge and there is no infrastructure (neither regulatory, institutional nor technical) for safe utilization of the sludge. A temporary on-site storage with potential expansion of the on-site storage capacities as well as deposition on the municipal landfill are sub-optimal solutions.

*Management and mitigation*

The following mitigation must be implemented during operations:

- Maintain operations of the WWTP with the design parameters and ensure that treated effluent meets defined discharge and receiving water quality standards.
    - Develop and implement a Sludge Management Strategy that includes *inter alia*:
    - Conditions for use of treated sludge for agricultural purposes, which would follow the provisions of the EU Directive 86/278/EEC on the protection of the environment, and in particular of the soil, when sewage sludge is used in agriculture, including prohibition of use of treated sludge for growing fruit and vegetable crops that are in direct contact with the soil and are normally eaten raw (e.g., lettuce, carrots), and so forth.
    - Implement monitoring programme for treated effluent and sludge on agricultural land and green belts fertilised by sludge, for pH, dissolved salts, heavy metals, and organic compounds, as well as regular chemical analyses of sludge before it is applied for agriculture purposes.
    - Untreated water cannot be used for irrigation;
    - Develop and implement a Spill Prevention Plan.

*Residual impact*

The residual impact of the discontinuation of untreated effluent to the Goshgar is **major** positive on the assumption that the WWTP will be operated as designed and comply with discharge and receiving water quality standards.

Given the uncertainties regarding the final disposal of the sludge which depends on implementation of a suitable disposal strategy in cooperation with range of various stakeholders the residual impact can range from **minor positive** in case of successful and environmentally sound re-use of the sludge for agriculture or similar purposes to **moderate negative** when the proposed project-level measures are implemented. At this stage it appears that considerable sludge volumes will have to be disposed at the municipal landfill and hence create additional pressure on already underdeveloped and underperforming waste management infrastructure.

## 6.4 Impact on Air

### 6.4.1 Construction Phase

*Activities*

During the construction stage the following activities / operations are considered as potential sources (stationary and mobile) of air emissions:

- Land clearing and vegetation removal,
- Earth / excavation works, stockpiling, backfilling
- Demolition of existing infrastructure.
- Loading, transportation and unloading of materials,
- Welding and cutting,

- Concrete works and asphalt pavement,
- Operation of construction machinery and heavy vehicles.

*Aspects*

Environmental aspects associated with construction activities include:

- Dust;
- Tailpipe emissions from vehicles and machinery (carbon dioxide, carbon monoxide, nitrogen oxides and aromatic hydrocarbons);
- Welding fumes; and
- Solvent fumes;

*Impacts*

The activities and aspects detailed above would bring about changes in air quality that could in turn result in adverse human health and/or human health effects and potentially an adverse impact on habitat.

*Receptor sensitivity*

The local baseline air quality is relatively good, not directly affected by the emissions from the industrial facilities and heavy traffic that is characteristic for other areas in Ganja. Elevated dust emissions are experienced during the peak summer dry periods and during agricultural harvest season. The Project site area is located outside of residential areas and therefore the potential temporary changes in air quality will be experienced mainly by construction workers. The receptor sensitivity is **high** because of human health risks.

*Impact magnitude*

No dispersion modelling has been done to determine the likely ambient air quality changes during construction, but these changes are unlikely to be significant. Although a broad range of atmospheric emissions is likely these will be relatively small and limited to the immediate location of the works. Only dust generation may be an issue during the dry summer months but is unlikely to be much more than a nuisance off site due to the relatively small emissions and the distance to residential areas. The dust emissions will be impacting area within approximately 500 m from the site. Only several dispersed residential houses thus might be potentially affected by a temporary nuisance caused by increased dust pollution. Impact magnitude is thus expected to be **low**. Worker exposure would only be for the duration of a work shift and PPE such as dust masks can be easily used to further limit the risk.

*Impact significance*

The potential impact on air quality is assessed as **moderate-low.** Dust emissions will be limited to the immediate construction site and close vicinity, and the risk of affecting public health is small. Impact significance may be exacerbated in combination with high background dust loading due to high wind speeds and summer harvesting.

*Management and mitigation*

The following mitigation must be implemented during construction to reduce the potential impact magnitude on air quality:

Develop and implement a Construction Atmospheric Emissions Control and Management Plan to minimize negative ambient air quality effects:

- Perform regular technical maintenance of construction equipment and vehicles,
- Do not allow vehicles and machinery to idle. If vehicles and machinery are not being used then they must be switched off;
- While transporting friable materials keep the body of heavy vehicles covered,

- Limit vehicle speeds on unpaved roads
- Restrict excavation, earthworks and other dust-generating activities during the periods of strong winds,
- Apply regular watering to on-site and off-site dirt roads, especially during the excavation and other earthworks,
- Minimize the period between excavation and backfilling works,
- Store friable materials and temporary stockpiles of top-soil under waterproof canvas,
- Establish vegetation growth on stockpiles of topsoil to minimise wind-blown dust;
- Prohibit on site fires and burning,
- Avoid operating machinery and equipment during situations with worsened local air quality (such as smog and atmospheric temperature inversions).
- Ensure the use of Personal Protective Equipment (PPE) and in particular dust masks, and respirators where high risk of worker exposure is identified.
- In addition, once the detailed design of the WWTP has been completed, additional odour risk modelling must be conducted on that design. The results of the modelling must be presented to stakeholders.

*Residual impact*

Consistent application of the proposed mitigation measures will reduce the impact magnitude to negligible, and thus the residual impact will likely be of a **minor** significance.

### 6.4.2 Operation Phase

*Activities*

Following activities can produce atmospheric emissions during the operation of the WWTP:

- Wastewater treatment process
- Handling and storage of sludge
- Operation of machinery and equipment

*Aspects*

Wastewater treatment process is associated with various atmospheric emissions, in its different stages, namely from the aeration tanks, wastewater sedimentation tanks and wastewater treatment facilities and from deposits of generated sludge. Following compounds are typically emitted into the atmosphere:

- hydrogen sulphide,
- methane,
- ammonia,
- volatile organic compounds

Machinery and vehicles used in WWTP operations will produce usual set of tailpipe emissions

- carbon dioxide,
- carbon monoxide, nitrogen oxides
- aromatic hydrocarbons;

*Impacts*

The atmospheric emissions of polluting substances from the WWTP are typically emitted in volumes and concentrations that does not constitute a public health risk, however an

unpleasant odour can appear from the wastewater treatment facilities that may impact the WWTP workers and potentially nearby residential houses.

*Receptor sensitivity:*

Ganja has a population of approximately 331,000 inhabitants. The proposed WWTP will be located at the old WWTP in an agricultural area between the village of Sərkar (population approximately 4 850) and Ganja International Airport north of the city. The smaller municipalities of Samuz, Alimadadli, Garayeri, Govlarsari and Samux also fall within this area. The nearest land use in Ganja is mainly industrial and mixed use (airport and other industrial facilities). Local baseline air quality is relatively good, not directly affected by the emissions from the industrial facilities and heavy traffic that is characteristic for other areas in Ganja. The proposed site means that air quality impacts would be experienced mainly by WWTP workers and inhabitants of the adjacent residential houses. The receptor sensitivity is rated as potentially **moderate-high** given that there are no direct health risks, but there could be severe nuisance impact.

*Impact magnitude*

Overview

To assess potential air quality impacts during WWTP operations ambient air quality concentrations of known odorous compounds that could be emitted from the plant were modelled using a Gaussian air pollution dispersion model, SYMOS`97. The model domain was defined as a 12 km2 grid with the proposed WWTP in the centre with 1 641 grid points (receptors) at 1,5 m above ground. The model predicts ambient concentrations at each grid point for different emissions scenarios.

Meteorological input data

To determine dispersion potential, hourly meteorological input data is required in the form of wind velocity, temperature and atmospheric stability class. The Commonwealth Scientific and Industrial Research Organisation's "The Air Pollution Model" (TAPM) (Hurley, 2000; Hurley et al., 2001; Hurley et al., 2002) is used to model surface and upper air meteorological data for the study domain. TAPM uses global gridded synoptic-scale meteorological data with observed surface data to simulate surface and upper air meteorology at given locations in the domain, including topography and land cover. The global gridded data sets are developed from surface and upper air data submitted routinely by all meteorological observing stations to the Global Telecommunication System of the World Meteorological Organisation. TAPM has been used successfully in Australia where it was developed (Hurley, 2000; Hurley et al., 2001; Hurley et al., 2002). It is an ideal tool for modelling applications where meteorological data does not adequately meet requirements for dispersion modelling. TAPM modelled output data is therefore used to augment the site-specific surface meteorological data for the dispersion model.

The TAPM diagnostic meteorological model is used to generate a 3-dimensional temporally and spatially continuous meteorological field in hourly increments for the modelling domain, for the representative year. TAPM is a nested configuration of three domains, centred close to the site. The outer domain is 480 km by 480 km at a 24 km grid resolution, the middle domain is 240 km by 240 km at a 12 km grid resolution and the inner domain is 60 km by 60 km at a 3 km grid resolution. The nesting configuration ensures that topographical effects on meteorology are captured and that meteorology is well resolved and characterised across the boundaries of the inner domain. Thirty vertical levels are modelled in each nest from 10 m to 8 000 m, with a finer resolution in the lowest 1 000 m.

The 3-dimensional TAPM meteorological output on the inner grid includes hourly wind speed and direction, temperature, relative humidity, total solar radiation, net radiation, sensible heat flux, evaporative heat flux, convective velocity scale, precipitation, mixing height, friction velocity and Obukhov length. The topography and land use for the respective modelling domains is obtained from the dataset accompanying TAPM modelling package. This dataset

includes global terrain elevation and land use classification data on a longitude/latitude grid at 30-second grid spacing from the US Geological Survey, Earth Resources Observation Systems (EROS) Data Centre. Wind and stability class roses using these data are shown in **Figure 36**.

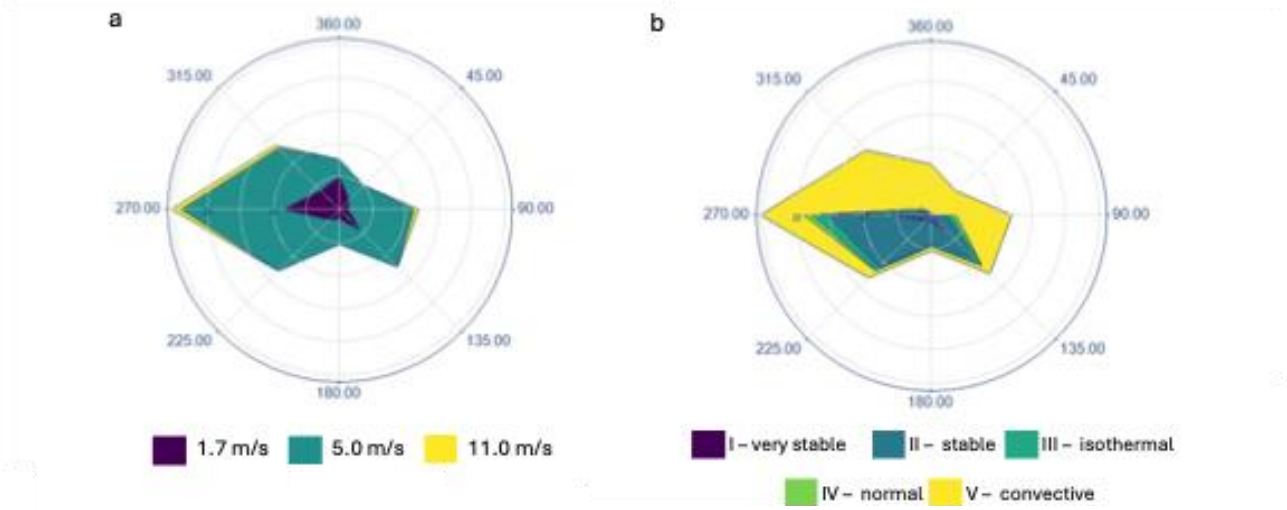



**Figure 36. Wind (a) and stability class (b) roses derived from the TAPM data set that have been used as meteorological input for the dispersion model.**

Predicted ambient concentrations

The maximum pollution concentration (in µg.m$^3$) do not align directly with odour sensory thresholds (OUE·m$^3$), which fluctuate considerably over time (even short durations). An odour coefficient of fluctuation must be applied to the maximum predicted concentrations. This coefficient depends on atmospheric stability, distance from source and the shape and size of the source (maximum characteristic dimension). Fluctuation coefficients were set at 2.3 for nearby areas (twice the source diameter) and 1.9 for more distant areas for stability classes I, II and III. For the other stability classes, values of 2.5 and 2.3 respectively apply.

Emissions characterisation

No odour emission estimates were available for the assessment. As such emissions were estimated using emission factors of odour-causing chemicals based on the treatment technology and the quantity of wastewater treated. $H_2S$ (hydrogen sulphide), and $NH_3$ (ammonia) are typical odorous emissions from WWTPs.

Two emissions scenarios were defined for the modelling namely maximum emissions without abatement, calculated per equivalent inhabitant using the WWTP (1.24 * OUE-s$^{-}$(1) PE) and the minimum emissions of odour substances (0.24 * OUE-s$^{-}$(1) PE) based on Best Available Techniques (BAT) - such as:

- measures at source (odour avoidance)
- waste air capture & containment
- abatement
- organisational and spatial measures.
- monitoring, maintenance and "evidence-based" management.

Two odour emissions scenarios were defined namely:

- Variant 1. without abatement - 1.24 ouE/s per 1 equivalent inhabitant (PE)
- Variant 2. with maximum abatement (BAT) - 0,24 ouE/s per 1 equivalent inhabitant (PE)

The estimated maximum capacity of the WWTP is 400,000 PE. The total emissions were defined as 96,000 ouE/s and 496,000 ouE/s for each scenario respectively and used as emissions in the model.

Source definition

Given that exact sources of odour emissions are not currently known, the entire WWTP area was used as a single area source with a diameter of 400 m (**Figure 37**). Individual pollutants may mask each other, and some may dominate in how they are experienced by people and so a mixture of emissions (OUE s-1) has been used.

**Figure 37. Depiction of the area source used in the dispersion modelling for the proposed WWTP**

Limit values

Ambient concentration limits are the maximum permissible pollutant concentrations. Such limits vary widely for odorous substances worldwide, including within the EU (**Table 58**).

**Table 58. Limit values for odorous substances in the EU.**

| Countries | Metrics | Limit (sensitive receptors) | Note |
|---|---|---|---|
| Netherlands | C98, 1h (ouE/m³) | 0.5 (built-up), 1.0 (industry / outside); older WWTP 1.5 / 3.5 | Specifically set for WWTP in Bkl 2020 |
| Germany | % odour hours/year | 10% (residential), 15% (industrial/rural) | TA Luft 2021, GIRL; emission ELV for biofilters 500 ouE/m³ |
| Belgium (Flanders) | C98, 1h (ouE/m³) | 0,5 | No-effect level; used for WWTPs |
| Italy (Lombardy) | C98, 1h (ouE/m³) | 1 / 3 / 5 | Depending on source sensitivity and offensiveness; regional criteria |
| Ireland | C98, 1h (ouE/m³) | 1.5 (sometimes 3) | EPA and EIA practice, no fixed national limit |
| Austria | % odour hours/year | ≈10 % (residential) | Provinces apply GOAA/GIRL principles |
| Spain | C98, 1h (ouE/m³) | 5 (in some regions) | Not a national standard, rather regional limits |
| Czech Republic | - | no binding immission limit | Case-by-case assessment according to integrated permit |

| Countries | Metrics | Limit (sensitive receptors) | Note |
|---|---|---|---|
| Slovakia | - | no explicit limit | Assessment under EIA and hygiene standards |
| Poland | C98, 1h (ouE/m³) | 5 | Used in permitting processes, not a national standard |

Results

For Variant 1, ambient odour concentrations exceeding 12 ouE/m³ are predicted in the southern part of the residential areas of Ziyadli and Sarkar municipalities. Ambient odour concentrations exceeding 5 ouE/m³ are predicted at the international airport and concentrations exceeding 3 ouE/m³ predicted in the Ganja residential area east of the airport (**Figure 43**).

For Variant 2, ambient odour concentrations are unsurprisingly seen to be significantly smaller than for Variant 1. Ambient odour concentrations exceeding 3 ouE/m³ are predicted in the southern part of the residential areas of Ziyadli and Sarkar villages. Ambient odour concentrations of 0.5 ouE/m³ and less are predicted at the international airport near the airport concourse. In the Ganja residential area to the east of the airport, concentrations between 0.5 and 1 ouE/m³ are predicted (**Figure 44**).

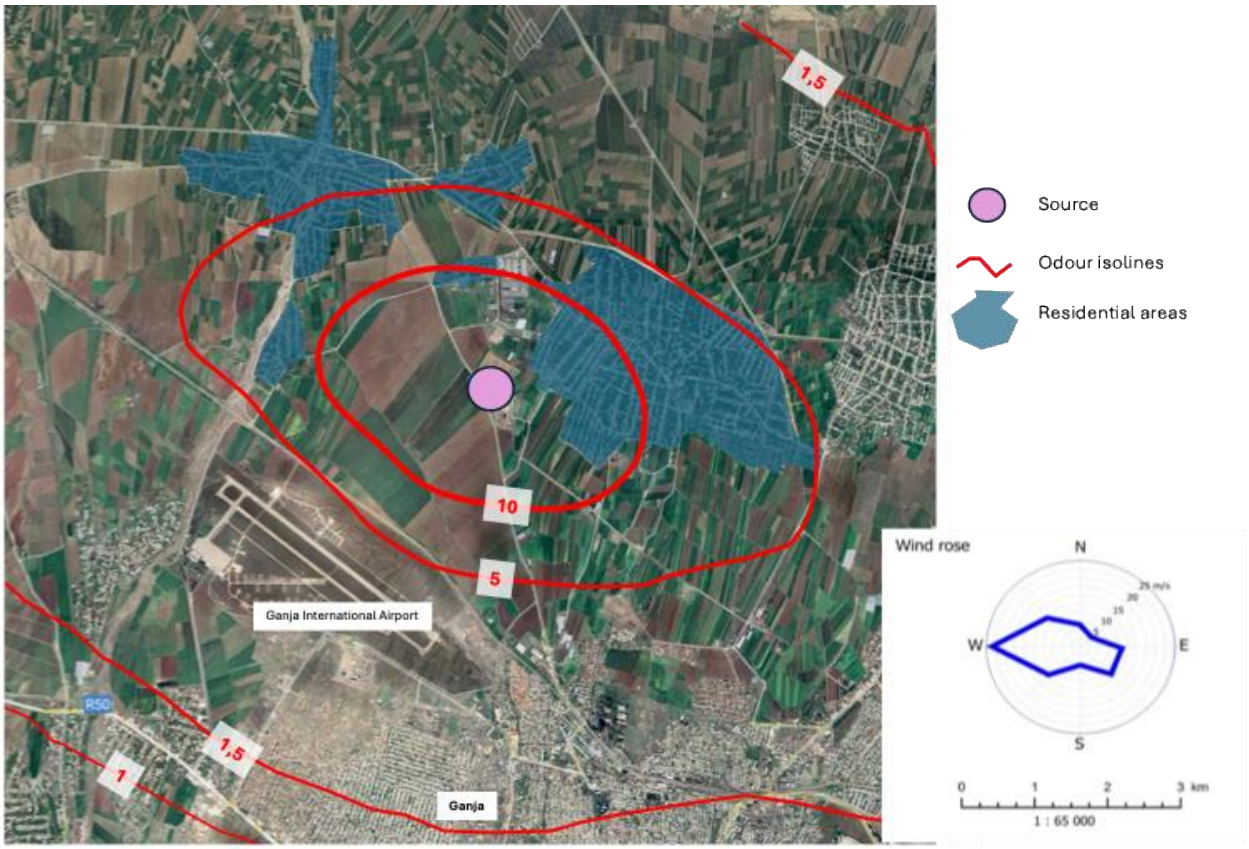



**Figure 38. Predicted ambient odour concentrations for Variant 1 with no emissions abatement**

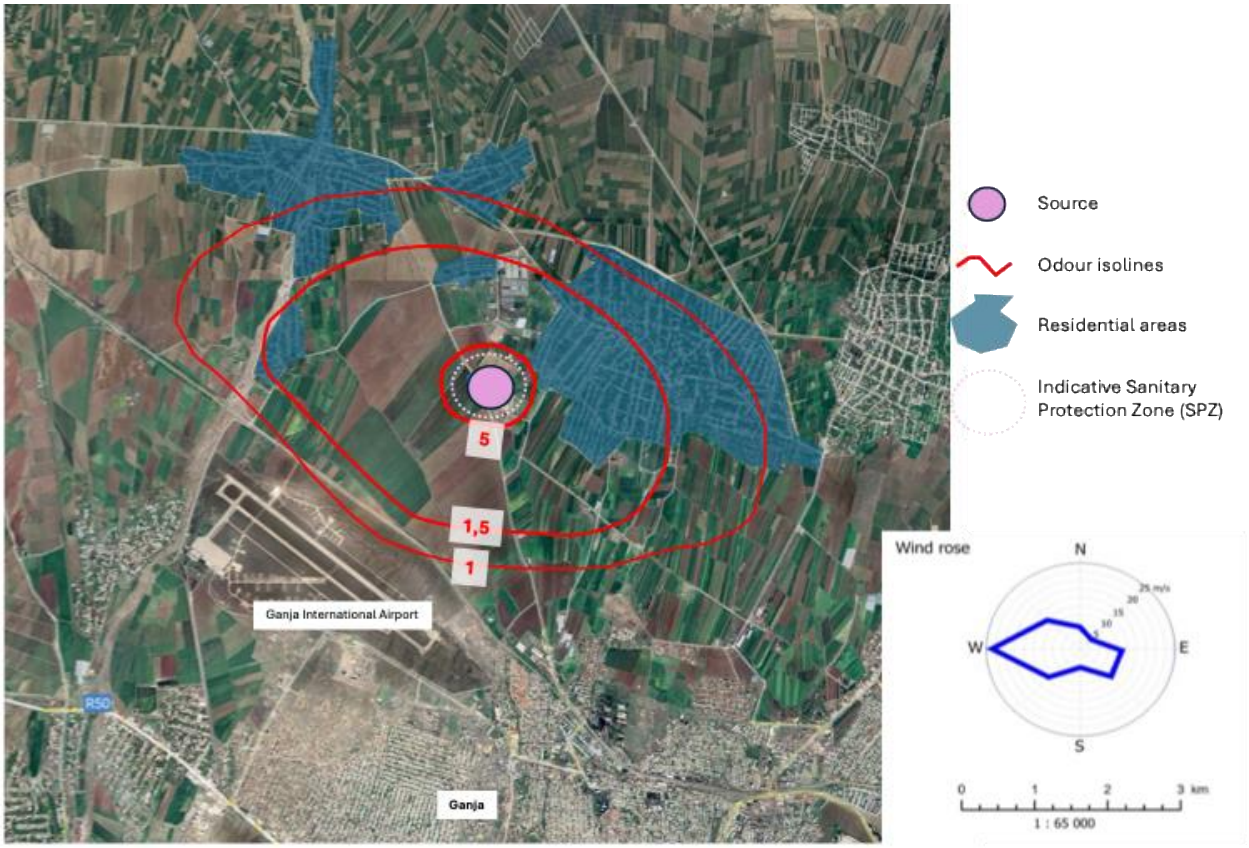



**Figure 39. Predicted ambient odour concentrations for Variant 2 with BAT emissions abatement. The likely Sanitary Protection Zone (SPZ) (nominally 500 m from source) is also indicated.**

Impact magnitude is assessed as **high** for variant 1 and **low** for variant 2 based on the assessment presented above.

*Impact significance*

Three locations were highlighted as experiencing potential odour episodes under a no-abatement emissions scenario, namely:

1. Ganja International Airport (GNJ),
2. Residential area of blocks of flats in Ganja east of the airport, and
3. Rural buildings on the common border of the settlements of Ziyadli and Sarkar.

Known odour perception and nuisance thresholds can be used to interpret the predicted ambient odour concentrations viz.

- ~1 ouE/m³ (detection threshold): odour is just perceptible but not usually disturbing.
- ~3 ouE/m³ (annoyance threshold): repeated exposure may cause discomfort and complaints in residential areas.
- ≥5 ouE/m³ (moderate irritation): odour is likely to be considered unacceptable by a significant part of the population.
- ≥10 ouE/m³ (strong irritation and potential physiological effects): odour may provoke headaches, nausea, or eye and throat irritation.

Variant 1 indicates that nearby residents may be exposed not only to annoyance levels but also, at times, to odour intensities of strong nuisance. Such exposure would present a substantial risk of community dissatisfaction, complaints, and reduced quality of life. At the same time the international airport is the gateway to the region, and arriving tourists and other visitors experiencing odour would reflect very negatively on the area discouraging tourism and immigration. Collectively these effects imply **high** negative impact significance for Variant 1.

Limits for urban development (1 OUE/m³) apply to the Ganja residential areas. Model predictions show that the limit could be achieved, if only under a BAT abatement emissions scenario. The rural area between Ziyadli and Sarkar is seen to experience the largest odour impact. Ambient odour concentrations here can reach values of more than 4 OUE/m³.

Predicted ambient odour concentrations for Variant 2 are close to or below detection thresholds for most of the population. Only in the closest residential areas may odour occasionally reach the annoyance threshold, but without progressing to levels associated with irritation or health-relevant effects. Collectively, these effects imply **low** impact significance for Variant 2.

*Management and mitigation*

A properly designed and well-operated wastewater treatment plant (WWTP) should not generate significant odour emissions. This is generally achieved by:

- maintaining biological processes under aerobic conditions, preventing the formation of hydrogen sulfide and other malodorous compounds and ensuring stabilised sludge,
- covering and ventilating key treatment units,
- cleaning the extracted air using biofilters or scrubbers and,
- ensuring regular maintenance,
- establishing a 'green buffer' around the WWTP.

*Residual impact*

When the above measures are applied consistently, odour episodes from the WWTP are unlikely implying **low** impact significance.

## 6.5 Climate Change

### 6.5.1 Climate Resilience

*Note: Due to the methodological assessment of climate resilience differing from the approach to the assessment of the likely impacts on the other environmental issues, this section does not follow the structure of the assessment applied for the other environmental impacts and risks.*

Climate change risks have been estimated in the Project feasibility study (Sweco, 2024) and are not expected to be significant. Within the Project timeframe, no notable increase in extreme heat events, drought or flooding is projected. All three climate risks have already been considered in Project design since they are already relevant The facilities are all designed for extreme heat and the stormwater management is designed for flood risks. The SWECO (2024) Feasibility Study further provides the following overview of climate-related risks including related mitigation measures (see table below):

**Table 59. Climate Change Risks to the Project**

| Hazard | Likelihood | Impact on project | Risks | Mitigation measure |
|---|---|---|---|---|
| Extreme heat events | High | Staff health impacts due to high temperature. | Health hazard due to dehydration; serious consequences. | Staff facilities require access for potable water and refrigeration unit at WWTP. Administration and Chemical Laboratory to be air-conditioned. This is normal design procedure. |
| | | In high temperatures, the WWTP biomass requires additional oxygen, otherwise the discharge standards will be exceeded. | Poor quality effluent due to high temperatures, however not considered a long-term impact on the WWTP effluent discharge. | Additional aeration needed at plant. Requires a change of operation, which is common procedure. |
| Droughts | Low | Higher concentration of pollutants in wastewater if drought leads to water scarcity, however the pollution load stays the same. | No major risks identified, since WWTP is designed for the load. | No measures proposed. |
| | | Potential lack of water resources. Based on information from the Shamkir reservoir, this seems unlikely. | No major risks identified. | No measures proposed. |
| | | High water demand | Insufficient capacity in system. | Use of water trucks. Already in place in Ganja. |
| Floods | Low | Flooding of plant | Based on elevation and (lack of) nearby water bodies no risk is identified. | No measures proposed. Normal drainage system at plant.<br>Placement of sensitive (electronic) equipment at higher elevation. |
| | | Stormwater inflow to sewer system. | Diluted wastewater and overflows occurring. | With the construction of a separate stormwater system, the issue should be mitigated. |

*Source: SWECO, 2024*

The Project is reportedly designed to address present climate risks (floods, droughts, extreme weather events) and climate scenarios over the Project lifespan. Climate screening indicates a low risk of extreme rainfall exacerbation with minimal change through to 2040. Extreme heat days (>35/year) are high risk (27 in 2020 to 40 in 2040), 38°C days move from 8 to 14, Wet Bulb Globe Temperature (WBGT), a measure of heat stress on the human body in direct sunlight, accounting for air temperature, humidity, wind speed, and solar radiation and thereby risk of heat-related illness. Climate screening indicates WBGT >35°C moves from 1 to 2 and heat waves (3+ days >35C) move from 4 to 7 (Jupiter ClimateScore™).

### 6.5.2 Greenhouse Gas Emissions

#### 6.5.2.1 Construction phase

The use of construction machinery and heavy vehicles will result in direct $CO_2$ emissions. The construction of the WWTP also requires substantial amounts of building materials, including concrete and steel, which have embodied GHG emissions in their production. Construction GHG and associated traffic emissions are negligible in the context of the Project life cycle, with

few practical means to materially reduce GHG emissions. Embedded emissions in construction materials are potentially significant as no low-emission alternatives (e.g. green steel and concrete) are simply not available in the Project context.

#### 6.5.2.2 Operation phase

*Activities*

GHG emissions are associated with:

- Wastewater treatment process and sludge disposal
- Electricity generation necessary to power the WWTP

*Aspects*

- Emissions associated with WWT process (Scope 1 emissions)
- Emissions associated with electricity consumed by the WWTP facility (Scope 2 emissions)
- Embedded GHG emissions from concrete and steel used in construction are indirect emissions that occur in the value chain, not from the company's direct operations. These are known as Scope 3 emissions.

*Impacts*

The implementation of the WWTP will reduce the GHG emissions from the wastewater in Ganja compared to the current baseline, where raw wastewater is discharged untreated. In general, a wastewater treatment process produces fewer GHG emissions than discharging untreated wastewater because it controls the decomposition of organic matter and captures or destroys the potent GHGs that would otherwise be released into the atmosphere. While the treatment processes still produce GHGs, they are significantly reduced and controlled. Untreated wastewater, when released into the environment, undergoes uncontrolled anaerobic decomposition, which is a major source of methane ($CH_4$), a gas with a global warming potential over 25 times that of carbon dioxide ($CO_2$).[134]

*Receptor sensitivity*

The receptor sensitivity is regarded as **high** given the massive importance of climate change risk to natural and social systems world-wide.

*Impact magnitude*

The analysis of the Project operational phase GHG emissions is consistent with the estimations made earlier within the Feasibility study (2024) by SWECO. Emissions from the waste sector, including WWTP emissions, constitute only a small fraction of the Azerbaijani total GHG emissions

Emissions from WWTP operations are currently estimated at:

- WWTP electricity consumption in full operation: 11,969 MWh/year
- WWTP annual load: 400.000 PE

[134] The global warming potential (GWP) metric is used to compare the warming impact of different gases over a specific timeframe, typically 20 or 100 years. It accounts for both the gas's potency and its longevity. Despite its shorter lifespan in atmosphere, methane has much greater radiative efficiency (i.e. the ability to capture heat) and therefore much greater global warming potential (GWP) in comparison with $CO_2$. Depending on the time framework of the assessment, methane is estimated to be 80 to 86 times more potent than $CO_2$ over 20-year period. Over a 100-year timeframe, methane's GWP drops to about 28 to 36 times that of $CO_2$.

- Biogas recovery and energy utilization: no[135]
- Other on-site energy production: no[136]

Emission factors to quantify emissions from the WWTP, were derived from EIB's carbon footprint methodologies[137] viz.

Scope 1 (direct emissions) include GHG from a) WW treatment and b) from sludge disposal.

- For the baseline scenario (without WWTP) an assumption was made that GHG emissions from non-treated wastewaters can be approximated with wastewater treatment process with "septic tanks" and sludge disposal "landfill" as per EIB methodology, resulting in GHG emission factor of 0.285 t.$CO_2$e/PE/year. This is the most rudimentary standard form of wastewater management, with GHG emission intensity close to an uncontrolled decomposition of discharged untreated wastewater.
- For the scenario with WWTP a process with "Carrousel (extended aeration)" and sludge disposal "landfill" is assumed, resulting in emission factor of 0.071 t.$CO_2$/PE/year)[138]

Scope 2 (indirect emissions) includes GHG related to the generation of the electricity consumed by the WWTP

- For the baseline scenario (without WWTP) there are no emissions from electricity generation
- For the scenario with the WWTP a combined margin grid emission factor for Azerbaijan[139], 384 g$CO_2$/kWh is used.

Scope 3 (embedded emissions) are the GHG emitted in producing concrete and steel that would be used for the construction of the WWTP.

No direct concrete and steel use information is available for the project, but it is nevertheless important to estimate possible embedded GHG. The purpose of the estimate is simply to allow a qualitative assessment of whether the net effect of the WWTP would be positive (net reduction in GHG) or negative (net increase in GHG). The estimated embedded GHG are shown in **Table 60**, with emission factors derived from Holcim, Azerbaijan to provide representative estimates. Note that the embedded GHG is a once off emission.

[135] Possibility of the biogas recovery was discussed extensively throughout the Project design preparation. The technological alternative with the anaerobic digestion and biogas production was abandoned in favour of the solution with extended aeration process. The selected treatment process including "Extended Aeration" utilising "Oxidation Ditches" (with upstream anaerobic zone) is deemed better suited to meet the strict nutrient removal standards for sensitive areas. The process utilizes aerobic sludge stabilization, hence does not produce biogas which could be combusted for electricity production. For details see the Feasibility study (SWECO, 2024).

[136] The opportunity to incorporate solar energy generation in the Project were discussed in the Project design process. A photovoltaic (PV) system with the installed capacity of 986 kWp with estimated annual production of 1,381 MWh/year was considered within the SWECO Feasibility study (2024), however it is not part of the current design.

[137] EIB Project Carbon Footprint Methodologies (Version 11.2). January 2023. ANNEX 6: CALCULATION OF CARBON FOOTPRINT FOR WASTEWATER TREATMENT FACILITIES eib_project_carbon_footprint_methodologies_2023_en.pdf

[138] EIB Project Carbon Footprint Methodologies, Annex 6. For the calculation the impact factor for the category "Carrousel (extended aeration)" with factor 0,015 t.CO2e/PE.y was used to approximate the WWTP technology emission factor of the Project. Note that all standard WWT processes with secondary, tertiary and additional treatment have similarly low emission factors compared with the technologies including only primary treatment. The differences in emission factors among the categories of the sludge disposal are relatively higher in the EIB tables.

[139] Data source: Harmonized_IFI_Default_Grid_Factors_2021_v3.2_0.xlsx (live.com). Combined margin grid emission factor, gCO2/kWh - Electricity consumption: 384 (Azerbaijan)

### Table 60. Estimated embedded GHG Emissions for the WWTP

| Estimated material volume | Emission factor | Embedded emissions (t $CO_2e$) |
|---|---|---|
| 20,000 m³ of reinforced concrete | 0,386 t $CO_2e/m^3$ (concrete)[140]<br>0,072 kg $CO_2e$ for estimated 100 kg of rebar in 1 $m^3$ of concrete[141] | 7,720 |
| 280 ton of structural steel | 1, 9t $CO_2e/t$[142] | 532 |
| TOTAL | | 8,252 |

### Table 61. Project GHG Emissions per annum

| Indicator | Unit | Baseline | With Project | Change | Remarks |
|---|---|---|---|---|---|
| Scope 1 emissions associated with WW treatment process | tonnes $CO_2e$/year | 114,040 | 28,400 | -85,640 | Annual load 400,000 PE. |
| Scope 2 emissions associated with WW treatment process | | 0 | 4,596 | 4,596 | WWTP Electricity consumption 11,969 MWh/year |
| Annual net GHG savings associated with the project scenario. | | | | 81,044- | Impact magnitude is low-medium positive |

*Impact significance*

The analysis indicates an annual net GHG savings (i.e. after accounting for the WWTP electricity consumption) of about 81,000 tonnes $CO_2e$/year. Embedded GHG are not considered significant in relative terms (indicatively a once off amount of some 8,000 to 10,000 t $CO_2e$ compared to some 81,000 t $CO_2e$ prevented annually over the lifespan of the project). The net saving is equivalent to GHG emissions of a large size industrial facility (annual emissions of 20,000 tonnes $CO_2e$ are conventionally used as a threshold requiring a dedicated climate impact analysis in project preparation). Waste sector- emissions in Azerbaijan are approximately 1.2 million tons of $CO_2$ eq/year[143] and some 2 percent of total national GHG emissions, so the reduction is assessed as **minor positive**.

*Management and mitigation*

The Project will have a modest net positive impact on GHG emissions with net annual GHG emissions savings of about 81,000 tonnes $CO_2e$/year compared to baseline.

Several GHG reduction options were considered during project design. The aerobic sludge stabilization process was chosen to meet strict local nutrient removal standards, despite its higher energy use and lower potential for biogas production and associated GHG emission reductions.

The Project´s positive effect on GHG emissions could be further enhanced by:

- Installation of solar (photovoltaic) electricity generating system

[140] Environmental Product Declaration (EPD) for the single product COPact C12/15 Ready-mix Concrete, EPD-IES-0025658. https://www.holcim.az/sites/azerbaijan/files/docs/epd_sertificate_v2.pdf

[141] Estimation made based on methodology provided in: BSRIA guide: Embodied Carbon. The Inventory of Carbon and Energy (ICE). 2011. Page 14. https://greenbuildingencyclopaedia.uk/wp-content/uploads/2014/07/Full-BSRIA-ICE-guide.pdf

[142] World Steel Association. Sustainability Indicators Report 2025

https://worldsteel.org/wider-sustainability/sustainability-indicators/#co2-and-ghg-emissions-intensity

[143] Communication to the United Nations Framework Convention on Climate Change from the Republic of Azerbaijan (2021)

This option was considered in the Feasibility study (2024). An installation of solar PV panels, utilising the space over the oxidation tanks covering approx. 1 ha could generate approximately 1 381 MWh electricity per year, reducing grid electricity demand and saving some additional 550 tonnes $CO_2e$/year.

Installation of PV power is independent of the WWTP treatment process. As such Solar PV could be introduced at some later stage.

- Sludge utilization

GHG emissions from the currently proposed sludge landfilling could be reduced by using the sludge on agricultural land, composting or incineration[144].

The Project Feasibility study (2024) found incineration and other complex sludge disposal methods unsuitable for the local context. Agricultural reuse of sludge is a viable option only if supported by a long-term national strategy that addresses structural barriers, such as minimizing heavy metals and contaminants in wastewater, establishing control and enforcement systems to meet standards, and building awareness among farmers. Reuse for land restoration or forestry may also be considered. Any land application must include contaminant monitoring, consideration of plant nutrient needs, and measures to protect soil and water quality.

Further reductions of GHG emissions from the sludge are thus possible but not realised currently for the project.

*Residual impact*

The residual GHG emissions of approximately 33,000 tons of $CO_2e$ will be generated by the treatment process and consumption of grid electricity. This residual impact could be further reduced potentially through the adoption of approaches not currently included in the project feasibility study.

## 6.6 Impact Caused by Waste Generation

### 6.6.1 Construction Phase

*Activities*

Most construction activities will generate some forms of waste.

*Aspects*

Various categories of solid waste are associated with construction and maintenance of construction machinery and vehicles. In addition, the need for (partial) demolition of the existing old on-site structures, will result in a potentially large quantities of demolition waste.

The main categories of construction waste are:

- Municipal solid waste;
- Spoil (excess excavated material);
- Vegetation waste;
- Packaging waste;
- Demolition waste (building rubble);

[144] EIB Project Carbon Footprint Methodologies, Annex 6. Depending on the wastewater treatment technology used in the process the resulting sludge emission factor in case of disposal on Landfill is typically about 30-40 % higher (i.e. generating more GHG emissions) than for “Land use without further treatment”, and even higher than for sludge “Composting” or “Incineration”.

- Scrap metal;
- Waste concrete;
- Used welding rods;
- Hazardous waste in the form of spilled oils, lubricants and fuel and other hazardous materials that may be required for coating and corrosion protection.

The detailed overview of the wastes by categories as per the national legislation and volumes estimations will be developed as a part of the documentation for the construction permit (including the EIA materials).

*Impacts*

Impacts from waste are many and varied including risks of contamination of soil, surface and groundwater, air quality and odour, and by extension overall ambient environmental quality and public health. Waste may also present a fire risk. These impacts will occur on-site and in close vicinity but may also result from associated traffic and disposal of the wastes on municipal waste landfill.

*Receptor sensitivity*

Receptor sensitivity can be regarded as **high**, given the state of the municipal landfill as previously described, as the only option for waste disposal.

*Impact magnitude*

Impact magnitude is considered **low**, as the impact will be limited to the construction site and the final waste disposal location, which will likely be the municipal waste landfill. It is likely that most bulk waste materials (namely excavated soil, and demolition rubble) will be re-used on-site for backfilling and terrain modification purposes. The transportation of construction waste for final disposal will avoid residential areas.

*Impact significance*

Considering the receptor sensitivity and the impact magnitude, the significance of potential waste generation impacts during construction is evaluated as **moderate**.

*Management and mitigation*

Waste generated during construction must be managed in accordance with a Waste Management Plan implemented specifically for the Project. This Plan shall at minimum contain:

- Detailed estimation of construction wastes by categories with indicated volumes and disposal method
- Provisions for on-site or off-site waste storage locations, containers and conditions,
- Environmental, fire, health and safety rules of the waste storage facilities,
- Actions to be implemented to ensure the provisions of waste management hierarchy
- (prevention, minimization, reuse, recycling, energy recovery and disposal),
- Arrangements for the safe transportation of waste,
- Provisions for the response to the accidents (leakages of liquid waste, spills of friable materials, and so forth.),
- Requirements and responsibility of the personnel,
- Provisions for waste inventory and records.

Before the start of construction, the exact locations of waste storage facilities shall be identified and areas designated for the separate collection/storage of waste. The waste storage facilities should be fenced to control access by unauthorized persons to the site. Workers engaged in

waste management activities are to be fully trained in complying with the Waste Management Plan.

*Residual impact*

The residual impact will remain of **moderate** significance, given the state of the municipal landfill. The limited volume of hazardous waste will have to be removed by a specialized waste operator for safe disposal.

### 6.6.2 Operation Phase

*Activities*

The waste generated by the WWTP operation can be divided into two types: process wastes from the wastewater treatment process and general wastes from the maintenance and operation of the facility.

*Aspects*

Process waste includes:

- Sand removed from the wastewater intake
- Bulk waste from the grids
- Sludge

The sludge constitutes the main waste stream of the Project and has important potential impacts.

General waste includes used bulbs, cleaning and maintenance related solid waste, household waste, plastic packaging materials, and so forth.

*Impacts*

Impacts from waste are many and varied including risks of contamination of soil, surface and groundwater, air quality and odour, and by extension on overall ambient environmental quality and public health. Waste may also present a fire risk. These impacts will occur on-site and in close vicinity but may also result from associated traffic and disposal of the wastes on municipal waste landfill. The re-use of the generated sludge can be associated with various risks (namely contamination of soil, water) depending on additional processing and the recipient sensitivity.

*Receptor sensitivity*

Receptor sensitivity can be evaluated from **moderate** (in case of deposition on designated landfill or on-site storage areas) to **high** in case of application of the sludge on the agriculture land designated for the food production.

*Impact magnitude*

Impact magnitude can be assessed as **medium** due to the substantial and continual production of the sludge. The projected sludge volumes are as follows:

- At 20% solids concentration, achieved by dewatering with a centrifuge or belt filter press, the volume is 42,360 m³/year
- At 40% solids concentration, achieved by drying on wind rows, the volume is 21,180 m³/year

*Impact significance*

Given the sustained generation of large sludge volumes potentially containing contaminants the impact is assessed as **major.** The potential impacts are exacerbated by the lack of clear strategy for the final disposal of the sludge since the Project local context does not provide infrastructure (regulatory, institutional and technical) for safe utilization of the sludge. Current planning is for temporary storage of sludge on the WWTP site but that will only provide about

2 year's worth of storage. Land not belonging to ASWRA has been identified that could be acquired should there be a need for additional sludge storage. The land acquisition process will need to comply with the Project's Resettlement Framework (which is based on the national regulations and EBRD PR5 requirements). The additional sludge storage area will also need to comply with the leachate management requirements detailed under 'Management and Mitigation' below.

Final disposal of the sludge is not known currently. Use of the sludge for agriculture is the preferred method of final disposal but the sludge would need to comply with strict quality requirements to be used for agriculture. The potential presence of heavy metals in the wastewater due to industrial discharges may preclude the sludge from being used for agriculture, in which case the only other disposal option is landfill (incineration is too expensive). Although not as stringent as the agricultural limits, there may be limitations too on landfill acceptance given the possible presence of heavy metals in the influent. At the same time, the aluminium factory which is the only likely source of heavy metals does not discharge to sewer and so the likelihood of heavy metals in the influent is low.

*Management and mitigation*

A Waste Management Programme must ensure:

- Elaborate and implement waste management procedure for all relevant waste streams
- Train personnel on safe handling of hazardous wastes, for the WWTP operations,
- Equip the facility with the waste separate collection / storage containers and define their locations,
- Update the hazardous waste passports considering wastewater treatment operations and waste generation volumes,
- Sign/update contracts with specialised waste handling (removal, recycling and disposal) companies.

Most waste streams, such as mixed household waste, garbage from cleaning of industrial facilities, bulk waste from the grids and sand removed from the wastewater intake can be removed from the site by the communal services and disposed safely in the municipal landfill. Plastic waste and used LEDs must be removed by specialized companies for recycling and safe final disposal.

The sludge volume will be reduced by dewatering and drying (wind rows) steps and then temporarily stored on-site. Subsequent disposal at the municipal landfill may also occur. For further minimization of potential risks and negative impacts (contamination, uptake of the landfill capacity) it is necessary to develop and implement a Sludge Management Strategy that includes *inter alia*:

- Maintaining a watching brief on the country-wide national sludge management plan for Azerbaijan that is being developed and implement practise defined in that plan.
- Prevent off-site migration of leachate from sludge storage areas through engineering and operational management controls. Engineering controls include lining systems, leachate collection and removal (e.g. redirecting back into inlet works or sludge thickeners) and if required, final cover/capping. Operational management controls include stormwater diversion to prevent contact with dried sludge, limiting liquid waste or high-moisture content material, application of operational covers such as daily soil covers or temporary geomembranes, and monitoring to ensure efficacy of leachate management. Conditions for use of treated sludge for agricultural purposes, which would follow the provisions of the EU Directive 86/278/EEC on the protection of the environment, and in particular of the soil, when sewage sludge is used in agriculture, including prohibition of use

of treated sludge for growing fruit and vegetable crops that are in direct contact with the soil and are normally eaten raw (e.g., lettuce, carrots), and so forth.

- A monitoring programme for treated effluent and sludge will be developed and implemented, which would establish a soil monitoring on agricultural land and green belts fertilised by sludge for pH, dissolved salts, heavy metals, and organic compounds, as well as introduce regular chemical analyses of sludge before it is applied for agriculture purposes.
- Should agricultural use not be feasible due to treated effluent quality not complying with the EU directive, ASWRA to identify sources of contaminants and enforce improved effluent quality from such sources to facilitate agricultural use.
- Sludge must be assessed for hazardous properties which if identified above safe municipal landfill thresholds, mean disposal at a hazardous waste site.
- If forced to dispose sludge at landfill and only as a last resort, identify at least a municipally and preferably EU compliant landfill. Even if sludge is acceptable for landfill disposal set a time-bound programme for phasing out landfill disposal in the shortest possible period, so as not to materially reduce the landfill lifespan.

Reusing sludge in agriculture is feasible if a long-term, preferably national, management strategy addresses barriers identified by EU experience. This requires reducing heavy metals and contaminants in wastewater, enforcing standards, and raising awareness among farmers. Sludge can also be considered for land restoration or forestry. Any land application must include contaminant monitoring and ensure soil, surface, and groundwater quality are protected while meeting plant nutrient needs.

*Residual impact*

Given the uncertainties regarding the final disposal of the sludge, the residual impact can range from **minor positive** in case of successful and environmentally sound re-use of the sludge for agriculture or similar purposes to **moderate negative** when the proposed project-level waste management measures are implemented but the considerable volumes of sewage sludge to be disposed at the municipal landfill creating additional pressure on already underdeveloped and underperforming waste management infrastructure.

## 6.7 Impact Caused by Noise and Vibration

A Noise and vibration assessment has been undertaken aligned with The Environmental Noise Directive (Directive 2002/49/EC)[145] and national legislation[146]. The aims of the Environmental Noise Directive are:

- The determination of exposure to environmental noise;
- Ensuring that information on environmental noise and its effects is mitigated; and
- Preventing and reducing environmental noise where necessary and preserving environmental noise where it is good.

Other relevant EU Legislation relating to noise includes:

- Directive 70/157/EEC on the approximation of the laws of the Member States relating to the permissible sound level and the exhaust system of motor vehicles; and

[145] European Parliament and Council (2002), 2002/49/EC, relative to the assessment and management of environmental noise

[146] In particular the Presidential Decree No. 796, of July 8, 2008, on Regulations of the vibration and noise pollution exerting negative environmental impact and health of the person, as amended.

- Directive 2000/14/EC on the approximation of the laws of the Member States relating to the noise emission in the environment by equipment for use outdoors.

### 6.7.1 Construction Phase

*Activities*

Potential construction noise and vibration impacts may arise from:

- Construction activities (earth works, drilling, excavation, building and so forth).
- Construction traffic such as large trucks, scrapers and graders, heavy rollers and heavy goods vehicles servicing, delivering and removing materials (including spoil and fill).

*Aspects*

- Noise;
- Vibration.

*Impacts*

Noise and vibration may cause a disturbance residents near the project site. Also, noise may affect the construction workers, however this issue is addressed in **Section 6.13** (OHS) of this report.

*Receptor sensitivity*

The closest residential area (approx. 10 family houses, part of Ziyadli village) is located approx. 300m northeast from the WWTP site. Therefore, the receptor sensitivity can be considered **medium**.

*Impact magnitude*

The most used construction machines together with associated noise levels at a reference distance of 15 m from the source are shown in **Table 62.**

***Table 62. List of Sources of Noise and Vibration***

| Source Emission | Equipment - a device with a description of maximum power | Emitted noise intensity (dB) expressed through the demonstration value of the equipment | Periods of emissions (hours per day) |
|---|---|---|---|
| Heavy vehicles and construction machinery | Bulldozer, excavator, trucks for transporting materials, pneumatic drill, stone drill, concrete mixer, mobile crane and so forth. | 80-90 dB | 8 (discontinuous noise) |

Noise impacts during construction will be temporary implying a **low** impact magnitude. Vibration may be experienced by residents during the construction phase only but it seems unlikely that the vibration would result in any structural damage.

*Impact significance*

Considering the receptor sensitivity and the impact magnitude, the significance of the likely impacts of noise and vibration during construction is evaluated as **minor**.

*Management and mitigation*

- Develop and implement a Construction Noise Management Plan that includes *inter alia:*
  - Noise prevention must be applied where predicted or measured noise impacts from the construction area could exceed the applicable noise level guideline at the most sensitive receptor;

- Noise control must be applied at source;
- Noise reduction options include:
    - Limiting the hours of construction activities including the transport to the workdays only and during daytime i.e. from 7.00am to 6.00pm; and
    - Use speed limiting to control noise from vehicles;
- A mechanism to record and respond to complaints.
- Ensure routine preventative maintenance of vehicles and machinery to reduce noise;
- Conduct routine inspections on vehicles and machinery so that excess noise can be corrected timeously.
- Install mobile noise protective screens during construction works;
- Avoid simultaneous use of high noise-generating equipment;
- Inform likely affected residents (Ziyadli village) about planned works and their duration, well in advance.

*Residual impact*

The residual impact will remain of **negligible** significance.

### 6.7.2 Operation Phase

*Activities*

Certain parts of the WWTP technology can generate noise during operations, including sand-filters, pre-thickeners, sludge dewatering, and blower units. Vibration is likely to be limited to the immediate proximity of mechanical equipment, if any.

*Aspects*

- Noise.

*Impacts*

Noise may cause a disturbance of the residents living close to the project site.

*Receptor sensitivity*

The closest residential area (approx. 10 family houses, part of Ziyadli village) is located approx. 300m northeast from the WWTP site. Therefore, the receptor sensitivity can be considered as **medium**.

*Impact magnitude*

According to the WWTP design, all parts of the WWTP that could generate noise, such as screens, sand-filters, pre-thickeners, and the sludge dewatering building, will be encased or covered. Also, blower units, which supply oxygen to the activated sludge, will be covered to reduce noise. Air inlets and outlets will be sound-insulated and equipped with frequency converters for optimal adjustment to changing oxygen demands, further helping to control noise levels. Considering the above, the impact magnitude can be evaluated as **low**.

*Impact significance*

Considering the receptor sensitivity and the impact magnitude, the significance of the likely impacts on noise during operations is evaluated as **minor**.

*Management and mitigation*

The necessary noise mitigation measures are already integrated in the design of the WWTP (see above).

*Residual impact*

The residual impact will remain of **negligible** significance.

## 6.8 Biodiversity Impact

Biodiversity impacts may occur within the direct project footprint (the WWTP facilities, on-site area for potential sludge storage and effluent pipeline corridor), and the area of influence around the Project site. Because the effluent pipeline will be buried (route 2), with opportunity for reinstatement of vegetation and habitat along the pipeline corridor, it is assumed that only the construction of the pipeline would have potential impacts on biodiversity. During operations discharge from the pipeline to the Goshgar river, could have (aquatic) biodiversity impacts depending on the quality of the effluent, but not the pipeline infrastructure itself.

Potential impacts are assessed within the context of EBRD PR 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources (2019) associated Guidance Notes (March 2023), and applicable national legislation. A distinction must be made between directly affected habitat and indirectly affected habitat:

Directly affected habitat refers to the physical destruction/transformation of habitat for construction. For this project this means the demolition of the old building and all excavations required for the WWTP infrastructure including the polishing ponds and the sludge disposal area. The treated wastewater discharge pipeline will also require excavation but in this case the excavation will be backfilled and the surface area rehabilitated to as close to original circumstance as can be achieved, once the pipeline has been installed. There will also be a road needed to access the site, which will also see the transformation/destruction of habitat.

Indirectly affected habitat refers to habitat where there is no physical destruction/transformation but where the quality of the habitat may be reduced by operations of the WWTP. Examples include air pollution, noise, poaching and others.

### 6.8.1 Construction Phase

*Activities*

Construction of the WWTP and the effluent pipeline corridor will include *inter alia*:

- Vegetation clearance, removal, transport and temporary storage of topsoil,
- Excavation,
- Demolition of old (relic) infrastructure and installation of new equipment for the WWTP
- Excavating a trench for the effluent pipeline, installing the pipeline and backfilling.
- Reinstatement of top soil over disturbed areas not occupied by infrastructure and revegetation and reinstatement.
- Construction traffic,
- Illumination of the construction area.

*Aspects, impacts and receptors*

These activities will result in the following aspects

- Physical destruction of habitats and potentially species,
- Noise,
- Vibration,
- Air pollution (mainly motor vehicle and construction equipment emissions and dust),
- Light.

These aspects result in impacts on the natural environment and specific biodiversity receptors (**Table 63**).

**Table 63. Aspects, potential impacts and affected biodiversity receptors**

| Aspects | Expected impacts | Receptors |
|---|---|---|
| Physical destruction of habitats and species | Destruction of habitats and associated potential loss of species | Vegetation and terrestrial fauna within the footprint of the WWTP and along the pipeline corridor.<br>Plants: PBF - Broad-leaved Cotton grass (*Eriophorum latifolium Hoppe,* one location, about 50-60 individual plants); oriental plane-tree (*Platanus orientalis L.*) (one location, 2-3 trees)<br>Animals (not PBF): European glass lizard (*Pseudopus (Ophisaurus) apodus*, at least two individuals), Dice snake (*Natrix tesselata*), approximately – 10-20 individuals) |
| Noise<br>Vibration | Disturbance of animals | Animals within the WWTP footprint and adjacent areas.<br>The same two species of reptiles,<br>plus birds - PBF:<br>Black Francolin (*Francoloinus francolinus)* (dozens)<br>Gray Partridge (*Perdix perdix*) (dozens) |
| Air pollution | Photosynthesis disturbance due to dust on plant leaves and needles; inhalation of exhaust gases by animals. | Vegetation and fauna within the WWTP footprint and immediately adjacent areas. |
| Light | Attraction of insects, disorientation of migrating birds and butterflies, increased risk of predation of nocturnal animals. | Flying insects, migrating birds and insects |

Destruction of habitats and species

Vegetation clearance, excavation and earthworks will destroy the habitat within the WWTP footprint, but these are mainly fallow lands with weedy vegetation (**Figure 40**). Small patches of natural steppe vegetation are intact only at and between the boundaries of arable lands. Broad-leaved Cotton grass (*Eriophorum latifolium Hoppe)* was found close to the eastern boundary of the Project footprint (**Figure 27**). There are also tree rows and hedges at the eastern boundary (**Figure 40**); including the presence of the oriental plane-tree (*Platanus orientalis L.)*. These plant priority species at the Project boundary can be left intact. Care will be needed not to damage these species with access roads or temporary contractor lay-down areas.

The ruins of the old WWTP (relic buildings) are habitats for at least two reptile species – the European glass lizard (PBF) and the Caucasus Emerald Lizard. These habitats will be destroyed when the ruins are demolished. To some extent, and to some extent only, reptiles using that habitat would have opportunity to escape injury or death, but there is no 'replacement' habitat to which they could easily transition. Loss of habitat, even without direct population loss, means less chance of survival and almost certain reductions in populations over time. Without mitigation it must be assumed that the reptile populations currently using the relic buildings as habitat would be completely lost and that is a potentially significant impact.

With mitigation, however, including pre-construction biodiversity surveys and adaptive management practices (e.g. scheduling construction works to reduce impacts, search and rescue of species if present and relocation to alternative habitat) population impacts can be effectively mitigated.

In similar vein, if the effluent pipeline corridor follows an existing irrigation canal, species such as Grass Snake and Dice Snake (priority species) will be disturbed but could simply move to new areas provided that the species are not injured or killed during construction or otherwise prevented from escaping. Again, the potential loss of population needs to be mitigated, by avoiding the habitat principally but if that is not possible scheduling construction to coincide with lower risk seasons (like Autumn but no later than mid-November to avoid hibernating animals).


*Source: EIA Report, Dornier-Schneider Consulting, 2016.*

**Figure 40. Land Use at the Project site and its vicinities**

Avifauna use the agricultural land for foraging. There will be no direct loss of agricultural land for the project, and should there be a need for the same for construction purposes (e.g laydown area) reinstatement to pre-existing conditions following completion of construction would ensure No Net Loss. The area required for sludge disposal (see **Figure 2**) must also undergo search and rescue prior to clearing any vegetation.

Disturbance of animals by noise and vibration

Animals in the Project and adjoining areas are already affected by noise from traffic on the R21 and farming activities and so have likely adapted to the noise. There may be slight displacement of these animals (viz. moving further away from the site than they are currently) notably during the construction phase but little more impact than that. It seems that the reptiles in the relic buildings would be most susceptible to vibration from construction activities but as described earlier it is the physical destruction of their habitat that would be far more of a threat to their survival.

Influence of air pollution

Fundamental changes in ambient air quality because of atmospheric emissions from construction activities are not expected. Changes in ambient air quality, such as they are, would be experienced only close to the sources, although mechanically generated dust may be dispersed further than emissions from vehicles, plant and machinery. Again, the species most at risk from air quality changes are those within the construction footprint but they will have been moved away anyway by the destruction of their habitat.

Vegetation on the boundaries of the Project footprint will be polluted by dust settling on the leaves and covering the stomata (intensity of the dust fallout will lessen with distance from the pollution source). Dust will obviously be more of a risk during the dry season. In the wet season dust generation will be inhibited and dust that had settled on leaves would likely be washed off the leaves by the rain.

Disturbance due to artificial lighting (light pollution)

Illumination of the Project will add modestly to the overall area lighting as the site is located between villages (the nearest village is Ziyadli) and the R21 highway R21. As such the additional potential impact on migratory birds will be insignificant. The site lights will attract nocturnal insects, and result in losses of the same but this will be localised to the immediate site.

General

Offsite habitat and animal disturbance is much less of a concern, because the habitat will remain largely intact, albeit with reduced habitat quality. As previous described animals occurring in these areas of influence are broadly acclimatised to these nuisance effects. As such it seems unlikely that the nuisance effects would result in appreciable population reductions.

Priority species such as the Greek (Mediterranean) tortoise, Black Francolin and Gray Partridge were observed some distance from the Project site. Over these distances it is difficult to see that such nuisance impacts would be significant. It will be necessary to conduct an additional field survey before commencing construction, to ensure that none of these priority species are in or near the project site.

*Assessment of impact significance*

Impact significance is presented **Table 64**. Significance is allocated as a function of exposure to the potential impacts which is in turn a direct function of the distance of the receptors from the source of the impacts.

**Table 64. Impact significance matrix (without mitigation)**

| Receptors (biodiversity features) | Receptor sensitivity | Magnitude of impact | Impact significance |
|---|---|---|---|
| *Plant species* | | | |
| PBF: Broad-leaved Cotton grass (*Eriophorum latifolium Hoppe* (one location, 50-60 individuals); oriental plane-tree *(Platanus orientalis L.)* (one location, 2-3 trees) | Medium | Medium | Moderate |
| *Animal species* | | | |
| PBF: Greek (Mediterranean) tortoise (*Testudo craeca,* at least, one individual)* | High | Negligible | Moderate |

| Receptors (biodiversity features) | Receptor sensitivity | Magnitude of impact | Impact significance |
|---|---|---|---|
| European glass lizard (*Pseudopus (Ophisaurus)* apodus) (at least 2 individuals) | High | High or Medium | Major |
| Dice snake (*Natrix tesselata*) (10-20 individuals) | High | Low | Moderate |
| PBF: Black Francolin (*Francoloinus francolinus)* (dozens), Gray Partridge (*Perdix perdix*) (dozens) | Medium | Negligible | Minor |
| *Fish species* | | | |
| Fish (x1)<br>PBF: *Cobitis taenia* | High | Medium positive | Moderate positive |

*One individual of the species Greek (Mediterranean) tortoise (*Testudo craeca*) was found further south-west from the WWTP plots, within fragments of dry steppe among cultivated fields; due to large distance from the WWTP plots, magnitude of impact classified as negligible.

The three other plant priority species, PBF (*Sternbergia vernalis (Miller) Gorer & J.H.Harvey*, Eldar pine *Pinus eldarica*, *Punica granatum L.*) will not be affected during construction.

*Mitigation and management measures*

- Develop a Biodiversity Management Plan (BMP) that includes the following mitigation and/or /management measures:

**Priority plant species:**

- Protect Broad-leaved Cotton grass (*Eriophorum latifolium Hoppe)* located at the eastern boundary of the WWTP plot by fencing;
- Preserve the tree alley, rows, hedges and groves located on the eastern boundary of the WWTP with fencing. This will protect, among other tree species, the Oriental plane-tree (*Platanus orientalis L.*). Trees and hedges located among arable lands and fields are good habitats for different animal species;
- Before construction conduct a detailed floristic survey of the construction area including the final design of the electricity supply infrastructure, with particular attention to endemic, relict, and threatened species; if such species are found, collect seeds and store them in suitable conditions, and then plant them in green areas at the Project site or adjoining areas. Translocation of species must be conducted wherever possible, e.g. Rhizomatous species can be replanted to other areas and later reintroduced into the original site.

**Priority animal species:**

Prior to construction

- Create alternative habitat for fauna occurring in the relic buildings. Such alternative habit could be created by accumulating large rocks supplemented by demolition rubble (ensuring that the demolition rubble was kept as large pieces). The importance of the large pieces is in creating nooks and crannies and burrows and hiding place for the reptiles. The larger pieces also create basking space where the reptiles can be exposed to sunlight. The alternative habitats must adjoin/connect to fields with grass or fallow lands with weedy vegetation.
- The alternative habitat would need to be established before starting demolition of the relic buildings but could be scheduled in such a way as to maximise the contribution to the alternative habitat of building rubble. Before starting demolition of the relic buildings, a 'search and rescue' operation would need to be conducted

to find and capture all (or at least most) of the reptiles in the relic buildings, especially the European glass lizard, *Pseudopus (Ophisaurus) apodus,* Caucasus Emerald Lizard, *Lacerta strigata*, and Red-bellied racer, *Dolichophis schmidti*).

This operation must include a snake specialist because of the potential presence of the highly venomous Levantine viper, *Macrovipera lebetina,*. If Levantine viper specimens are found, they must be caught and relocated to suitable habitats outside the Project site and settlements (preferably, to the Mingecaur-Turyanchay Emerald site territory);

- Reptiles captured in the search and rescue could then be released into the alternative/replacement habitat as soon as possible after capture. The entire process would need to be supervised by a species expert to ensure the safe capture, temporary holding and then release.
- Survey the WWTP site in warm months (April-October) prior to construction to confirm no Greek (Mediterranean) tortoise (*Testudo craeca*) specimens or burrows. If found near the construction site, specimens must be captured and relocated to suitable habitats;
- Avoid using the existing drainage/irrigation channels for the treated effluent pipeline corridor and rather run the pipeline corridor several meters away from the existing channels to avoid direct physical impacts on the channels. If there is no other option but for the pipeline corridor to follow the existing drainage channel, the trench must be excavated during Autumn (but no later than mid-November so as to avoid hibernating animals) so as not to disturb eggs and offspring of Dice snakes *(Natrix tesselata*), Grass snakes (*Natrix natrix*) and amphibians inhabiting the drainage channel;
- Develop a Code of Conduct for construction workers prohibiting poaching in general but specifically Black Francolin (*Francoloinus francolinus*) and Gray Partridge (*Perdix perdix*) along roads close to the WWTP site,
- Survey the areas around the WWTP construction site from February to September to confirm absence of species and relocate as required should specimens be observed;
- Monitor compliance with the Worker Code of Conduct and implement compliance and enforcement action as needed.

**Aquatic species**:

- Conduct an aquatic survey at the proposed treated effluent discharge point including invertebrates, identify potentially sensitive species and define and implement management actions for such sensitive species.

*Residual impact*

Impact significance with mitigation is shown in **Table 65**.

**Table 65. Impact significance matrix (with mitigation)**

| Receptors (biodiversity features) | Receptor sensitivity | Magnitude of impact | Impact significance |
|---|---|---|---|
| *Plant species* | | | |
| PBF: Broad-leaved Cotton grass (*Eriophorum latifolium Hoppe* (one location, 50-60 individuals); oriental plane-tree *(Platanus orientalis L.)* (one location, 2-3 trees) | Medium | Negligible | Negligible |
| *Animal species* | | | |

| Receptors (biodiversity features) | Receptor sensitivity | Magnitude of impact | Impact significance |
|---|---|---|---|
| PBF: Greek (Mediterranean) tortoise (*Testudo craeca, at least one individual*)* | High | Negligible | Negligible |
| European glass lizard (*Pseudopus (Ophisaurus)* apodus, at least 2 individuals) | High | Low | Negligible |
| Dice snake (*Natrix tesselata*) (10-20 individuals) | High | Low | Negligible |
| PBF: Black Francolin (*Francoloinus francolinus) (dozens),* Gray Partridge (*Perdix perdix*) (dozens) | Medium | Negligible | Negligible |
| *Fish species* | | | |
| Fish (x1)<br>PBF: *Cobitis taenia* | High | Medium positive | Moderate positive |

### 6.8.2 Operation Phase

*Activities*

Operation activities will include:

- discharge of treated wastewater to the Goshgar river,
- long-term storage of sludge.

*Aspects, impacts and receptors*

During these activities the following aspects may influence biota of the Goshgar river and area of the sludge storage:

- Treated wastewater discharge,
- Land transformation for sludge storage.
- Leachate from sludge storage area

The aspects and potential impacts are presented in the below table, together with the potentially affected biodiversity receptors.

**Table 66. Aspects, potential impacts and affected the biodiversity receptors**

| Aspects | Expected impacts | Receptors |
|---|---|---|
| Wastewater discharged to the Goshgar river | Change in water quality in the river and in species composition and ratio | Fluvial benthos fauna, fish species, riverine vegetation |
| Land transformation | Destruction of habitats and potential loss of species | Plants and terrestrial animals inhabiting the potential sludge storage. |
| Leachate from sludge storage area | Contamination of soil, surface and groundwater | Terrestrial animals, fluvial benthos fauna, fish species |

Change of chemical composition of the river waters, of species composition and ratio

Currently, untreated wastewater from Ganja is discharged into the Goshgar river. The water quality has been reduced accordingly together with associated changes in the aquatic ecosystem from its natural state. The new WWTP will comply with the discharge standards in the EU's Urban Wastewater Treatment Directive, which for large-scale WWTPs above 100,000 PE and for sensitive areas (Goshgar River) demand 70-90% removal of the main water

pollutants[147]. Chlorine will not be used for disinfection because it is hazardous to downstream aquatic life. UV-treatment will be used instead. The net effect is that there will be ***a significant improvement in water quality*** with the commissioning of the WWTP. It is simply not possible to define the full scale of the improvement to the aquatic ecosystem, but the positive impact cannot be overstated. The positive impact will only be realised, however, with the upgrading of the collector system for the wastewater to stop the multiple diffuse sources of wastewater discharge to the Goshgar and Ganja Rivers.

Destruction of habitats and species in the sludge storage area

Grasses, clover and arable lands would be affected by the construction of the sludge storage, if it is decided to construct such outside of the land owned by ASWRA**.** Two Eldar pine (*Pinus eldarica*) specimens are located there (Figure 4).

*Assessment of impact significance*

Impacts significance is summarised in the below table without mitigation.

**Table 67. Impacts significance matrix**

| Receptors (biodiversity features) | Receptor sensitivity | Magnitude of impact | Impact significance |
|---|---|---|---|
| PBF: plant Eldar pine (*Pinus eldarica*) (two locations) | Medium | High | Major – negative |
| Aquatic biodiversity of the Goshgar river | Medium | High | Major - positive |

*Mitigation and management measures*

- Develop a Biodiversity Management Plan (BMP) that includes the following mitigation and/or /management measures:

  **Plant species:**

  - Protect two Eldar pines (*Pinus eldarica*) currently located in the sludge storage area
  - If the trees cannot be protected they must be replaced elsewhere,
  - Protect the Eldar pine (*Pinus eldarica*) located further south-west from the WWTP site (on arable land).

  **Animal species:**

  - Prior to construction, conduct a search and rescue operation across the footprint of the sludge storage area to identify, capture and relocate fauna (and flora previously not identified);
  - develop rules of conduct for encountering rare, endangered or dangerous animals and regularly train the WWTP staff on the application of the rules.
  - Should priority animal species such as the tortoise access the site regularly, then a suitable barrier could be established later, using adaptative management principles.

    Note Sludge Management Strategy required under Waste, which includes prevention of off-site discharge of leachate from the sludge disposal area.

[147] Annex 1 of the Directive https://eur-lex.europa.eu/eli/dir/2024/3019/oj/eng

**Aquatic species**:

Monitor presence of aquatic species and changes during operations.

*Residual impact*

The mitigation would serve to reduce the negative residual impact significance to **negligible**. The positive residual impact of discontinuing the discharge of untreated sewage to the river, remains **high – positive.**

## 6.9 Impact on Landscape and Visual Amenity

### 6.9.1 Construction Phase

*Activities*

All construction activities including ground clearing, excavations, borrow pits, temporary stockpiling of material, large construction vehicles and machinery, scaffolding and shuttering, and so forth.

*Aspects*

- Physical transformation of the landscape

*Impacts*

The construction of the WWTP and the pipeline will have visual impacts that will affect the aesthetics of the landscape. The major visual impact will be where the physical construction activities will be occurring, and this will be due to the presence of plant and machinery as well as the excavated areas and material stockpiles. Considering limited duration of construction, the impacts will be of the temporary nature.

*Receptor sensitivity*

The project site includes fields, remnants of the WWTP construction from the early 1980s, and settlements along the existing outfall channel. Considering its anthropogenic character, the receptor sensitivity can be evaluated as **low**.

*Impact magnitude*

The impact magnitude is **low** because of the temporary nature of the impact and its limitation mainly to the project site and the pipeline routing.

*Impact significance*

The impact significance would be **negligible** as a function of the receptor sensitivity and the impact magnitude.

*Management and mitigation*

There is no mitigation that would effectively reduce the visual impacts during construction. However, certain measures should be implemented after construction, see below.

*Residual impact*

The residual impact will remain of **negligible** significance.

### 6.9.2 Operation Phase

*Activities*

- Existence of new buildings and other parts of WWTP.

*Aspects*

- Visual perception of the area.

*Impacts*

The existence of new building and other parts of the WWTP will change the visual perception of the area.

*Receptor sensitivity*

The project site includes fields, remnants of the WWTP construction from the early 1980s, and settlements along the existing outfall channel. Considering its anthropogenic character, the receptor sensitivity can be evaluated as **low**.

*Impact magnitude*

The impact magnitude is **low** because of its limitation mainly to the project site and its close surroundings.

*Impact significance*

The impact significance would be **negligible** as a function of the receptor sensitivity and the impact magnitude.

*Management and mitigation*

The following mitigation must be implemented at the beginning of the operations:

- Temporary land use areas should be restored to their original condition upon completion of construction. This includes the areas temporarily affected by the construction of the discharge channel and the WWTP;
- This may also involve revitalisation of temporarily disturbed areas (e.g., construction material storage areas) as soon as possible post-construction, undertaking restoration of fertile soil and vegetation upon completion of construction activities;
- Plant a green buffer belt 15m to 20m around the WWTP.

*Residual impact*

The residual impact will be of **negligible** significance

## 6.10 Impacts on Local Economy and Incomes

### *6.10.1 Construction phase*

*Activities*

During the construction phase the Construction Contractor will procure a range of raw materials, various products, equipment, and services to address the Project needs. Many construction goods and necessary equipment will need to be brought afar. However, many necessary products and materials are produced or sold in the country and region/ district: e.g., construction materials (e.g., sand, cement), diesel fuel (for construction vehicles), food products (for construction workers), etc.

The indicative list of services to be purchased at the construction stage include:

- Transportation of construction materials and equipment;
- Transportation of construction workers;
- Accommodation of skilled construction staff (the FS does not mentioned the need for a construction camp);
- Food and catering for Project staff;
- Security services for construction sites and warehouses of construction materials;
- Removal of construction waste from the construction sites, etc.

*Aspects*

The socio-economic aspect associated with the construction activities is contracting businesses including local small and medium enterprises to provide necessary goods and services.

*Impact*

The Project-related local procurement is expected to raise income and contribute to an increased welfare of people running respective businesses and their employees. The above activities and aspects could result in increased demand for some goods produced at the local level or sold at the local market (e.g., food products, diesel fuel for heavy vehicles, construction materials) and services provided by existing local businesses e.g., transportation companies, security agencies, agricultural producers, local shops, catering companies, hotels/real estate agencies, waste collection companies. The assumed further knock-on effects include increased incomes of local Project's suppliers and sub-contractors, and then expanding these businesses and potentially opening new ones, and therefore creating new jobs at these businesses benefitting from the Project.

*Receptor sensitivity*

Receptors of such impact are local markets of specific goods and services including local businesses – potential Project's sub-contractors and suppliers. The sensitivity of these receptors must be viewed as **low** due to large numbers of actors at the markets of concern, and the fact that locally procured goods and services are not unique.

*Impact magnitude*

Impact magnitude is **medium** as it adds benefits, it is regional to national by extent and relatively short-term by duration, and the number of businesses required to support the Project is assumed to be relatively small.

*Impact significance*

Impact significance would be **minor** as a function of low sensitivity of the receptors and medium impact magnitude.

*Management and mitigation*

The following enhancement measure should be implemented to increase magnitude of the potential beneficial impact on local markets including businesses:

- Oblige the Construction Contractor to develop (during the design development) and implement (during the construction phase) **the Procurement Plan** in line with the national legislation and EBRD PR1/PR2; such Plan will aim at maximizing local procurement subject to service/product requirements.

*Residual impact*

With the correct application of the enhancement measure the impact magnitude could be increased to high implying **residual significance rating of this beneficial impact as minor to moderate**.

### 6.10.2 Operation Phase

*Activity*

- Regular operation of the WWTP.

*Aspect*

- Provision of treated effluent for irrigation purposes;
- No access to untreated wastewater;

- Supply of raw and construction materials for pipeline maintenance works / small-scale procurement;
- Payment of taxes and social payments.

*Impact*

As discussed in the baseline, the local economy of Samukh District is primarily based on agriculture. Local residents cultivate crops and sell them on the local markets in Ganja, Baku, and Sumgait. At the same time, the fact that the crops are grown in Samukh district has created a kind of "anti-brand" at the local level. It is known that untreated wastewater from Ganja has been, or could have been used for irrigation at various times, and soils in the area adjacent to the WWTP are contaminated. There is no precise information on the degree of soil pollution in this area, as no formal studies have been conducted. Nevertheless, unverified information circulating through unofficial channels have created negative public perceptions regarding agricultural products from Samukh district.

The lack of state monitoring, regulatory control, or independent studies on the quality and pollution of agricultural lands in the Project area prevents an objective assessment of the current situation. Consequently, the lack of reliable information limits the ability to correct the negative information background and aggravates social tension that exists around this issue in the Samukh district and Ganja. This situation significantly restricts the marketability of agricultural products from nearby settlements, narrowing sales opportunities and lowering prices. Ultimately, this directly affects the income of the local residents engaged in agriculture.

The implementation of the Project will fundamentally change the situation and address its root causes. The transportation of polluted municipal wastewater through open channels and its discharge into the Goshgar River will be stopped, making it impossible to irrigate agricultural lands with polluted wastewater. Only clean water will be used for irrigation. Existing soil pollution (if/where it exists) will gradually be mitigated, creating new incentives for the development of agricultural production in the Project area and across Samukh District.

In addition, local procurement of some services and goods sold at the local market (e.g., some construction materials, food products) for maintenance purposes can be expected. Further, taxes and social contributions will be paid to the state / municipal budgets.

*Receptor sensitivity*

The economic conditions of the local farmers are seen as of **low to medium sensitivity**, and of local companies (that can be included in the maintenance) as **very low to low**. Being stable and not fragile, the sensitivity of the state / municipal budgets is seen as **very low**.

*Impact Magnitude and Significance*

This impact on local economy and impacts on farmers is assessed as positive and of low magnitude, given its local scale. So, the significance of impact would be **minor to moderate**.

The impact for local companies will be positive and of **negligible to minor significance** (given the small scale of potential services).

The input into the state / municipal budget would be of **negligible** significance (positive).

*Mitigations / Enhancement Measures*

- Develop the WWTP design documentation in accordance with the legislation of Azerbaijan, EBRD PRs, and GIIP and have it approved by the authorized bodies;
- Carry out construction and operate the WWTP in accordance with the Project documentation, including the ESAP and ESMP;
- Conduct a survey of soil pollution in the Project area, jointly with competent authority;
- Ensure public access to the survey results and maintain an ongoing monitoring of pollution of agricultural soils in the WWTP area in accordance with the ESMP.

*Residual impacts*

Implementation of the mitigations will enhance and sustain the key positive impact of the Project on agricultural development, the main economic activity in the Project area, at moderate **significance**. Additionally, improvements in sanitary condition resulting from Project implementation will contribute to the development of related sectors of the local economy, including recreation, potentially fisheries and others. Other positive impacts (procurement and budgetary payment) will remain **negligible to minor**.

## 6.11 Impacts on Local Employment and Labour Market

### 6.11.1 Construction Phase

*Activities*

For the construction works, ASWRA will hire the Construction Contractor who will manage the whole construction process, including the recruitment.

*Aspects*

The *key aspect* generating valuable social impacts on local employment and labour market is the involvement of workforce into the construction of the WWTP (direct and indirect).

It is assumed by the ESIA Consultant that approximately 100 highly skilled and semi-skilled direct workers will be required for construction. The precise number of workers, along with the specific qualification requirements, will be defined at the detailed design stage. Most likely, qualified workers will come with the construction contractor as its permanent personnel (according to a preliminary estimation, from 50% up to 70% of the direct workers). The rest of jobs could be the new ones generated for this particular project.

*Impact Assessment*

*Impacts* (increasing employment, strengthening of the labour market) can occur at the local and regional levels depending upon Human Resource (HR) policy of the Construction Contractor.

In addition, the Project is expected to generate indirect employment opportunities in ancillary sectors, including supply chains, vehicle maintenance, transport services and others. Some of the workforce will be hired temporarily, either through shift rotations or for the entire construction period.

*Impact Magnitude*

According to the research of the impact of infrastructure projects on employment[148], the ratio of the sum of indirect and induced jobs to direct jobs is estimated at 2. In other words, the creation of one direct job is expected to generate two additional indirect and induced jobs. If 50% of these jobs are filled by the local population, approximately *100-150 new jobs* could be created in the local labour market during the construction phase of the Project (*medium*). Therefore, these jobs will only be available for WWTP construction phase (3 years).

[148] EIB. 2015. Employment Impact of EIB Infrastructure Investments in the Mediterranean Partner Countries. Summary report. June 2015. Section 3.3. https://www.eib.org/attachments/country/femip_study_summary_employment_impact_en.pdf

IFC. 2013. IFC Jobs Study: Assessing Private Sector Contributions to Job Creation and Poverty Reduction. January 2013. https://www.ifc.org/wps/wcm/connect/a93ef4fe-8102-4fc2-8527-5aff9af7f74f/IFC_FULL+JOB+STUDY+REPORT_JAN2013_FINAL.pdf?MOD=AJPERES&CVID=jMRYe5J

*Recipients' sensitivity and impact significance*

Labour markets of the City of Ganja and Samukh district have different sensitivities to new job places. The employment opportunities are especially important for rural population of Samukh district (medium sensitivity) and less important for Ganja labour market (low sensitivity).

The Project impact on employment is therefore assessed as positive, local, and short-term. The impact significance:

- for rural (Samukh) population and labour market is assessed as **positive moderate**,
- for the City of Ganja as **positive low to negligible**.

*Mitigations / Enhancement Measures*

The positive impact on the local employment can be enhanced by prioritizing the hiring of local labour and the procurement of local goods and services, to the extent possible and economically feasible. The following measures are proposed to enhance the positive Project impact:

- Develop (prior to construction) and implement a Recruitment Policy for the Project in line with the national legislation and EBRD PR1/PR2 and ASWRA's Human Resource Policy;
- Oblige the Construction Contractor to develop a Construction Phase Recruitment Procedure, approve it at least a month before the construction, and implement it. The Recruitment Procedure will inter alia:
  - Specify the qualifications and skill levels for the construction staff;
  - Prioritise the employment of local residents, subject to their qualification;
  - Contain training provisions for the potential local workforce;
  - Require that construction workers would be provided with an employment reference/ confirmation letter and a skills/training log, to enhance their subsequent employment prospects;
  - Timely provide information locally on available employment opportunities and required qualification during the construction phase.

*Residual impact*

The implementation of these measures will enhance the positive impact on local employment in terms of transparency and sharing of benefits, as well as improvement of public perception of the Project and strengthening its social sustainability. However the significance of the impact will remain **positive low to negligible for Ganja and positive moderate for rural (Samukh) population and labour market.**

### 6.11.2 Operational phase

*Activities*

During the operational phase, the regular operations maintenance will take place.

*Aspects*

The key social aspect is the creation of long-term job places. The number of permanent personnel required for these operations is 21, as per the FS. No indirect local employment opportunities are expected (unless there is maintenance, which is short-term).

*Impacts*

Relevant impacts are the same - increased employment and strengthened the labour market.

*Magnitude and receptor sensitivity*

Although the total number of positions is limited and thus the magnitude is low, these long-term jobs are important for recipients, in particular for rural communities / settlements (high sensitivity*).*

*Impact significance*

The impacts on local employment and labour markets during the operations are therefore assessed as **positive minor to moderate** for the rural settlements and **negligible** for the City of Ganja.

*Mitigation/Enhancement Measures:*

To enhance the positive effect, it is recommended to:

- Give priority to the employment of local residents, including, where possible, residents of the nearest settlements in Samukh district and Kapaz municipality of Ganja.
- Provide additional training to local applicants if/where necessary. Given the high turnover of personnel and ongoing labor migration from the region, it is advised to train more individuals than are required to operate the WWTP. This approach will create a reserve of qualified personnel for the enterprise and contribute to the more sustainable operation of WWTP.

*Residual impact*

The *residual impact* is expected to remain **positive minor to moderate** for the rural settlements and **negligible** for the City of Ganja. The proposed enhancement measures will strengthen the local sustainability of the Project, which is considered the main benefit of this approach.

## 6.12 Impacts on Infrastructure and Public Services

### 6.12.1 Construction Phase

*Activities*

The construction of the WWTP facilities will place temporary pressures on local infrastructure and public services. The main activities that will likely affect the infrastructure are as follows:

- Operation of heavy vehicles to transport materials, equipment, and workers along main roads and village roads.
- Use of construction machinery and equipment.
- Excavation and earthworks for foundations and equipment installation.
- Generation of solid waste from the construction workforce and activities.

*Aspects*

Social aspects associated with construction activities include:

- Increased heavy vehicle traffic on main roads and village roads.
- Temporary rise in electricity demand for construction equipment at the WWTP site.
- Potential interference with underground infrastructure (gas infrastructure, water supply, and others utilities);
- Risk of disturbance or contamination of artesian wells and irrigation canal.
- Additional solid waste generation from construction workforce.

*Impacts*

The above-mentioned aspects may result in the following impacts:

- Road surface degradation, dust pollution, congestion, and temporary disruption to public and school bus services;
- Short-term electricity supply disruptions may occur due to transformer overload or accidental damage to power lines, which affects households and the operation of water supply pumps;
- Temporary gas supply interruptions or leaks may occur if gas lines are accidentally damaged;
- Potential contamination or disruption of village water supply systems due to earthworks;
- Additional solid waste from up to 100 workers, creating short-term pressure on local waste collection and landfill capacity.

*Receptor sensitivity*

Roads and traffic are considered **medium sensitivity**. Main roads are in good condition, but internal village roads—such as the gravel streets in Istikhana—are of average quality and prone to degradation. Residents rely on reliable transport access to Ganja, Samukh, and Sumgait.

Electricity infrastructure is also **low sensitivity**, as rural households and agricultural activities depend on a stable supply. Gas infrastructure has **low sensitivity**, with the SOCAR-operated network providing 100% household coverage in Samukh District.

Water supply systems are **low sensitivity**, since artesian wells are essential for domestic use and irrigation.

The waste management system is **medium sensitivity**, as local services exist but have limited capacity and limited alternatives.

*Impact magnitude*

Construction-related heavy vehicle movements will cause noticeable effects such as surface degradation, dust, and temporary disruptions to transport services. Impacts are localized but will occur frequently during the construction period. The overall assessment of the impact magnitude is **medium**.

Temporary power demands may exceed the capacity of local transformers, creating the risk of short-term supply disruptions. The impacts might be limited in duration and thus is assessed as **low**.

The likelihood of interference with underground gas lines is relatively **low**, and any impacts would be temporary and localized.

Earthworks may disturb or contaminate artesian wells. However, the likelihood of contamination is low, so the magnitude of the impact is also **low**.

Although the temporary workforce will generate additional solid waste, the volumes will be relatively small compared to local capacity. Therefore, impacts are considered **low**. Note that the impacts from waste generation are reviewed separately in **Section 6.6**.

Overall, the magnitude of impacts on infrastructure and public services is assessed as **low**.

*Impact significance*

Considering the receptor sensitivity and the impact magnitude, the significance of the likely impacts on infrastructure and public services is assessed as **moderate** (taking a conservative approach).

*Management and mitigation*

- Develop and implement a Traffic Management Plan that includes speed limits, alternative routes, a scheduling to avoid peak community hours, and provision of

information to the local residents about the start of construction traffic movement at least two weeks before the construction commences.

- Conduct utility surveys during the detailed design stage to identify and avoid the locations of electricity, gas, and water infrastructure at the WWTP site and along the effluent pipeline route and access roads. Ensure the continuity of services is provided during the Project construction and operations.
- Monitor water quality at artesian wells to minimize disruptions to water supply system. Provide alternative water delivery option (e.g., water trucks) in case of contamination.
- Provide on-site waste collection and ensure disposal at approves landfill.
- Following construction, rehabilitate the used public roads, if affected, to the pre-project or better condition

*Residual impact*

With proper mitigation, the impact on public infrastructure and public services is expected to be **negligible negative**.

### 6.12.2 Operation Phase

*Activities*

The operation phase includes ongoing wastewater treatment and effluent discharge, as well as routine maintenance. Most of the cars on the road will be people going to and from work. There might also be some cars carrying equipment for maintenance or replacement.

*Aspects*

Key social aspects during operation include:

- Traffic associated with the operation of WWTP.
- Higher electricity demand requiring a stable supply to avoid system overload or interruption.
- Risk of contamination of artesian water wells if treatment processes fail or overflows occur.
- Additional solid waste generation from permanent WWTP staff (Note that the impacts from industrial waste generation are reviewed separately in **Section 6.6**.)

*Impacts*

These aspects may result in the following impacts:

- Dust pollution, congestion, particular on village roads.
- Higher power requirements could cause short-term disruptions from transformer overloads or accidental damage to power lines, impacting households and irrigation pump operations.
- System failures or overflows at the WWTP could result in untreated or partially treated wastewater entering local water sources, including artesian wells. This could contaminate the water in these areas, posing health risks to households and affecting agricultural irrigation that depends on these wells.

*Receptor sensitivity*

Roads, electricity, gas, water supply, and waste management in the project area are all considered of **low to medium** sensitivity.

*Impact magnitude*

Traffic impacts are low because operational traffic is minimal; effects are localized and manageable. Electricity impacts are low, as higher demand could strain transformers if capacity is insufficient, though proper planning can prevent disruptions. Water supply impacts are medium, with positive effects from increased irrigation and reduced pollution, but a small risk of contamination exists in case of operational failures. Solid waste impacts are low, as volumes from the workforce are minor compared to local capacity.

Overall, the magnitude of impacts on infrastructure and public services is assessed as **low**.

*Impact significance*

Overall, the significance of operational impacts is assessed as **minor**.

*Management and mitigation*

- Assess electricity infrastructure capacity during the design stage to ensure sufficient supply and prevent overloads.
- Implement regular monitoring of water quality at artesian wells and irrigation channels.
- Develop and implement the Emergency Response Plan for operational failures (e.g., overflow, system breakdowns)

*Residual impact*

With proper mitigation, residual impacts during operation are expected to be **negligible negative**.

## 6.13 Impact on Occupational Health and Safety of Employees

The Project presents occupational health and safety risks to on-site workers during both construction and operational phases.

### 6.13.1 Construction Phase

*Activities*

All construction activities.

*Aspects*

The following hazards will exist during construction of the WWTP and pipeline:

- Vehicle and machinery movements.
- Deep excavations.
- Working at heights.
- Dust and vehicle fume exposure.
- Noise.
- Severe weather (hot or cold).
- Exposure to arc welding.
- Suspended loads and,
- Live circuits.

*Impacts*

Injuries and disease manifestations would include:

- Falls, Slips, and Trips - Working on scaffolding, ladders, or roofs and uneven surfaces, debris, or lack of traction, leading to falls on the same level.

- Struck-By Hazards - Workers can be struck by moving vehicles, heavy equipment, or falling objects from above.
- Caught-In/Between Incidents - Being caught, crushed, or compressed between moving machinery, objects, or collapsing structures.
- Electrical Hazards - Contact with exposed or faulty wiring, equipment, and improper electrical practices can lead to electrocution, burns, and fires.
- Hazardous Materials Exposure - Inhaling dust, solvent fumes, or vehicle, plant and machinery emissions can cause respiratory problems, long-term illnesses like lung disease, and cancer. Exposure to paints, adhesives, and other chemicals can lead to skin irritation, respiratory issues, and poisoning.
- Noise and Vibration -Prolonged exposure to noise can result in permanent hearing loss. while continuous use of power tools and vibrating equipment can damage nerves and blood vessels known as and-arm vibration syndrome (HAVS).
- Heavy Machinery and Equipment - Accidents involving cranes, forklifts, and other heavy equipment can cause serious injuries or fatalities
- Collapses - Unstable trenches, excavations, or building structures can collapse on workers causing severe injury or death.
- Other Risks - Injuries can occur from lifting heavy materials, either manually or with machinery. Repetitive motion or awkward postures can lead to musculoskeletal injuries (ergonomics). Extreme temperatures can cause heat-related illnesses or cold exposure. Psychosocial hazards include stress and other mental health challenges.

*Receptor sensitivity*

Overall receptor sensitivity is high simply by virtue of the human morbidity or mortality risk.

*Impact magnitude*

Impact magnitude is potentially high as all the risks could lead to disabling injuries or death and long-term human health effects.

*Impact significance*

Impact significance would be **major** as a function of the high receptor sensitivity and same levels of impact magnitude. However, the impact magnitude could be reduced through application of mitigation measures detailed below.

*Management and mitigation*

- Develop and implement a Construction Occupational Health and Safety (OHS) Management Plan that includes *inter alia*:
  - An OHS risk assessment must be conducted for all construction activities to identify all potential hazards. Mitigation must be planned for each hazard based on the mitigation hierarchy where eliminating the hazard is the priority and the use of Personal Protective Equipment (PPE) should only be seen as a last resort.
  - The Contractor must be obliged to comply with local OHS legislation and EU Directives on OHS and use of personal protection equipment (89/654/EEC, 89/656/EEC, 89/686/EEC and 2009/104/EC).
  - Assessing the health and capability of workers to perform tasks – e.g. ensuring that workers scared of hights are not assigned to working at height.
  - Preparation of emergency response plans (see below sections) specifically applicable to construction hazards and including the provision and maintenance of necessary emergency response and rescue equipment.
  - Enough first aid trained employees to respond to emergencies.

- Implementation of specific personnel training on worksite health and safety management including a communication program with a clear message about management commitment to OHS. The communication program should also include regular meetings such as daily "toolbox" talks prior to initiation of work shifts.
- Integration of behavioural considerations into health and safety management, including on- the-job behavioural observation processes.
- Adequate illumination for safe working conditions.
- Signage in hazardous areas, installations, materials, safety measures, emergency exits, and other such areas should be in accordance with international standards
- To the extent that alternatives cannot eliminate or sufficiently reduce a hazard or exposure, workers and visitors must be provided with the necessary personal protective equipment (PPE), instruction and monitoring in the appropriate maintenance and use. Applicable PPE include, at a minimum, safety helmets and footwear, in addition to ear, eye, and hand protection.
- Control activities by having a permit to work system for performance of hazardous tasks.
- Regular inspection and maintenance of working area and equipment.
- Ensure adequate availability and maintenance of first aid kits, fire extinguishers, and PPE throughout the construction area.
- Good housekeeping at all times across the construction area.
- Access control to construction areas.
- Prescribing maximum speeds in and around the construction site, assign dedicated parking areas for employee vehicles, and implement reverse parking only.
- Prevent workers from entering excavations unless absolutely necessary and where it is necessary, ensure that excavation sides sides are shored appropriately to prevent collapse.
- Ensuring equipment is maintained to manufacturers' standards and that noise baffles are fitted.
- Reducing exposure times for people working near noisy machinery.
- Providing workers with appropriate hearing protection.
- Implement a drugs and alcohol policy.
- Provide preventive treatment to site workers and families, e.g., immunisation. health monitoring.
- Promote healthy lifestyles amongst the workers including topics such as limiting alcohol consumption, giving up smoking, healthy eating and safe sex.

The list of mitigation measures is not necessarily exhaustive and must be implemented in respect of project specific circumstances and in the spirit of continual improvement.

*Residual impact*

With the correct application of the mitigation measures the impact magnitude could be reduced to low implying an overall residual significance rating of moderate.

### 6.13.2 Operation Phase

*Activities*

- Maintenance and inspections.
- Vehicle movement and,

- Emergency situations.

If the repairs or maintenance of the facilities requires excavation, demolition/ and or rebuilding this would have the same characteristics and impacts as construction activities.

*Aspects*

- Corrosion, equipment failure.
- Transport accidents and,
- Emergency accidents.

The following hazards will exist during operations of the WWTP:

- Vehicle and machinery movements.
- Working at heights.
- Severe weather (hot or cold).
- Dangerous animals.
- Live circuits.
- Confined spaces.
- Asphyxiation risk.
- Dangerous (potentially odourless) gases, and
- Fire and explosion.

*Impacts*

Injuries of different severity, including sever injury, permanent disability, fatality and adverse human health effects.

*Receptor sensitivity*

Impact magnitude is medium to high as people are a receptor of high sensitivity.

*Impact magnitude*

Impact magnitude is high, obviously depending on the severity of accidents, as some of them could lead to severe injury, death or adverse health impacts.

*Impact significance*

Impact significance would be **major** as a function of the high receptor sensitivity and same levels of impact magnitude. However, the impact magnitude could be reduced through application of mitigation as detailed below.

*Management and mitigation*

- Develop and implement an Operations Occupational Health and Safety (OHS) Management Plan that includes *inter alia*:
  - An OHS risk assessment must be conducted for all activities to identify all potential hazards. Mitigation must be planned for each hazard based on the mitigation hierarchy where eliminating the hazard is the priority and the use of Personal Protective Equipment (PPE) should only be seen as a last resort.
  - There must be compliance with local OHS legislation and EU Directives on OHS and use of personal protection equipment (89/654/EEC, 89/656/EEC, 89/686/EEC and 2009/104/EC).
  - The health and capability of workers to perform tasks – e.g. ensuring that workers scared of hights are not assigned to working at height – must be determined and applied in a fit for purpose manner.
  - Promotion and monitoring of safe driving amongst employees.

- Preparation of emergency response plans specifically applicable to operational hazards and including the provision and maintenance of necessary emergency response and rescue equipment.
- Enough first aid trained employees to respond to emergencies.
- Implementation of specific personnel training on worksite health and safety management including a communication program with a clear message about management commitment to OHS. The communication program should also include regular meetings such as daily "toolbox" talks prior to initiation of work shifts.
- Integration of behavioural considerations into health and safety management, including on- the-job behavioural observation processes.
- Adequate illumination for safe working conditions.
- Signage in hazardous areas, installations, materials, safety measures, emergency exits, and other such areas should be in accordance with international standards
- To the extent that alternatives cannot eliminate or sufficiently reduce a hazard or exposure, workers and visitors must be provided with the necessary personal protective equipment (PPE), instruction and monitoring in the appropriate maintenance and use. Applicable PPE include, at a minimum, safety helmets and footwear, in addition to ear, eye, and hand protection.
- Control activities by having a permit to work system for performance of hazardous tasks.
- Regular inspection and maintenance of working area and equipment.
- Ensure adequate availability and maintenance of first aid kits, fire extinguishers, and PPE throughout the construction area.
- Good housekeeping always across the WWTP.
- Access control.
- Ensuring equipment is maintained to manufacturers' standards and that noise baffles are fitted.
- Reducing exposure times for people working near noisy machinery.
- Providing workers with appropriate hearing protection.
- Implement a drugs and alcohol policy.
- Provide preventive treatment to site workers and families, e.g., immunisation. health monitoring.
- Promote healthy lifestyles amongst the workers including topics such as limiting alcohol consumption, giving up smoking, healthy eating and safe sex.

*Residual impact*

With the correct application of the mitigation measures the impact magnitude could be reduced to low implying an overall residual significance rating of **moderate to minor**.

## 6.14 Impacts on Community Health, Safety and Wellbeing

The current situation in the project implementation area creates discomfort, hazards and risks for the health of the local population:

- the smell of wastewater near the existing canal is a factor of concern, and biological and chemical pollution of these waters creates risks of infectious diseases, poisoning with toxic substances contained in untreated wastewater, creates an unsanitary situation around the designed WWTP;

- Destroyed, semi-destroyed, unfinished facilities on the unfenced WWTP site create multiple hazards and injury risks to local community, especially children, as well as livestock;
- Existing visual impacts are discussed in **Section 6.9.**

Project implementation will change the existing situation to the better.

### 6.14.1 Construction Phase

*Activities*

- Demolition of the existing structures;
- Use of heavy vehicles and construction machinery with internal combustion engines within the construction corridor and at the WWTP sites;
- Site preparatory works including vegetation stripping, grading, topsoil excavation and stockpiling;
- Trench excavations and backfilling trenches and reinstatement of vegetation layer;
- Welding;
- Transport of soil and backfill material, and so on.

*Aspect*

Aspects associated with the above construction activities which would result in socio-economic impacts include:

- Tailpipe emissions (carbon dioxide, carbon monoxide, nitrogen oxides and aromatic hydrocarbons) from machinery and vehicles;
- Welding fumes;
- Solvent fumes;
- Noise and vibration from the movement and operation of construction machinery and vehicles within the WWTP sites and pipeline construction corridor including construction sites for Project roads;
- Noise, vibration and artificial lightning from Project's construction vehicles travelling along the access roads to the construction corridor and WWTP sites;
- Increased road traffic accident hazard at the access roads and local roads due to intensive traffic of heavy vehicles; and
- Potential influx of construction workers.

*Impacts*

These aspects would bring about the following **community health and safety impacts / risks**, such as:

- Risk of traffic accidents due to movement of construction vehicles;
- Risk of accidents due to open pits or trenches (especially for children),
- Possible nuisance related to noise pollution and vibration, light pollution, air / dust emissions
- Possible influx of job seekers/construction workers.

*Receptor sensitivity*

The receptors are residents of settlements in the vicinity of the WWTP sites and along the proposed effluent pipeline route. As the health of the people might be affected, the sensitivity is seen as **high**.

*Impact magnitude*

Magnitude of different types of impacts may vary from **negligible** (traffic accidents) to **medium** (accidents due to open pits or trenches).

*Impact significance*

Significance of impacts on community health and safety could be **moderate to major**.

*Mitigation and management measures*

- Continue implementing the SEP, including
  - the delivery of safety lessons in local schools;
  - Prior of the construction activities to inform local community about the construction schedule, the company and responsible persons, the contact information and safety measures to be undertaken by the community members; set up the relevant billboards and provide the relevant information materials
- Prohibit the Construction Contractor to carry out on night-time construction activities and vehicle traffic;
- Oblige the Construction Contractor to fence the construction sites [the best solution would be to fence the WWTP sites prior to construction if possible];
- Oblige the Construction Contractor to develop (during the pre-construction phase) and implement (during construction phase) a Construction Traffic Management Plan (see details in **Section 6.12**). The Plan should promote the selection and use of roads in a manner that minimises risks to community safety. The Plan should be agreed with the municipal and/or national safety services and local authorities;
- Implement an Emergency Response Plan for the construction phase; and
- Oblige the Construction Contractor to:
  - Maximize the use of the local workforce subject to qualification requirements;
  - Establish or implement an existing worker Code of Conduct that sets clear expectations for worker interaction and behaviour with the local residents;
  - Conduct health awareness training for workers including sexually transmitted diseases and HIV/AIDS at induction and then periodically throughout their employment; and
  - Monitor the implementation of workers' health specification, including among sub-contractors.

*Residual impact*

The mitigation measures are to reduce the community health and safety risks providing the residual risks not more than **minor** negative.

### 6.14.2 Operation Phase

*Activity*

- Regular operation of the WWTP.

*Aspect and Impact*

The Project will have a multifaceted long-term positive impact on the well-being of the population during the operational phase. It is expected that improved sanitation will enhance the quality of life of the local population. Health risks to the population will be reduced, the number of cases of infectious diseases among children and adults is expected to decrease. Discomfort associated with the odour will also be avoided.

*Receptor sensitivity*

As the health of the people might be affected, the sensitivity is seen as **high**.

*Impact magnitude*

Magnitude of the operational impact is **medium to high** given that the population of both the Ganja and local settlements will experience various types of benefits.

*Impact significance*

The impact on the community's health and wellbeing at the operational phase is assessed as positive, long-term, and of major **significance**.

*Mitigations / Enhancement Measures*

To enhance the positive impact and increase its sustainability the following is recommended:

- Strictly follow the technological / technical / EHS instruction and guidelines during the operational phase, provide the proper training / instructions to WWTP personnel that will create the reliable basis for the sustainable work of the WWTP;
- Continue implementing the SEP (to be updated for operations) with a special focus on obtaining information from the community (including immediate signals on local concerns), and strengthening trust and cooperation.

*Residual impact*

The residual impact on the community's health and wellbeing will be **major positive**.

## 6.15 Impacts on Local Land Use and Livelihoods

### 6.15.1 Pre-Construction and Construction Phases

*Activity*

- Construction of the effluent discharge pipeline (and potentially access roads).

*Aspects*

- Allocation of land for the construction of the effluent discharge pipeline (and potentially access roads).

*Impact*

As the construction of the WWTP will be carried out within the existing Client-owned land plots, additional land will be required only for the Effluent Channel (i.e., a corridor of the effluent line itself and a 20 m buffer / safety corridor) and possibly access roads.

The need for temporary land for construction purposes will be determined at the stage of detailed design and in the Construction Management Plan.

As noted in the baseline, pastures adjacent to the two WWTP sites are used for livestock farming. At the same time, the southern site of the WWTP (not the one with the effluent ponds) is informally used for grazing and keeping livestock in the unfinished and deteriorating structures (that require demolition); the sites are also crossed by the farmers that lead their livestock to the pastureland in the vicinities.

Some irrigated arable land plots around the WWTP sites have been transferred to local residents for agricultural use. These parcels are used legally; no informal use has been identified during the site visit. The owners often lease their land parcels to farmers who bring such land plots together and create relatively large fields on which crops are grown.

The existing diversity of land use needs to be reorganized to bring it in compliance with national legislation and EBRD PRs. Informal use of ASWRA assets and grazing livestock at the WWTP site is obviously not acceptable and must be ceased.

The Project-related land acquisition is not expected to trigger physical displacement.

Economic displacement impacts are expected due to land acquisition and restricted access to ASWRA's land.

*Receptor sensitivity*

The local residents who informally use the WWTP site for livestock grazing will lose access to the on-site pastures. The sensitivity of the farmers is assessed as **medium** assuming the importance of this activity to them.

*Impact magnitude*

The overall magnitude is seen as **low** since:

- Half of the underground effluent pipeline is assumed to use the existing discharge canal before bending to the west and running for another 2.1km. While it may cross the state, private and municipal land, its corridor is not large and the land take is not significant. Besides, after the restoration, the land can continue to be used for grazing (but some safety restrictions will apply).
- Very few local residents use the southern WWTP site informally for grazing livestock.
- The option to cross the territory with livestock will be retained as there is a sufficient space between the two land plots of ASWRA.

*Impact significance*

The negative impact is assessed as **moderate**.

*Mitigation measures*

- Consult local farmers and authorities about the availability of alternative community pastures and ensure the local authorities allow access for the affected farmers;
- During the detailed design, route the effluent pipeline so that to avoid or minimise the impact on the private land;
- Prepare a Resettlement Framework to outline the potential impacts of land acquisition and land use restrictions due to the Project.
- If the resettlement impacts are confirmed at the detained design stage as unavoidable, prepare and implement a Resettlement Plan (including relevant livelihood restoration).

*Residual impact*

With the implementation of the proposed mitigations, the residual significance of this negative impact is expected to become **negligible**.

### 6.15.2 Operational phase

*Activities*

- Regulator operations of the WWTP facilities.

*Aspects*

- Established of the WWTP SPZ and enforcement of the related land use restrictions (no food crops).

*Impact*

At the operational phase, the WWTP SPZ is to be established and enforced. The normative SPZ is 500 m, however its smaller size can be justified and officially approved if technical solutions are adjusted, emitting facilities are sited as far as possible from the houses, BATs are used for capturing and treating emissions, and the prevailing winds are considered it is the

SPZ. ASWRA plans to take all possible action to reduce the size of the SPZ for the Ganja WWTP, ideally so that it matches the boundaries of the land plots owned by ASWRA. If some small parts of the SPZ remain outside of the Client-owned land, ASWRA will consider buying these land plots. There is also a risk that if residential houses fall within the SPZ, they will need to be relocated.

Currently, the possibility of establishing the SPZ within the client-owned land plots is not verifiable and will need to be confirmed at the detailed design stage.

Particular attention is to be paid to the area between two ASWRA land plots (assets). This area may be affected by WWTP operations from both sides and thus can be exposed to increased emissions, including odour impacts. This area (that is squeezed between two ASWRA's sites) is currently used by local farmers for crop cultivation. The land is irrigated with underground water from boreholes (one of which is located within this area) and is farmed using hired labour. As per the 2024 FS, ASWRA considered acquiring this land, however ASWRA did not plan to do this at the time of this writing.

*Receptor sensitivity*

The local residents who informally use the WWTP site for livestock grazing will lose access to the on-site pastures.

- The sensitivity of the farmers cultivating the lands around the WWTP sites might be from **low to medium**, depending on their dependence of land.
- If, despite the designers' effort, the residential houses fall within the SPZ, then the sensitivity of the those that may be relocated is assessed as **high**.

*Impact magnitude*

The number of farmers / households that may be affected by the SPZ land use restrictions is not known. Some part of the land around the WWTP site is not used for agriculture (it was called a wasteland in the baseline). Overall, the magnitude can be assumed from **negligible to medium**. The magnitude of the physical displacement impact will be similar, as very few houses currently fall in a normative SPZ.

*Impact significance*

The significance of economic displacement impact might vary **from negligible to moderate**; and that for physical displacement impact can be **moderate to major**.

*Mitigation Measures*

- Include in the detailed design the proposed measures to prevent and mitigate air emissions from the WWTP facilities to reduce the SPZ;
- During the detailed design stage, site the facilities so that to ensure that the primary sources of emissions are as far as possible from residential areas and arable lands, at a distance at least equal to the normative SPZ (500m).
- During the detailed design stage, develop a SPZ Design Document and have it approved, upon consultations with environmental and sanitary-epidemiological authorities.
- Include the risks of economic and physical displacement related to the SPZ's regime into the Resettlement Framework.
- If the resettlement impacts are confirmed at the detained design stage as unavoidable, prepare and implement a Resettlement Plan (including relevant livelihood restoration).
- During the preparation of the RP conduct and document consultations with all displacement - affected persons, including vulnerable households (if any).

*Residual impact*

After implementation of mitigation, the residual impact is expected to become **negligible**.

## 6.16 Impacts on Gender Inequality and Vulnerable Groups

### 6.16.1 Construction Phase

*Activities*

The main activities that are likely to affect gender inequality and vulnerable groups during the construction stage are the recruitment and mobilization of a predominantly male construction workforce, as well as the operation of heavy vehicles and machinery.

*Aspects*

Social aspects associated with construction activities include:

- Engagement of a predominantly male construction workforce.
- Increased traffic and related road safety risks affecting children and the elderly.
- Temporary disruptions to public transportation services affect women and vulnerable groups who depend on them for access to education, healthcare, and markets.

*Impacts*

The above listed social aspects may result in:

- Construction work is typically male-dominated, which may limit direct employment opportunities for women. However, women may indirectly benefit from the increased demand for local services and small-scale trade.
- Increased heavy vehicle traffic on local and village roads poses higher safety risks for pedestrians, especially schoolchildren and the elderly.
- Restricted mobility for vulnerable groups (e.g., children, elderly, people with disabilities and women) due to traffic congestion and public transportation disruptions.

*Receptor sensitivity*

Vulnerable groups—including women, children, the elderly, people with disabilities, internally displaced persons (IDPs), and low-income households—have limited adaptive capacity and are disproportionately affected by disruptions to mobility, safety, and employment. Therefore, their sensitivity is considered **moderate**.

*Impact magnitude*

Impacts are generally temporary and localized. The impact magnitude is assessed as **low**.

*Impact significance*

These impacts are short-term but might directly affect sensitive groups and may intensify existing gender inequalities. The significance of the impact is assessed as **minor**.

*Management and mitigation*

The following mitigation measures are recommended for implementation at the construction stage:

- Conduct community awareness and engagement sessions to inform residents about construction schedules, traffic plans, and available support.
- Coordinate with local authorities to ensure continued access to public transport, particularly school buses and services relied on by women and the elderly.

- Prioritize local hiring where possible, including opportunities for women in non-heavy labour roles.

*Residual impact*

With effective mitigation, residual impacts are expected to be **low adverse**. Risks of exacerbating gender inequality or disproportionately affecting vulnerable groups can be minimized through proactive management, monitoring, and community engagement.

### 6.16.2 Operation Phase

*Activities*

The WWTP will routinely operate and will provide permanent technical and administrative jobs during the operation phase.

*Aspects*

Social aspects associated with operation stage include:

- Creation of permanent employment opportunities during operation at the WWTP, traditionally dominated by men.
- Improved wastewater management and sanitation.
- Increased availability of treated water for irrigation.

*Impacts*

These aspects may result in the following impacts:

- Risk of gender inequality in employment.
- Improved wastewater management will positively affect the environment and agriculture by reducing soil contamination, increase the availability of water for safe irrigation, and enhancing crop quality and marketability. This, in turn, strengthens the local economy, supports livelihoods, and may expand employment in agriculture and related sectors such as food processing and trade.
- Operation of the WWTP is also expected to improve public health by reducing pollution. These benefits will particularly benefit vulnerable groups, including women (as primary caregivers), children, pensioners, and low-income households. Improved sanitation is expected to reduce healthcare costs and the time women spend managing family health issues.
- The availability of treated wastewater for irrigation is a beneficial outcome of WWTP construction, although it may also pose certain challenges. The question of equitable distribution of treated waters was raised during scoping consultations. Households already facing financial difficulties (particularly female-headed households, IDPs, and pensioners) may be disproportionately affected if tariffs increase.

*Receptor sensitivity*

Vulnerable groups, including women, children, the elderly, people with disabilities, internally displaced persons (IDPs), and low-income households, have limited adaptive capacity. These groups are disproportionately affected by changes in access to infrastructure, services, and employment opportunities. Therefore, their sensitivity is assessed as **moderate**.

*Impact magnitude*

Impacts are localized but could be long-term. The impact magnitude is assessed as **low**.

*Impact significance*

Considering the sensitivity of vulnerable groups and the impact magnitude, the potential effects on gender inequality and vulnerable communities during operation are considered as ranging from **minor negative to minor positive for various types of impacts**.

*Management and mitigation*

The following mitigation measures could be recommended:

- Adopt gender-sensitive recruitment practices, with targets for women's employment.
- Provide vocational and on-the-job training for women to facilitate their participation in laboratory operations, monitoring, administrative functions, and maintenance.
- Enforce equal pay for equal work across all project-related employment.
- Implement and monitor the Operational Worker Code of Conduct to prevent gender-based violence, harassment, and discrimination. Support this code with awareness-raising and training initiatives.
- Collaborate with local authorities to implement affordability mechanisms for treated wastewater tariffs, including subsidies, and ensure equitable distribution to guarantee vulnerable households have equal access to treated water from the WWTP.

*Residual impact*

With the implementation of mitigation, residual impact on gender equality and vulnerable communities is expected to be **minor positive**.

## 6.17 Impact on Cultural Heritage

### 6.17.1 Construction Phase

*Activities and Aspects*

Earthworks activities will take place during the construction phase which would result in potential impacts on cultural heritage.

*Impact*

No cultural heritage has been identified in the Project area. So, no negative impact is expected.

However, during the excavation work potential loss or damage may occur to chance finds and/or undiscovered underground heritage assets.

*Receptor sensitivity*

Sensitivity of undiscovered remains (chance finds and/or unknown underground heritage assets) may vary from negligible to high depending on their value, condition, rarity and other features.

*Impact magnitude and impact significance*

The potential impacts on the undiscovered archaeological sites/chance finds are limited to the pipeline corridor, WWTP site and assess roads. Given that a potential, and therefore a likelihood, for chance finds is rather low in these areas, the magnitude is seen as **low** as well. As the sensitivity of undiscovered finds is uncertain, the significance of the potential impact on such assets can vary from negligible **to major**.

*Management and mitigation*

- Reduce the size of the construction corridor as much as possible;
- Limit vehicle movements and machinery activities to the cleared area within the construction corridor, and minimise the scale of earth works;
- Prior to construction works, develop a Chance Finds Procedure for the Project and train the Construction Contractor and its relevant workers in applying this Procedure.

*Residual impact*

**No residual impact** is expected provided the mitigation measures are implemented.

### 6.17.2 Operation Phase

No impacts are expected if the maintenance activities take place within the 10 m buffer strips to both sides of the effluent discharge line, within the WWTP sites or the earlier disturbed construction areas.

# 7 CUMULATIVE IMPACT ASSESSMENT

## 7.1 Introduction

This section contains a cumulative impact assessment (CIA), i.e., E&S impact of the Project is considered in combination with potential impacts from other projects or activities that are currently conducted or will be implemented in the near future. The CIA considers those projects/activities for which there is sufficient publicly available information to identify their interaction with the Project in time and / or space and assess the possibility of cumulative impacts.

The CIA methodology is based on a step-by-step process, described in the IFC guidelines *Cumulative Impact Assessment and Management - Guidelines for the Private Sector in Emerging Markets* (2013) [149] and complies with the requirements of Council Directive 85/337/EEC *on the assessment of the effects of certain public and private projects on the environment* (1985, with amendments). In accordance with the IFC guidelines, the CIA is carried out in six steps:

- Step 1 – identification of valued environmental and social components (VECs), and spatial and temporal boundaries of the assessment;
- Step 2 – identification of other projects for inclusion in the assessment, as well as environmental drivers;
- Step 3 – gathering background information on the identified VECs (this information is presented in **Chapter 5** and is not repeated in the current section);
- Step 4 – assessment of the cumulative impact on the identified VECs;
- Step 5 – assessment of the significance of predicted cumulative impacts; and
- Step 6 – cumulative impact management.

The assessment of the potential cumulative impact is qualitative and based on the E&S Consultant's expert judgement using impact significance criteria.

## 7.2 Step 1 – Determining VECs, and Identifying Spatial and Temporal Boundaries of the Assessment

Valued Environmental Components (VECs) are typically equated to E&S recipients that might be affected by the project being assessed. However, it makes sense to single out those VECs, the impact on which, after implementation of mitigation measures, may exceed the threshold of minor significance (per the current ESIA, these are impacts with a residual significance from minor through to moderate and no impacts of major negative residual significance). Based on the results of the ESIA, the VECs were identified for further analysis during the CIA as shown in **Table 68**.

[149] https://www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/sustainability-at-ifc/publications/publications_handbook_cumulativeimpactassessment.

### Table 68. Characteristics of VECs Identified for the Purpose of the CIA

| VEC | Impact description | Residual Significance of Impact / Risk |
|---|---|---|
| Air quality | Construction activities would bring about changes in air quality that could in turn result in negative human health and/or human health effects. | Minor negative |
| Water | The main activities likely to affecting the water quality during the WWTP operation are the management of the sludge and treating sewage. | From moderate negative to minor positive |
| Waste generation | Various categories of solid waste are associated with construction and maintenance of construction machinery and vehicles. In addition, the need for (partial) demolition of the existing old on-site structures, will result in a potentially large quantities of demolition waste. | Moderate negative |
| Local / regional economy and labour market | Construction activities could result in new direct workplaces and increased wellbeing of workers; as well as in increased demand for some goods and services needed for the Project. The secondary effects include increased incomes of Project's suppliers and sub-contractors and new job openings at these businesses benefitting from the Project. | Moderate positive (from moderate to major) |
| Employee health and safety | Risks to the health and safety of workers during the construction and operation stages due to pollutant emissions, noise and vibration levels within the sites. | Minor to moderate negative |
| Community Health and safety (construction stage) | A number of impacts/risks might be expected:<br>• Risks of road accidents involving pedestrians and road users of local roads to be used by the Project vehicles.<br>• Discomfort related to noise and emissions from the construction sites and vehicle movements along the roads to the construction corridor;<br>• Discomfort related to vibration and artificial lighting from the construction sites and vehicle movements along the roads to the construction corridor; | From minor to moderate negative |
| Community health, safety and wellbeing (operational stage) | Improving sanitation will improve the quality of life of the local population:<br>• Health risks to the population will be reduced, the number of cases of infectious diseases among children and adults will decrease.<br>• Discomfort associated with the odor will not be an issue any more. | Major positive |

Other typical E&S recipients could include public infrastructure facilities (apart from roads), ecosystem services, including tourism and recreation, etc. However, these recipients are not considered as VECs and are not taken further into the CIA, since the residual significance of the Project impact on them is rated as low or negligible, and the implementation of other projects/activities included in the CIA should not lead to a significant cumulative negative impact.

For the purposes of the current assessment, the **time frame** for the CIA encompasses the Project construction (presumably, from mid-2026 to October 2029) and operations (some 30-40 years).

The spatial (geographical) boundaries of the CIA are accepted as the area where direct and indirect impacts are expected to occur and include the site of the WWTP with its Sanitary-Protection Zone, the corridor along the effluent discharge pipeline and the neighbouring settlements.

## 7.3 Step 2 – Identification of Other Activities (Projects) for the Inclusion in the CIA and Environmental Drivers

Screening of available data and documents[150] regarding the planned activities, as well as the consultations with the relevant municipal authorities have identified the following main state-funded construction projects in Ganja city and Samukh district, planned for the period 2025 – 2028, which may result in cumulation of the environmental or social impacts of the WWTP. This list is compiled based on Azerbaijan's national development priorities, the State Investment Programme, public statements by government officials, consultation with the relevant local authorities, and decrees from the President of Azerbaijan.

**Ganja City**

The projects planned in Ganja focus on modernizing infrastructure and improving social services in line with the national development goals outlined in the document 'Azerbaijan 2030: National Priorities for Socio-Economic Development', approved by the Order of the President of the Republic of Azerbaijan in February 2021.[151] The projects are financed directly from the state budget and through the capital investments of state-owned companies e.g. ASWRA or 'Azerishig'. Exact timelines and budget allocations for specific projects are finalized and detailed in State Investment Programmes approved by the government each year.

**1. Transportation Infrastructure**

*(Primary Executing Body: Ministry of Digital Development and Transport)*

- **Modernization of Ganja International Airport:** Comprehensive upgrade including runway rehabilitation, expansion of apron areas, and terminal enhancements to increase capacity and accommodate larger aircraft.
- **Reconstruction of Intra-City and Peripheral Highways:** Major overhaul of key city arteries, including Heydar Aliyev Avenue and connecting roads to improve traffic flow and safety (aligned with the national highway reconstruction program).
- **Reconstruction of Ganja Railway Station:** Modernization of the passenger terminal and surrounding infrastructure to improve comfort and service quality.

**2. Water Supply and Sanitation Systems**

*(Primary Executing Body: "Azersu" OJSC)*

- **Rehabilitation of Ganja's Water-Supply and Sewage Networks:** A large-scale project to map, replace, and modernize aging pipelines to reduce water loss, ensure continuous supply, and improve sewage treatment.
- **Construction of New Water Lines:** Expansion of the network to new residential areas and the industrial zone to support the city's growth.

**3. Energy and Utilities**

*(Primary Executing Bodies: Ministry of Energy, "Azerishig" OJSC)*

- **Modernization of the Ganja Thermal Power Plant:** Upgrading and replacing outdated boiler and distribution equipment to increase energy efficiency, reduce environmental impact, and ensure reliable heating for the city.

[150] E.g. State Statistical Committee of the Republic of Azerbaijan, 2025: Construction in Azerbaijan

[151] https://president.az/en/articles/view/50474

- **Reinforcement of Electricity Transmission and Distribution Grids:** Construction of new substations and refurbishment of power lines to meet growing demand and prevent outages.

**4. Education and Healthcare**

*(Primary Executing Bodies: Ministry of Education, Ministry of Health, Local Executive Authority)*

- **Construction of New School Buildings:** Building new comprehensive secondary schools in newly developed micro-districts to address demographic growth and eliminate the need for multi-shift education.
- **Capital Repair and Reconstruction of Existing Schools:** Major renovation and, in some cases, complete rebuilding of schools in disrepair to meet modern educational standards.
- **Modernization of Ganja State University's Infrastructure:** Construction of new academic buildings, laboratories, and dormitories to expand capacity.
- **Equipment Upgrades for Ganja Central Hospital:** Supplying new diagnostic and medical equipment to regional healthcare facilities to improve the quality of service.

**5. Socio-Cultural and Sports Facilities**

*(Primary Executing Bodies: Ministry of Youth and Sports, Ministry of Culture)*

- **Renovation of the Ganja Olympic Sports Complex:** Upgrading facilities to international standards to host training and competitions.
- **Renovation of Cultural Centers and Libraries:** Improving public access to cultural resources and modernizing these community spaces.

**6. Environmental Improvement**

*(Primary Executing Bodies: Ministry of Ecology and Natural Resources, Local Executive Authority)*

- **Rehabilitation of the Ganjachay River Basin:** Ecological cleaning and landscaping of the riverbanks to improve the city's environment and create public recreational spaces.
- **Development of New Green Zones and Parks:** Creating new public parks and green areas to enhance the city's ecological health and residents' quality of life.

**Samukh District**

Samukh's state investment priorities focus on modernizing rural infrastructure, improving agricultural productivity, and enhancing social services. The key topics are the irrigation and rural road reconstruction, as these are fundamental to the district's economy. Projects are implemented by the relevant ministries and agencies in coordination with the Samukh District Executive Authority. Timelines, specific village lists, and budget allocations are provided in the annual State Investment Programme. Some smaller-scale projects may be funded from the local district budget.

**1. Agricultural & Water Management Infrastructure**

*(Primary Executing Bodies: Ministry of Agriculture, Amelioration and Water Management Agency)*

- **Modernization of Irrigation and Melioration Systems:** A high-priority project involving the **concretization of irrigation canals**, rehabilitation of water reservoirs, and repair of pumping stations. This aims to reduce water loss and increase agricultural efficiency.

- **Development of Agro-Industrial Infrastructure:** State investment in primary infrastructure (access roads, electricity, water lines) to support the creation of **agro-parks or industrial estates** designed to attract private agribusiness investment.

**2. Transportation Infrastructure**

*(Primary Executing Bodies: State Agency of Automobile Roads, Local Executive Authority)*

- **Reconstruction of Inter-Village and Rural Roads:** Asphalt paving and rehabilitation of roads connecting the district center with surrounding villages and between major villages to facilitate transport of agricultural goods and improve connectivity.
- **Repair of Samukh Railway Station:** Modernization of the station's infrastructure for improved passenger service.

**3. Water Supply and Gasification**

*(Primary Executing Bodies: "Azersu" OJSC, "Azerigaz" Production Union)*

- **Expansion of Centralized Drinking Water Supply:** Construction of new water pipelines and water towers to connect more villages to a reliable source of clean drinking water, reducing dependence on well water.
- **Continuation of the Gasification Program:** Expansion of the natural gas network to additional villages in the district, including the construction of necessary distribution infrastructure.

**4. Education and Healthcare**

*(Primary Executing Bodies: Ministry of Education, Ministry of Health, Local Executive Authority)*

- **Construction, Capital Repair, and Reconstruction of Schools:** Major renovation or complete rebuilding of general education schools in the district center and villages that are in disrepair or emergency condition.
- **Rehabilitation of Kindergartens:** Repair and equipment upgrades of pre-school educational institutions.
- **Equipment Upgrades for the Central District Hospital and Rural Medical Points:** Supply of modern diagnostic and medical equipment to improve the quality of primary healthcare services for the rural population.

**5. Social Infrastructure and Sports**

- (Primary Executing Bodies: Ministry of Youth and Sports, Ministry of Culture, Local Executive Authority)
- **Renovation of Cultural Houses and Libraries:** Modernization of community cultural centers in the district center and larger villages.
- **Development of Public Parks and Green Spaces:** Landscaping and creation of public recreational areas in the district center to improve residents' quality of life.
- **Construction/Renovation of Local Sports Facilities:** Building or upgrading sports fields and gyms to serve the youth population.

**6. Administrative and Social Services**

*(Primary Executing Body: Local Executive Authority, supported by relevant state agencies)*

- **Establishment of an ASAN Service or DOST Center Branch:** Construction or allocation of a facility to house a center providing integrated state and social services to citizens under one roof, significantly improving access to bureaucracy.

In addition, the CIA recognises that the WWTP represents a part of the PIP, aimed at improving water and sanitation for the entire Ganja city, including among others:

- 827 km water supply pipeline including house connections;
- 75,000 $m^3$ water storage on nine locations;
- Completion of two of the reservoirs - landscaping, buildings and chlorination neutralization unit;
- 907 km wastewater collection pipes including house connections;
- Stormwater management in 3,620 ha of the city– approx. 225 km of pipe and channels.

## 7.4 Steps 4 and 5 – Characterization and Assessment of the Main Cumulative Impacts

The analysis of the above activities planned to be implemented within the PIP for potential contribution to the cumulative impact during the construction and operation of the Project facilities has resulted in the following considerations and assessments[152]:

### 7.4.1 Cumulative impacts during construction

Cumulative impacts may occur during the construction phase with the air quality, waste, local / regional economy and labour market, and employee health and safety as potentially affected VECs.

The impacts on the air quality and the employee health and safety would be short-term and localised, with an intensity that would vary significantly depending on the actual activities on the construction sites and related traffic intensity. Considering that the planned activities are localized across the entire city, the **significance of cumulative impacts on air quality and the employee health and safety are minor negative.**

Several construction projects implemented in parallel for several years will result in a significant increase of the waste production, including hazardous waste, with its secondary impacts including risks of contamination of soil, surface and groundwater, air quality and odour, and by extension overall ambient environmental quality and public health. Considering existing insufficient capacities and with current waste management practices largely not meeting contemporary standards, the **cumulative impacts associated with the waste generation can be evaluated from moderate to significant negative**.

Relatively extensive construction activities running in parallel for several years may provide several new direct workplaces and increased wellbeing of workers; as well as in increased demand for some goods and services. Therefore, the **significance of cumulative impacts on local / regional economy and labour market can be evaluated as moderate positive.**

### 7.4.2 Cumulative impacts during operation

The water resources and health of the local population are the VECs, which can be affected during the operation of the WWTP. The enhanced wastewater management and sanitation system in Ganja under the PIP, which the WWTP is a part of, should result in improved water quality and thus reducing related health issues. Thus, **the cumulative impacts on the water quality and health of the population can be evaluated as major positive.**

[152] Within the limits of existing and available data, the assessment of the significance of the predicted cumulative impacts is qualitative in nature.

## 7.5 Step 6 – Cumulative Impacts Management

All projects identified should be designed and constructed in compliance with national regulation, their specific lender requirements and Good International Practice, thus reducing the potential for cumulative negative impacts in construction phase regarding the air quality and employee health and safety.

However, the key for effective mitigation of the cumulative negative impacts related to the waste generation during construction would be the ensure sufficient capacities and waste management practices following the international good standards. Therefore, it can be recommended to include this issue to the next update of the annual State Investment Programme.

# 8 STAKEHOLDER ENGAGEMENT

Stakeholder Engagement must be maintained throughout the Project lifecycle. Furthermore, within the ESIA, Stakeholder Engagement is an effective tool for collecting and analyzing information, assessing impact significance, identifying trade-offs, and making recommendations to improve the Project's environmental and social sustainability.

The public consultation and associated issues raised by stakeholders are briefly summarised in this section. More detailed information is provided in the SEP.

## 8.1 Stakeholder Identification

Stakeholders were identified and analysed in preparing the SEP. Stakeholders have been grouped as follows:

- **Internal stakeholders** representing organisations that implement the Project and associated management, staff, owners, shareholders, contractors and subcontractors involved in current operations and benefiting from it (investors and shareholders); and
- **External stakeholders** representing groups or individuals not part of the Company and the Project but affected by their decisions and actions.

For effective and meaningful engagement, external stakeholders have been grouped as:

- Potentially affected parties:
  - Potentially affected communities;
  - Potentially vulnerable groups;
  - Potentially affected commercial and public organizations.
- Interested parties:
  - State authorities;
  - Regional/city/district authorities;
  - Communities;
  - Non-commercial organizations (non-governmental organizations (NGOs), mass media, academia and others);
  - Commercial organizations;
  - International financial institutions;
  - International initiatives and projects.

The possible impacts on and interests of the above groups are described in the Project's SEP.

The SEP has been developed to ensure effective engagement with all stakeholders, foster constructive relationships between ASWRA and local communities, and minimize the risk of conflicts. The SEP outlines actions, assigns responsibilities, and sets timelines tailored to each stage of the Project. This plan is flexible and can be further updated or expanded based on feedback from future consultation.

## 8.2 Summary of Previous Project Stakeholder Engagement Activities

The ASWRA generally uses several channels of communication and operates an external grievance mechanism for the water supply and wastewater services in Ganja.

The WWTP project has been discussed with stakeholders since its inclusion in strategic planning documents (Green City Action Plan [153], Ganja Master Plan [154] and Strategic Environmental Assessment for the Master Plan).

Initial scoping consultations were held in July 2024 with representatives from ASWRA, Ganja Sukanal, local municipalities, and residents[155]. During the stakeholder meeting in Ganja, the background of the WWTP Project was presented. Stakeholders expressed support for the project, highlighting expectations that it would meet international standards and minimize impacts on local communities.

## 8.3 Stakeholder engagement activities within the ESIA process

Stakeholders were engaged during the ESIA Scoping Stage in May the 30-th to August the 2-nd 2025 (see the photos below). A total of seven consultation meetings were held: 1) two in Ganja and 2) five in Samukh District (in the villages of Ziyadly, Istikhana, Golvarsary, Garaeyri and Sarkar).

Participants included municipality and local authority representatives, farmers, pensioners, teachers, businesspeople, academics, NGOs and individual citizens. Some 151 people participated in the scoping engagements, 78 men and 73 women a nearly balanced gender representation (52% men, 48% women) (**Table 69**).

**Table 69. Scoping meeting participants by gender**

| Meeting | Attendees | |
|---|---|---|
| | Men | Women |
| Azerbaijan Technical University | 8 | 20 |
| NGO representatives | 6 | 6 |
| Ziyadli village | 34 | 12 |
| Istikhana village | 6 | 9 |
| Sarkar village | 8 | 12 |
| Govlarsari village | 9 | 5 |
| Garayeri village | 7 | 9 |
| TOTAL | **78** | **73** |

Overall, local communities expressed support for the Project, viewing it as a solution to longstanding issues such as unpleasant odour, a shortage of water for irrigation, and unemployment. The consultations addressed a broad range of topics that can be grouped into two main categories: project-specific issues and social and environmental community concerns. Project specific topics included issues of site selection, design standards, treatment capacity, odour control, sludge management, stormwater handling, and sanitary protection zones. Stakeholders also requested information on financing and project timelines due to previous delays.

Concerns related to social and environmental issues centred on job creation, impacts on daily life and the local economy, role of the community in decision-making, irrigation water shortages and contamination risks, the safety of treated water, potential negative impacts on agriculture,

[153] AtkinsRéalis. 2024. EBRD Green Cities - Ganja Green City Action Plan. https://ebrdgreencities.com/assets/Uploads/PDF/Ganja-Green-City-Action-Plan-EN.pdf

[154] UNECE. 2023. Public Hearing on the Pilot Strategic Environmental Assessment for the draft Master Plan of the city of Ganja. https://unece.org/info/events/event/382914

[155] SWECO. ESIA Scoping Report, July 2024.

environment, and biodiversity, protection of local infrastructure from construction impacts, noise and odour reduction, and resolving health risks linked to the existing sewage canal. An important question was raised about illegal distribution of untreated water. It was subsequently reported that the unauthorized sale of untreated water had been stopped. But in March 2026, the issue was flagged again. With the onset of summer, the illegal sale of untreated wastewater may well resume


Meeting with representatives of academia in Ganja


Meeting with residents of Ziyadli village

**Figure 41. Scoping consultation meetings in May-August 2025**

ESIA consultation started in December 2025. The ESIA package, including the ESIA report, the ESMP, the ESAP, the RF, and an updated SEP reflecting the outcomes of the Scoping consultations, was disclosed on 15 December 2025 in both English and Azerbaijani. The public was informed of the 120-day disclosure period through announcements on ASWRA and EBRD websites. Printed copies of the NTS and SEP were made available at several public locations in Ganja and Samukh. No written comments were received by ASWRA during the disclosure period. All verbal questions raised at the meetings were answered by the consultant and captured for the record.

Two formal public hearings were held: one in Samukh (March 4, 2026) and one in Ganja (March 5, 2026). Additionally, two informal meetings took place in local teahouses in Ziyadli village (March 4) and Garayeri village (March 5) to encourage open conversation in a less formal setting. These informal meetings were attended only by men due to local cultural norms restricting women's presence in teahouses.

Meeting participants included municipality and local authority representatives, farmers, and individual citizens. A total of 138 people participated of which 122 were men and 16 were women. In Ganja city, 18 men and 8 women attended the meeting, and in Samukh town, 49 men and 8 women. In Ziyadli village, the informal meeting was visited by 28 men, and in Garayeri village by 27 men. Overall, men made up 88% of all participants, while women accounted for only 12%.

The public hearings highlighted the need for the Project and overall support from local residents. However, a number of concerns were raised about the planned WWTP related to design, environmental and land-related issues, job creation and stakeholder engagement. People asked whether the plant would be large enough for future population growth, if it would handle stormwater, and the project timeline. Concerns also focused on odour from the plant and proximity to agricultural land. Farmers are concerned that this could affect their ability to obtain European bio-certification, which may require a 100–150 meter buffer zone.

Many supported using treated wastewater for irrigation to help local agriculture and address water shortages. The issues of land ownership and the sanitary protection zone were raised. The residents inquired whether homes within that zone would need resettlement. The residents were also interested if jobs will be offered to residents first during construction and operations. In Samukh, residents presented video evidence of untreated wastewater discharging continuously from the new collector pipelines into diversion ditches. The increased wastewater flow had previously flooded homes and a cemetery. The ESIA team promised to investigate and include the findings in the ESIA.

Public hearing in Ganja

Public hearing in Samukh

Informal meeting in teahouses in Samukh and Garayeri

**Figure 42. ESIA consultation meetings in March 2026**

## 8.4 Further Stakeholder Engagement Steps

Consultation and engagement activities will continue throughout the entire Project lifecycle.

The Stakeholder Engagement Programme encompasses all the project stages and lists specific activities for all the project lifecycle including, inter alia, OVOS disclosure for 30 days and OVOS stakeholder consultations planned for the pre-construction stage, as per national legislation requirements.

There are still unanswered stakeholder questions because certain project specifics are not yet available. It is strongly recommended that as the project moves into detailed design, and in compliance with local environmental regulatory approvals and EBRD disclosure requirements,

that an addendum be compiled to provide the answers to these questions. The addendum should then be disclosed for stakeholder information.

## 8.5 Grievance Mechanism

In accordance with the EBRD requirements, a grievance mechanism should be established to review and resolve concerns and/or questions raised by stakeholders in a timely, transparent, fair and cost-effective manner.

In May 2025 ASWRA developed a Project Grievance Mechanism for external stakeholders[156], using existing communication and engagement channels and enhancing them with actions to fulfil EBRD standards. Stakeholders were informed about the Project Grievance Mechanism during the scoping consultations in May - August 2025.

By the end of April 2026, no comments had been submitted to the grievance mechanism. The existence of the grievance mechanism was strongly emphasised by the Consultant during the public hearings.

**Contact Details for Raising Project-related Inquiries or Complaints:**

ASWRA, Moskva avenue 67, AZ 1012 Baku, Azerbaijan

Tel: (+99412) 431-47-67/87, WhatsApp (+994 55) 209 95 59

Call centre: 955, Fax: (+99412)430-28-87

E-mail: info@adsea.gov.az

Website: https://adsea.gov.az/

ASWRA Ganja

Ganja, Üzeyir Hacıbəyov str. 76, AZ2001

Tel: (+99422) 255-77-29, (+99422) 265-00-09

[156] A separate mechanism is developed to address worker grievances.

## Annex 1. LIST OF PLANT SPECIES OBSERVED IN THE PROJECT AREA

| № | Latin species name (per life forms) | Abundance (with scoring)* | IUCN Red Data List | Red Book of Azerbaijan | Relict of endemic species |
|---|---|---|---|---|---|
| | **Trees** | | | | |
| 1 | *Pinus eldarica* | 1 | | NT | Endemic |
| 2 | *Platanus orientalis L.* | 1 | DD | VU | Endemic |
| 3 | *Morus nigra* | 1 | | | |
| 4 | *Juglans regia* | 1 | | | Relict |
| | **Shrubs** | | | | |
| 5 | *Caragana grandiflora (Bieb) DC.* | 1-2 | | | |
| 6 | *Tamarix ramosissima* Lebed. | 1 | | | |
| 7 | *Acasia dealbata* | 1 | | | |
| 8 | *Ficus carica* L. | 1 | | | |
| 9 | *Rubus idaeus* L. | 1 | | | |
| 10 | *Punica granatum* | 1-2 | LC | VU | Relict |
| 11 | *Astracantha microcephala (Wield) Podlech.* | 1-2 | | | |
| 12 | *Atraphaxis spinosa L.* | 1 | | | |
| | **Subshrubs** | | | | |
| 13 | *Salsola dendroides Pall.* | 1-2 | | | |
| 14 | *Kochia prostrata* Roht | 3-4 | | | |
| | **Perennial herbs** | | | | |
| 15 | *Stipa caspia C.Koch.* | 3-4 | | | |
| 16 | *Festuca rupicola Heuff* | 2-3 | | | |
| 17 | *Artemisia lerchiana web.* | 2 | | | |
| 18 | *Eriophorum latifolium Hoppe* | 2 | LC | EN | |
| 19 | *Agropyron cristatum (L) Gaetrn* | 1-2 | | | |
| 20 | *Zygophyllum fabago L.* | 1-2 | | | |
| 21 | *Sternbergia vernalis (Miller) Gorer & J.H.Harvey* | 1-2 | | EN | |
| 22 | *Peganum harmala L.* | 1-2 | | | |
| 23 | *Poa bulbosa L.* | 1-2 | | | |
| 24 | *Echium rusicum J.F.Gmel* | 1-2 | | | |
| 25 | *Rumex euxinus Klock* | 1 | | | |
| 26 | *Cirsium vulgare* T. | 1-2 | | | |
| 27 | *Ranunculus sceleratus L.* | 1-2 | LC | NT | |
| | **Annual herbs** | | | | |
| 25 | *Aegilops cylindrica Host.* | 1-2 | | | |
| 26 | *Lolium rigidum Gaudin.* | 1-2 | | | |
| 27 | *Bromus japonicus Thunb.* | 1-2 | | | |
| 28 | *Neotorularia contortuplicata (Steph) Hedge et.J.Leonara* | 1-2 | | | |
| 29 | *Lepidium ruderale. L.* | 1-2 | | | |
| 30 | *Medicago minima (L.) Bartalini* | 1-2 | | | |
| 31 | *Erodium cicutarium (L) L' Her* | 1 | | | |
| 32 | *Allium rubellum Bieb.* | 1 | | | |
| 33 | *Plantago loeflingii* | 1 | | | |
| 34 | *Tragopogon graminifolius DC.* | 1 | | | |

| № | Latin species name (per life forms) | Abundance (with scoring)* | IUCN Red Data List | Red Book of Azerbaijan | Relict of endemic species |
|---|---|---|---|---|---|
| 35 | *Crambe orientalis* L. | 1 | | | |
| 36 | *Xanthium spinosum L.* | 1 | | | |
| 37 | *Matricaria chamomilla* | 1 | | | |

**Keys to the above table:**

**Abundance** is determined according the Drude scale.

Drude's 6-point scale is expressed as follows:

1. plant occurs singly 1 plant per $1m^2$
2. plant occurs rarely up to 25 per $1m^2$
3. somewhat abundant up to 125 per $1m^2$
4. very abundant more than 125 per $1m^2$
5. very abundant up to 625 per $1m^2$
6. abundant more than 625 per $1m^2$

**Conservation status**

in IUCN Red List column:

- LC - Least Concern
- DD – Data Deficient
- In the Red Book of Azerbaijan column:
- EN - endangered
- VU - vulnerable
- NT – near threatened

## Annex 2. SPECIES OF THE VERTEBRATE TERRESTRIAL ANIMALS FOUND IN THE STUDY AREA DURING THE FIELD SURVEY OR POTENTIALLY INHABITANTS

| № | Species name (in Latin) | Species name (in English) | Family | Status in the IUCN Red Data List and Red Book of Azerbaijan (RBA) | Description of the species biotope | Source of the species occurrence data |
|---|---|---|---|---|---|---|
| **1. Amphibians (Amphibia)** | | | | | | |
| 1 | *Bufotes* variabilis* | Variable Toad | Bufo | LC (common species) | Open area with grass and sparse shrub cover | During the field work the temperature was very high, in such conditions the toads hide. Residents say that they are often found in their gardens, everywhere. |
| 2 | *Pelophylax* ridibundus* | Marsh Frog | Rana | LC widespread species | Puddles and irrigation canals | During the field work the temperature was very high, in such conditions the toads hide. Residents say that they are often found in their gardens, everywhere. |
| 3 | *Hyla orientalis* | Oriental tree frog | Hylidae | LC (common species) | Found in shrubs and trees | Literature |
| **2. Reptiles (Reptilia)** | | | | | | |
| 1 | ***Testudo graeca*** | Greek tortoise | Testudinidae | VU, RBA VU | Grasslands and hills, surroundings of cultivated fields, gardens and vegetable patches in adjacent areas. | One individual recorded in the study area (within fragments of dry steppe plains closed to cultivated fields) |
| 2 | ***Pseudopus (Ophisaurus) apodus*** | European glass lizard | Anguidae | LC common species | Grasslands and small hills, surroundings of cultivated fields, and gardens and vegetable patches in adjacent areas. | Two specimens observed near the ruins of the station. |
| 3 | ***Lacerta strigata*** | Caucasus Emerald Lizard | Lacertidae | LC common species | Shrubby plains and small hills, shrubbery around cultivated fields, shrubbery in adjacent areas, and gardens. | Two specimens observed near the ruins of the station. |
| 4 | ***Natrix natrix*** | Grass snake | Colubridae | LC common species | Irrigation canals around cultivated fields and in adjacent areas | 3 specimens were encountered in an irrigation canal near the boundary of the site. It was difficult to determine the species, they quickly disappeared into the algae. Previous studies showed their distribution in all irrigation canals. |
| 5 | ***Natrix tessellata*** | Dice snake | Colubridae | LC common species | Irrigation canals around cultivated fields and in adjacent areas | 3 specimens were encountered in an irrigation canal near the boundary of the site. It was difficult to determine the species, they quickly disappeared into the algae. Previous studies of this area showed their distribution in all irrigation canals. |

| № | Species name (in Latin) | Species name (in English) | Family | Status in the IUCN Red Data List and Red Book of Azerbaijan (RBA) | Description of the species biotope | Source of the species occurrence data |
|---|---|---|---|---|---|---|
| 6 | ***Dolichophis schmidti*** | Red-bellied Racer | Colubridae | LC common species | Grasslands and small hills, surroundings of cultivated fields, and gardens and vegetable patches in adjacent areas. | The snake was found on a hill on the edge of the property, hiding in the rocks. |
| 7 | *Eirenis collaris* | Collared Dwarf Racer | Colubridae | LC common species | Grasslands and shrubbery around cultivated fields and in adjacent areas | Literature |
| 8 | *Macrovipera lebetina* | Levantine viper | Viperidae | LC common species | Plains and small hills, surroundings of cultivated fields, shrubbery, gardens, and vegetable patches in adjacent areas | Literature |
| **3. Birds (Aves)** | | | | | | |
| 1 | ***Turdus merula*** | Eurasian blackbird | Turdidae | LC common species | Gardens, vegetable patches, and shrub areas | 6 individuals were observed in different places |
| 2 | *Erithacus rubecula* | European robin | Turdidae | LC common species | Gardens, vegetable patches, and shrub areas | Literature |
| 3 | *Luscinia megarhynchos* | the Common Nightingale | Turdidae | LC common species | Gardens, vegetable patches, and shrub areas | Literature |
| 4 | *Periparus ater* | Coal Tit | Paridae | LC common species | Gardens and areas with sparse shrub vegetation | Literature |
| 5 | *Cyanistes caeruleus* | Eurasian blue tit | Paridae | LC common species | Gardens and areas with sparse shrub vegetation | Literature |
| 6 | *Parus major* | Great tit | Paridae | LC common species | Gardens and areas with shrub vegetation | Literature |
| 7 | *Sturnus vulgaris* | European Starling | Sturnidae | LC widespread species | Gardens and open areas with berry-bearing shrubs | Literature |
| 8 | *Motacilla alba* | White Wagtail | Motacillidae | LC common species | Vegetable patches and pastures grazed by livestock | Literature |
| 9 | *Pica pica* | Eurasian magpie | Corvidae | LC common species | Gardens and roadside areas with sparse trees and shrubs | Literature |
| 10. | ***Corvus corone*** | Carrion crow | Corvidae | LC widespread species | Tree-covered areas in residential settlements and along roadsides | observed 4 individuals in different places |
| 11 | *Sylvia borin* | Garden Warbler | Sylvidae | LC common species | Gardens and dense shrublands | Literature |
| 12 | *Sylvia communis* | Common Whitethroat | Sylvidae | LC common species | Gardens and dense shrublands | Literature |
| 13 | *Phylloscopus sibilatrix* | Wood Warbler | Phylloscopidae | LC common species | Gardens with young and green trees | Literature |

| № | Species name (in Latin) | Species name (in English) | Family | Status in the IUCN Red Data List and Red Book of Azerbaijan (RBA) | Description of the species biotope | Source of the species occurrence data |
|---|---|---|---|---|---|---|
| 14 | ***Passer domesticus*** | House Sparrow | Passeridae | LC<br>widespread species | Grasslands, shrublands, gardens, and cultivated fields | Flock of 10-15 birds observed near houses |
| 15 | *Passer hispaniolensis* | Spanish Sparrow | Passeridae | LC<br>widespread species | Grasslands, shrublands, gardens, and cultivated fields | Literature |
| 16 | *Francolinus francolinus** | Black Francolin | Phasianidae | LC<br>RBA-NT | Shrublands and cultivated fields | The species has not been recorded in the study area. Local inhabitants described individuals occurring along the roads and hearing them in the Spring |
| 17 | *Perdix perdix** | Gray Partridge | Phasianidae | LC<br>RBA-VU | Shrublands and cultivated fields | The species has not been recorded in the study area. Local inhabitants described individuals occurring along the roads and hearing them in the Spring |
| 4. **Mammals (Mammalia)** | | | | | | |
| 1 | *Erinaceus concolor* | Southern white-breasted hedgehog | Erinaceidae | LC<br>common species | Shrublands of the plains, sparse woodlands, gardens, and vegetable patches | Previous research |
| 2 | *Lepus europaeus* | European hare | Leporidae | LC<br>common species | Plains, shrublands, sparse woodlands, gardens, and vegetable patches | Literature |
| 3 | *Apodemus agrarius* | Striped field mouse | Muridae | LC<br>common species | Plains, cultivated fields and their surroundings, adjacent areas, hills, shrublands, gardens, and vegetable patches | Previous research |
| 4 | *Meriones erythrourus* | Red-tailed jird | Cricetidae | LC<br>common species | Cultivated fields and their surroundings, adjacent areas, hills, shrublands, gardens, and vegetable patches | Literature |
| 5 | *Microtus arvalis* | Common vole | Cricetidae | LC<br>common species | Cultivated fields and their surroundings, adjacent areas, hills, shrublands, gardens, and vegetable patches | Previous research |
| 6 | *Canis aureus* | Golden Jackal | Canidae | LC<br>common species | Dense shrublands, hills, and woodlands in open plains | Literature |
| 7 | *Vulpes vulpes* | Red fox | Canidae | LC<br>common species | Dense shrublands, hills, woodlands, and gardens in open plains | Previous research |
| 8 | *Meles meles* | European badger | Mustelidae | LC<br>common species | Dense shrublands, hills, woodlands, and gardens in open plains | Previous research |

**Keys to the above table**

**Latin names highlighted in bold – observed during the field study**

Latin names with asterisks – observed by local residents

**Conservation status**

in IUCN Red List and RDA: LC - Least Concern; VU – vulnerable; NT – near threatened.

# Annex 3. DESCRIPTION OF SETTLEMENTS LOCATED NEARBY PROPOSED WWT

## Ziyadli village

### *General information*

Ziyadli is a village in the administrative-territorial unit of Samukh district of the Republic of Azerbaijan. The total area of the village is 1,100 ha. The distance to the district center (Samukh) is 7.5 km, the distance to Ganja is 7 km.

### *Demography*

The total amount of the population is 2,850 people, including 52% men (1,510 persons) and 48% women (1,340 persons). The age group 25-44 years dominates (**Figure 43**). The proportion of children in the population structure is quite large (22.1%), while the elderly represent only 6.9%. This indicates that the village has a relatively young and dynamic population, with potential for further growth in the working-age group.

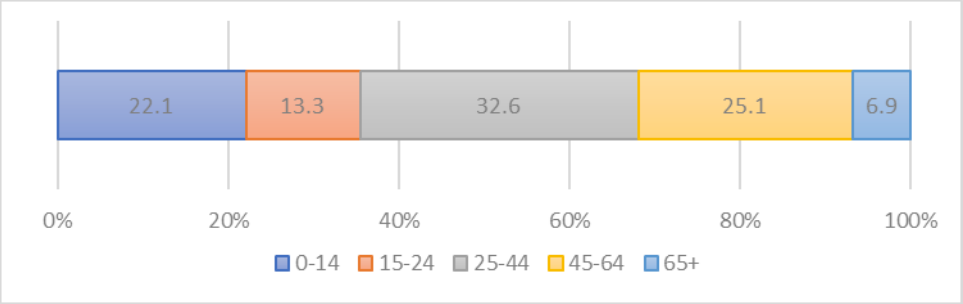



**Figure 43. Age population of Ziyadli village**

Most people are Muslim. There is a working mosque.

### *Economy and employment*

The main source of employment for residents is agriculture and livestock farming. There are no industrial enterprises in the village. Some residents are employed in Ganja (teachers, nurses, etc.), while men and a large share of youth seek daily temporary low-skilled work in the city (e.g., loaders, construction laborers). This type of temporary employment constitutes up to 50% of household income. Around 10% of the male workforce are labor migrants working in Russia or Ukraine, sending regular remittances to support their families. Some men are also engaged in seasonal private harvesting activities in Samukh or Ganja.

Both men and women have similar opportunities in low-skilled, temporary agricultural work: «*Men, like women, work as hired laborers and receive daily wages*"[157]. Women with formal education diplomas cannot find jobs match their qualifications: "*Women with education cannot find work in their specialty, they work in the fields.*"[158] This suggests underutilization of women's human capital.

Women are more often engaged in socially accepted "feminine" occupations such as teaching, tutoring, and small-scale services: "*Today, the most popular profession is tutoring, ...*

[157] Minutes from the focus group with working-age women in Ziyadli village (31.07.2025)

[158] Minutes from the focus group with working-age women in Ziyadli village (31.07.2025)

*hairdresser, women's hair stylist, makeup artist, tailor, cook, pastry chef."*[159] These jobs are often home-based or involve microbusinesses (salons, tailoring, cooking), which may offer flexibility but provide limited stability.

The village of Ziyadli is characterized by a relatively high employment rate, with 83% of the labor force employed (**Table 70**). Among the employed population, only 21 people work under formal contracts, suggesting that the majority of employment may be informal or unregistered. The number of unemployed people is 298, representing approximately 15% of the labor force. This figure is five times higher than in Samukh District, where the unemployment rate was 3.8% in 2023 (**Table 47**). The creation of just 14 new jobs in 2024 is insufficient to address the challenge of high unemployment. Regarding economic entities, there are a total of 25 registered businesses: 5 legal entities (companies or firms) and 20 individual entrepreneurs. This composition indicates that small-scale and individual entrepreneurship plays a significant role in the local economy.

**Table 70. Labor market in Ziyadli village, 2024**[160]

| Indicators | Numbers |
|---|---|
| Number of labor force, people | 1,980 |
| Number of employed population, people | 1,647 |
| Number of contract workers, people | 21 |
| Number of newly created jobs | 14 |
| Number of unemployed population, people | 298 |
| Number of economic entities: | |
| legal entities | 5 |
| individuals | 20 |

Nearly 70% of Ziyadli residents have completed secondary school (**Figure 44**), indicating a generally literate and trainable labor force. Only 6% hold university degrees, while around 15% have mid-level technical or vocational education from colleges or professional schools. In total, 470 people (21%) have higher, college, or vocational education. However, the local labor market offers very few skilled jobs, which results in underemployment. Limited non-agricultural opportunities force many educated residents into informal or temporary work, or to seek employment through migration.

[159] Minutes from the focus group with working-age women in Ziyadli village (31.07.2025)

[160] Statistics of Ziyadli municipality

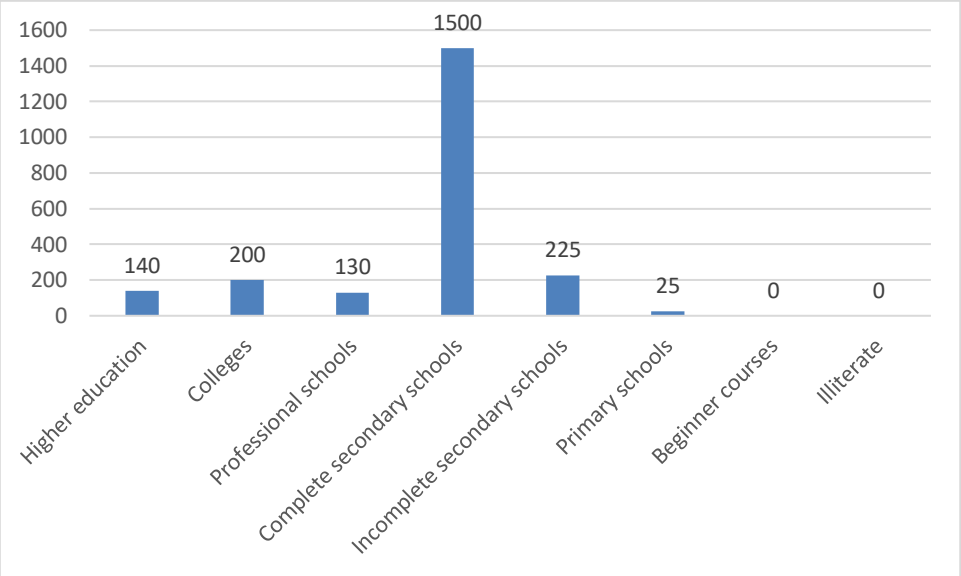



**Figure 44. Education structure of the population, Ziyadli village, 2019 Census data**

Residents of Ziyadli have access to land plots for crop cultivation. Following land reform, households received land allocations averaging 3,500 m² per person[161]. These plots are either cultivated directly by families themselves or leased to others.

The village consists of 567 households, of which approximately 82% are engaged in livestock farming. Households typically raise cattle, sheep, cows, goats and poultry). Approximately 80% keep 2–4 cows, 85–90% own sheep and goats, and nearly all (98%) keep poultry (**Table 71**), (**Figure 45**).

**Table 71. Livestock production by households, Ziyadli village (2024) [162]**

| Indicators | Numbers |
|---|---|
| ***Livestock production*** | |
| Meat, net weight, kq | 5,700 |
| Milk, l/day | 3,875 |
| Eggs pcs/day | 18,600 |
| Wool, t/year | 6 |

[161] Interview with the Head of the Ziyadli municipality

[162] Statistics of Ziyadli municipality

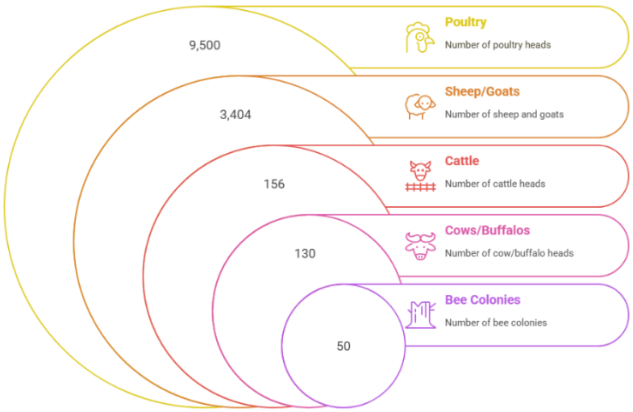



**Figure 45. Number of livestock in households, Ziyadli village[163]**

Households consume part of their production and sell 35-45% in regional and national markets. Products such as milk, cheese, yogurt, lamb, beef, and poultry are transported primarily to Ganja markets near the airport, railway station, and 5–6 city urban markets. To reduce costs and improve efficiency, residents often cooperate by pooling products into shared containers for collective sale at the wholesale market[164].

Unemployment is disproportionately high among women (60% of the unemployed are women), compared to men (40%). Youth unemployment stands at 10-15% in the 20-25 age group and about 6% in the 25-30 age group. Over the past five years, the unemployment rate has been higher among women. Women face time constraints due to household responsibilities. This indicates that unpaid domestic labor significantly reduces the time available for income-generating activities: “It's hard, we do homework until one in the morning to get everything done.” There is low awareness among women of government programs to support employment: “If they were, it would be good, but we don't know about them.”[165] Nevertheless, women have expressed interest in community-based initiatives (e.g., knitting courses leading to a small production unit). This indicates potential for collective empowerment and local enterprise development if support is provided.

***Income and expenditures***

Households’ income in Ziyadli is derived primarily from salaries and farming. In 2024, the nominal wage of agricultural workers in Ziyadli municipality amounted to 550-700 AZN per month[166]. A typical government job provides only about 300 AZN per month, while daily wage workers – mostly employed in greenhouses and fields – earn around 15 AZN per day., which translates to 350-400 AZN per month: “…. At state work they receive 300 manat. Hired workers earn 15 manat per day, 350-400 manat per month”[167]. Women contribute to household income, often through agricultural labor or by selling products from household farming such as eggs,

[163] Statistics of Ziyadli municipality
[164] Interview with the Head of the Ziyadli municipality
[165] Minutes from the focus group with working age women in Ziyadli village (31.07.2025)
[166] Statistics of Ziyadli municipality
[167] Minutes from the focus group with working age women in Ziyadli village (31.07.2025)

milk, dairy, and meat: “Subsistence farming… We sell and live off this income"[168]. However, this income is unstable and highly seasonal.

According to the information from households, food accounts for at least half of the family budget (“…. not less than half of the budget, that is 300 manat”[169]), while utility costs range from 70 to 120 AZN depending on the season.

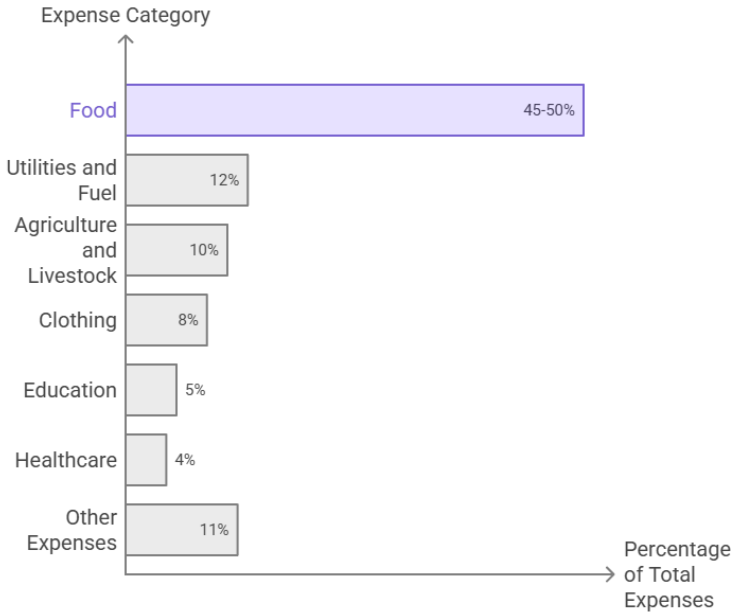



**Figure 46. Average household expenditure distribution in Ziyadli village**

The average household expenditure distribution highlights the dominance of basic needs in household budgets, leaving little flexibility for long-term investments or unexpected costs (**Figure 46**).

Credit plays a significant role in local financial strategies. Almost all families use bank loans, primarily for agriculture, livestock, or housing improvements (“Almost the entire village uses credit bank cards” [170] ). While loans provide access to essential investments, they also represent a monthly financial burden: “……Yes, the loan is a monthly burden, but we can afford it. The people in the village cope with paying interest, and despite the difficulties, we have not heard of any problems with loan repayment”[171].

### *Social assistance*

In Ziyadli village, vulnerable groups include low-income families, pensioners (9.7%), recipients of social assistance (7.8%), large and single-parent families (12–17%), persons with disabilities (≈2%), and a small share of refugees/IDPs (0.1–0.2%)[172].

Around 15–25% of households seek support from the municipality—most often for food, winter fuel, social assistance documents, housing and land issues, or medical certificates.

[168] Minutes from the focus group with working age women in Ziyadli village (31.07.2025)
[169] Minutes from the focus group with working age women in Ziyadli village (31.07.2025)
[170] Minutes from the focus group with working age women in Ziyadli village (31.07.2025)
[171] Minutes from the focus group with working age women in Ziyadli village (31.07.2025)
[172] Statistics of Ziyadli municipality

***Public utilities and infrastructure***

**Natural gas and electricity supply**

All houses are electrified and use natural gaz.

**Water consumption and wastewater disposal**

Access to safe water in Ziyadli village remains limited and uneven. The main water sources are:

- Artesian/subartesian wells – 50–60% of households
- Centralized water supply system – 20–30% of the village
- Springs and open sources – 10–15%
- Rainwater and collected water – 5–10% (used as backup supply)

Drinking water is primarily obtained from artesian wells, supplied on a schedule of 2 hours in the morning and 2–3 hours in the evening. Irrigation depends on both the Shamkir channel and artesian wells. Ziyadli currently operates 18 artesian wells, 10 designated for drinking and 8 for irrigation. However, some of these wells produce slightly saline water, which can only be used for irrigation[173]. As residents reported, they “have no choice and use this salty water for irrigation,” despite the risks of soil salinization and reduced crop yields.

On average, residents consume 70–90 liters of water per day. From a quality perspective, most households depend on artesian water but still prefer to purchase spring water for drinking. Others have installed domestic filters to make artesian water potable (“Some, including us, installed filters at home and do not buy spring water”[174]).


**Figure 47. Water distribution infrastructure in Ziyadli village**

[173] Interview with the Head of the Ziyadli municipality

[174] Minutes from the focus group with working age women in Ziyadli village (31.07.2025)

The Ziyadli village has no sewage system. Instead, households use pit latrines and septic pits, which are periodically filled, covered with soil, and replaced by new pits. Lack of treatment facilities raises concerns over water safety and public health.

Local residents themselves recognize the importance of WWTP. They stress that the construction of a sewage treatment facility would have a direct positive impact on both health and local agriculture:

- "These wastewater discharges [from Ganja] pollute our land and the river. Of course, treatment will improve the ecology and preserve our health."175
- Villagers also report stigma in local markets: "When we sell products in Ganja, buyers ask where we are from. Hearing 'Samukh,' some refuse, saying that produce here is irrigated with wastewater and considered contaminated."

**Roads and transport accessibility**

The village of Ziyadly has a very good connection to Ganja. Minibuses run from Ziyadly every 20 minutes.

**Social Infrastructure**

Ziyadli village has house of culture, new school for 540 pupils and kindergarden for 60 children, medical-akusher point (**Figure 48**). There are also shops, including chain supermarkets, post offices, internet access (both mobile and cable), and mobile and landline telephone services (mobile communication is predominantly used).

| | |
|---|---|
|  |  |
| House of culture | Medical-akusher point |

[175] Minutes from the meeting with farmers and residents living near the Project area in Ziyadli village (31.07.2025)

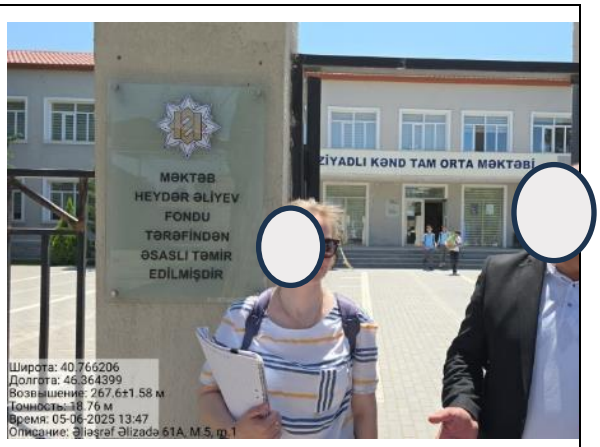
| | |
|---|---|
|  |  |
| Kindergarden | School |

**Figure 48. Social infrastructure of Ziyadli village**

### Istikhana village

#### *General information*

The village of Istikhana is a village in the administrative-territorial unit of the Samukh region of the Republic of Azerbaijan. The total square area – 9 ha.

The settlement was established in the 1970s with the construction of a greenhouse farm specializing in lemon cultivation. To accommodate the plant's workforce, four multi-story apartment buildings were constructed. After Azerbaijan's independence, the plant faced financial difficulties and largely ceased operations. Between 1995 and 1998, it was privatized and changed owners multiple times. In recent years, however, the enterprise has expanded to cover more than 46 hectares of greenhouses, where both citrus fruits and vegetables are now cultivated.

Unlike residents of other villages in the Ziyadli municipality, citizens of this settlement did not receive land plots during the 1992 land distribution, due to its status as a township. As a result, many residents have been informally using surrounding areas for housing and small plots. Many homes lack garden plots, and some are located on Goygol district land, with their legal status still unresolved. This has led to a widespread lack of cadastral registration for land, creating legal and administrative challenges for households today.

#### *Demography*

The population of Istikhana village is 900 people (on 01.01.2024), including 52% (480 persons) are men, 48% (420 persons) are women. In the age structure the group of 45-64 dominates (**Figure 49**). The age structure reflects an ageing but still active working population, with a low proportion of youth. There are 168 households in the village Istikhana. Most of the population are Muslim.

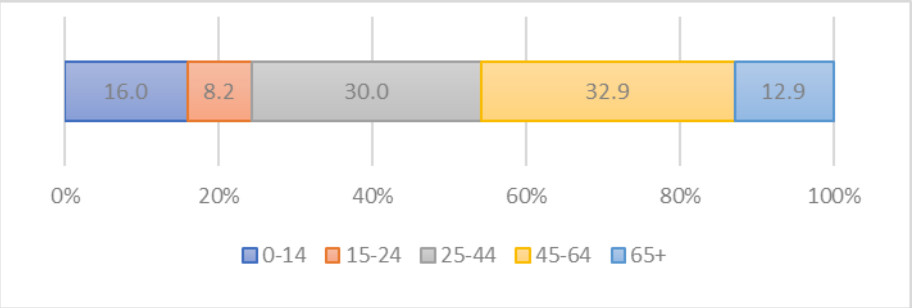



**Figure 49. Age population of Istikhana village**

***Economy and employment***

Employment opportunities in Istikhana village are limited. Permanent jobs are scarce, with only 10-12 residents employed at the greenhouse complex, mostly in positions as laborers or security staff. Other villagers are occasionally engaged as seasonal workers, earning hourly or daily wages without long-term stability. 12.9% of the population are pensioners, receiving pensions as their main source of income.

The total labor force in the village is 689 people, of whom 477 are currently employed. This means that approximately 69% of the labor force is employed, while 200 people, or about 29%, are unemployed, indicating a relatively high unemployment rate (**Table 72**).

**Table 72. Labor market in Istikhana village, 2024** [176]

| Indicators | 2024 |
|---|---|
| Number of labor force, people | 689 |
| Number of employed population, people | 477 |
| Number of contract workers, people | 12 |
| Number of newly created jobs | - |
| Number of unemployed population, people | 200 |
| Number of economic entities: | |
| legal entities | - |
| individuals | - |

There are no registered legal or individual entities in the Istikhana village, which reflects the lack of entrepreneurial activity and limits job creation (lack of newly created jobs).

The education profile of Istikhana shows a population that is largely educated at the college level, with smaller shares having higher education or only basic schooling. This indicates a relatively trainable workforce, although the small number of university graduates suggests limited access to advanced professional skills (**Figure 50**).

[176] Statistics of Ziyadli municipality

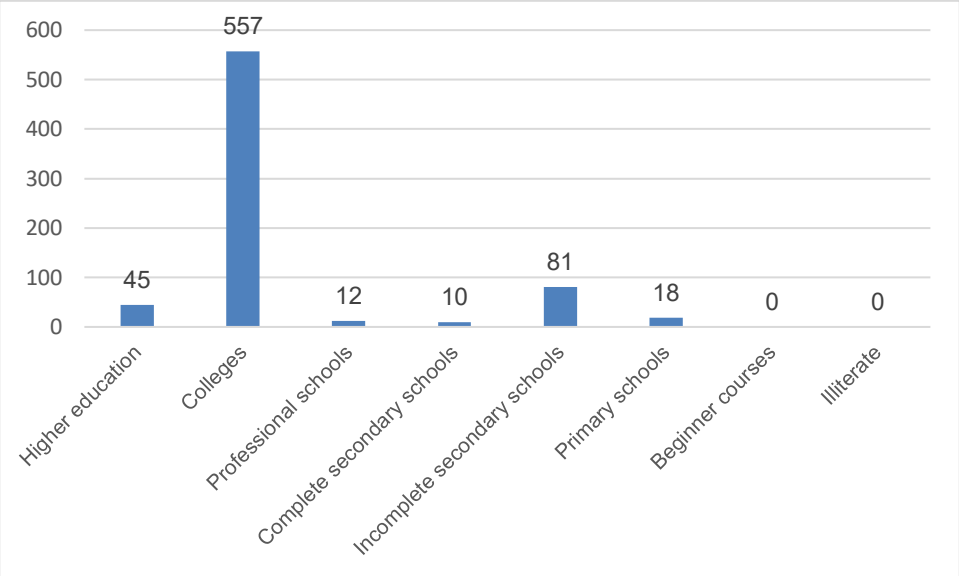



**Figure 50. Education structure of the population, Istikhana village, 2019 Census data**

Unlike neighboring villages, residents of Istikhana have no access to arable land, which restricts engagement in crop production. Nevertheless, many families keep small numbers of domestic animals for subsistence and limited market sale (**Table 73**), **(Figure 51**). Lack of access to land and pastures significantly reduces opportunities for expanding agriculture.

**Table 73. Livestock production by households, Istikhana village (2024)**[177]

| Indicators | Numbers |
|---|---|
| ***Livestock production*** | |
| Meat, net weight, kq | 1,800 |
| Milk, l/day | 650 |
| Eggs pcs/day | 1,200 |
| Wool, t/year | 1,9 |

[177] Statistics of Ziyadli municipality

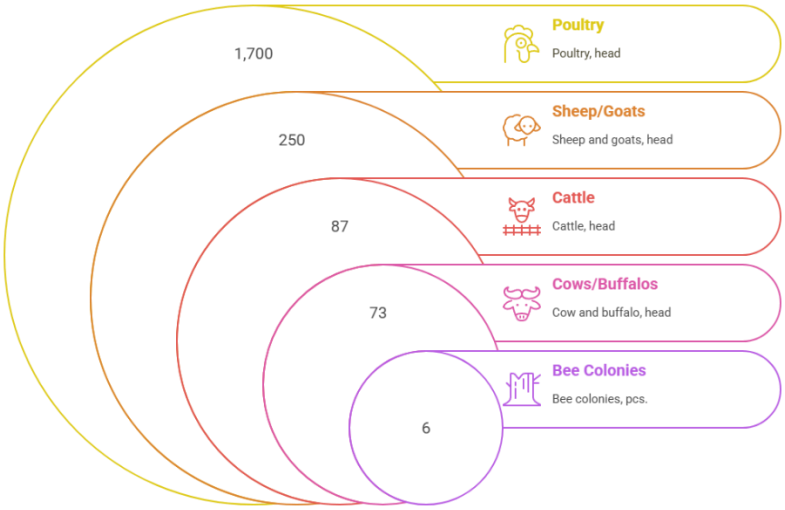



**Figure 51. Number of livestock in households, Istikhana village**[178]

### *Income and expenditure*

A significant portion of Istikhana's population lives below the poverty line, relying primarily on pensions ranging from 190 to 350 manat per month. Families typically consist of 4 to 7 members. The average monthly salary in the village is about 490 manat. Some households generate additional income from the sale of agricultural and livestock products, while others depend on social support (mainly pensions) or irregular earnings from seasonal and temporary work.

Household expenditures are largely dominated by basic needs. On average, 45–50% of household budgets are spent on food, 12% on utilities and fuel, 10% on agriculture and livestock-related expenses, 8% on clothing, 5% on education, 10% on healthcare, and 8% on other miscellaneous costs. This distribution illustrates the limited financial flexibility of families.

### *Social assistance*

In Istikhana, vulnerable groups include low-income and impoverished families, pensioners, people with disabilities, large or single-parent families, and those who have lost the head of the household. Key figures are as follows: pensioners make up 19.7% of the population, social assistance recipients 7.8%, refugees or displaced persons 0.1%, large and single-parent families 18%, and persons with disabilities around 2%.

Since the village has no agricultural land, household incomes are seasonal and unstable. The actual poverty rate is likely higher than official statistics. About 15–25% of families apply to the municipality for social and material support, both formally and informally. The most common forms of assistance sought include: food supplies, firewood or gas in winter, documentation for social benefits, housing and land issues, and certificates or recommendations for medical support.

### *Public utilities and infrastructure*

#### Natural gas and electricity supply

The greenhouse plant supplies electricity and gas.

[178] Statistics of Ziyadli municipality

#### Water consumption and wastewater disposal

The greenhouse plant supplies water. In the village of Istikhana, water is primarily used for domestic purposes. Only a small amount is used for irrigation. There is also a seasonal pattern in water use: in summer, demand increases for irrigation and livestock, while in winter, household use dominates.

#### Roads and transport accessibility

Istikhana village is connected to the Govlarsari–Ganja road by an 800-meter branch. Inside the village, all streets are gravel and not asphalted.

#### Social Infrastructure

The Istikhana village does not have a post office, a kindergarten, a community center, and a medical facility. The existing school is old and in need of repair. There is only one small grocery store, and other basic services and infrastructure are lacking.

Local residents commented on medical services and social infrastructure: *"We can get medical care only in government institutions in Samukh. Due to the lack of public transport, the fare is 6-10 manats, so our people very rarely seek medical care. You talk about the environment, but we do not have a playground - children play in the streets, municipal waste flows in the ditches"*[179].

### Govlarsari village

#### *General information*

Govlarsari is a village in the administrative-territorial unit of Ziyadli municipality of Samukh region of the Republic of Azerbaijan. The area of the village of Govlarsari is 1,100 hectares.

#### *Demography*

As of January 1, 2024, the village has a population of 1,578 people, of whom 49% (778 persons) are men and 51% (800 persons) are women. The predominant age group is 45–64 years (**Figure 52**)[180]. The village's age structure reflects a relatively young demographic (children – 21,4% and youth – 13,6%). There are 358 households in the village. Most people are Muslim. There is a mosque.

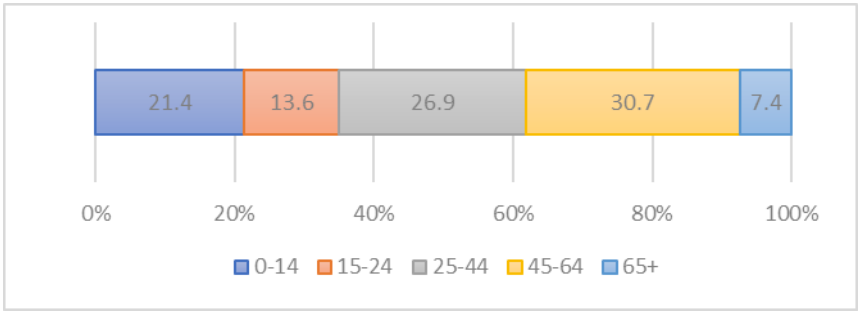



**Figure 52. Age population of Govlarsari village**

[179] Minutes of the scoping consultation with citizens of Istikhana village (31.07.2025)

[180] Data of Ziyadli municipality

### *Economy and employment*

The primary occupation of villagers is agriculture, while no industrial enterprises operate in the village. Up to 10% of the men in the village are labor migrants working in Russia or Ukraine, regularly sending money to their families. Some men also work in private businesses in Samukh or Ganja.

The total labor force in the village amounts to 970 persons, of which 849 are officially employed. The number of unemployed persons is 95, which translates into an unemployment rate of approximately 9.8% (**Table 74**).

**Table 74. Labor market in Govlarsari village, 2024**[181]

| Indicators | 2024 |
|---|---|
| Number of labor force, people | 970 |
| Number of employed population, people | 849 |
| Number of contract workers, people | 26 |
| Number of newly created jobs | - |
| Number of unemployed population, people | 95 |
| Number of economic entities: | |
| legal entities | 2 |
| individuals | 9 |

Economic activity is mainly concentrated in small enterprises, including 2 legal entities and 9 individual entrepreneurs.

According to the 2019 census, the population of Govlarsari has a diverse educational profile. The majority, 756 people (approximately 57%), have completed secondary school. College-level education is held by 280 individuals (about 21%), while 170 residents (13%) have higher (university) education. Professional school graduates account for 19 people (1.4%) (**Figure 53**).

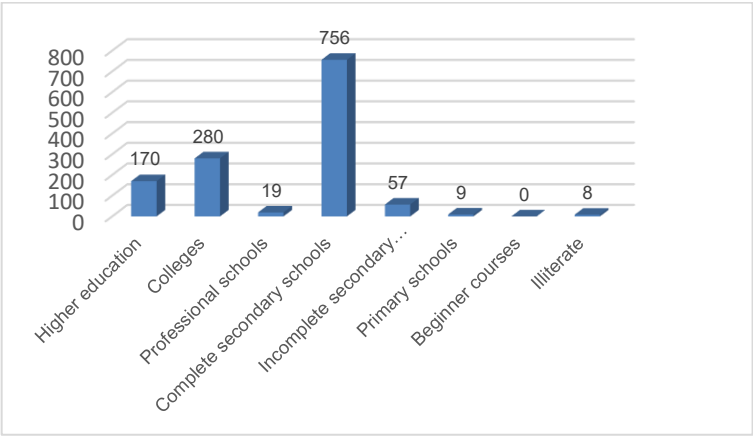



**Figure 53. Education structure of the population, Govlarsari village, 2019 Census data**

[181] Statistics of Ziyadli municipality

In 1992, the residents of the village received land plots for private ownership, averaging 1.6 hectares per person. These lands are either cultivated by the owners or leased out. The population of Govlarsari uses the land for growing crops and for livestock grazing (**Table 75**), (**Figure 54**). Farming and animal husbandry continue to be important sources of livelihood.

**Table 75. Livestock production by households, Govlarsari village (2024)**[182]

| Indicators | Numbers |
|---|---|
| ***Livestock production*** | |
| Meat, net weight, kq | 3,100 |
| Milk, l/day | 1,680 |
| Eggs pcs/day | 4,900 |
| Wool, t/year | 2.8 |

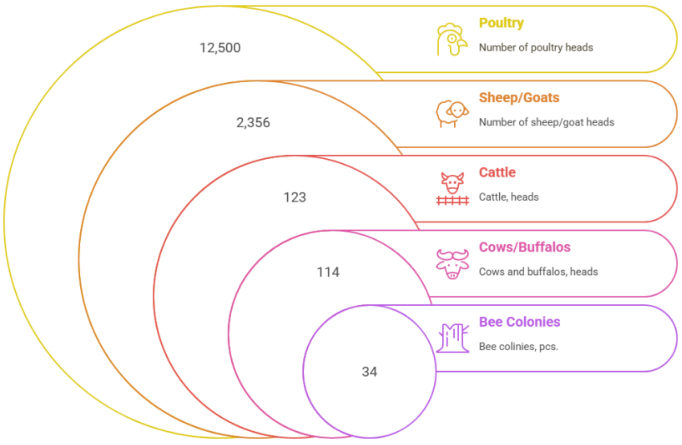



**Figure 54. Number of livestock in households, Govlarsari village**[183]

### *Income and expenditure*

The average monthly salary in Govlarsari in 2024 is 490 AZN, above the minimum income level. In the Ziyadli municipality, full-time agricultural workers earn 500–700 AZN per month, depending on the crop.[184]

Most household spending goes to basic needs: 45–50% on food, 12% on utilities and fuel, 10% on farming and livestock, with the rest on clothing, education, healthcare, and other expenses. This leaves little room for savings or unexpected costs.

### *Social assistance*

The structure of social assistance in Govlarsari village is similar to that in Ziyadli. Vulnerable groups include low-income families, pensioners (about 9.7%), recipients of social assistance (7.8%), large or single-parent families (12–17%), persons with disabilities (around 2%), and a small number of refugees or internally displaced persons (0.1–0.2%).

[182] Statistics of Ziyadli municipality
[183] Statistics of Ziyadli municipality
[184] Statistics of Ziyadli municipality

Approximately 15–25% of households request support from the municipality, most commonly for food, winter fuel, documentation for social benefits, housing and land issues, or medical certificates.

***Public utilities and infrastructure***

**Natural gas and electricity supply**

All houses are electrified and use natural gaz.

**Water consumption and wastewater disposal**

The main water sources in Govlarsari village are artesian/subartesian wells (used by 50–60% of households), a centralized water supply system (20–30%), springs and open sources (10–15%), and rainwater or collected water (5–10%) as a backup.

Drinking water mainly comes from artesian wells, supplied for 2 hours in the morning and 2–3 hours in the evening. Irrigation relies on both the Shamkir channel and artesian wells. On average, residents use 70–100 liters of water per day. The village does not have a sewage system.

**Roads and transport accessibility**

In the Govlarsari village, approximately 40% of the streets are paved with asphalt, while the remaining roads are unpaved, which may affect mobility, particularly during adverse weather conditions.

Public transport services are available, with several bus routes connecting the village to nearby urban centers: Route No. 2 to Samukh and Route No. 3 to Ganja. These connections facilitate access to employment, education, healthcare, and markets, although the limited number of routes may restrict mobility for some residents.

**Social Infrastructure**

The Govlarsari village has a house of culture, a new school for 800 children, and a kindergarten for 40 children. There is Internet and a telephone station, and a medical center. The village has good infrastructure, several beauty salons, men's hairdressers, several fashion studios, sewing workshops, two large markets and a number of specialized stores - building materials, electronics, clothing stores, etc.

| | |
|---|---|
|  |  |
| Market | Medical-akusher point |

| | |
|---|---|
|  |  |
| Kindergarden | Playground |

**Figure 55. Social infrastructure of Govlarsari village**

### Garayeri village

#### *General information*

Garayeri is a village and municipality in Samukh District of Azerbaijan. Its total area is 2,000 ha.

#### *Demography*

The total population of the village Garayeri is 6,484 people[185]. Of these, 50% (3,245 persons) are men and 50% (3,239 persons) are women. The predominant age group is 45-64 years[186] (**Figure 56**). The proportion of elderly people (65+) is relatively small at 3.9%, while children (0–14) is large - 23.7%. The village has a relatively young population. Most people are Muslim. There is a mosque.

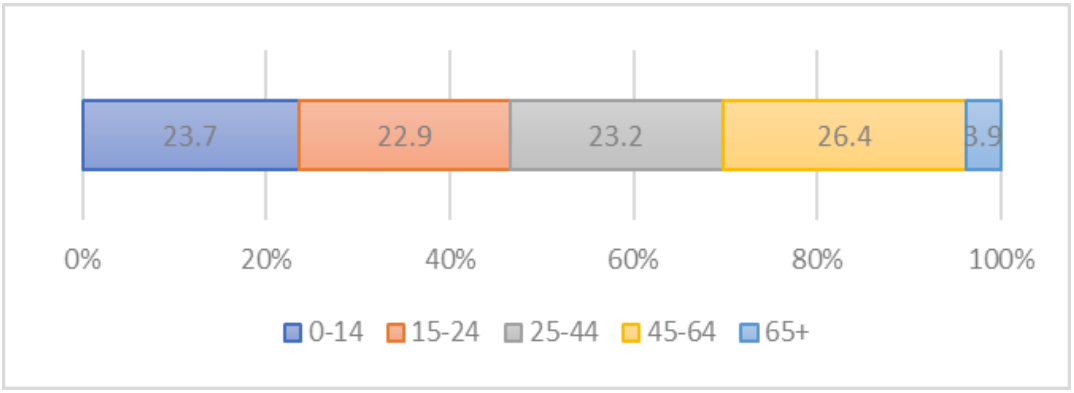



**Figure 56. Age population of Garayeri village**

[185] Department of Statistics of Samukh District

[186] Data of the rural executive committee

### *Economy and employment*

The total labor force in the village amounts to 4,850 persons, of which 4,086 (84.2%) are officially employed. The number of unemployed persons is 261, which translates into an unemployment rate of approximately 5.4 % (**Table 76**).

**Table 76. Labor market in Garaeri village, 2024**

| Indicators | 2024 |
|---|---|
| Number of labor force, people | 4,850 |
| Number of employed population, people | 4,086 |
| Number of newly created jobs | 33 |
| Number of unemployed population, people | 261 |
| Number of economic entities: | |
| legal entities | 13 |
| individuals | 41 |

In 2024, only 33 new jobs were created in the village, which demonstrates the limited capacity of the local economy to absorb the available labor force. Economic activity is mainly concentrated in small enterprises, including 13 legal entities and 41 individual entrepreneurs.

Residents of the village Garayeri grow grain, vegetables, fruits, fodder and oilseed crops - mainly alfalfa (for livestock) and sunflower, livestock farming, poultry farming, beekeeping (**Table 77), (Figure 57)**. Part of the products produced in the household are stored for consumption, and part is sold in the general and local markets of Azerbaijan - Baku and mainly Ganja (milk, cheese, yogurt, eggs, lamb, beef and chicken). About 35-45% of the products produced are sold.

**Table 77. Livestock production by households, Garayeri village (2024)[187]**

| Indicators | Numbers |
|---|---|
| ***Livestock production*** | |
| Meat, net weight, kq | 12,850 |
| Milk, l/day | 8,650 |
| Eggs pcs/day | 26,500 |
| Wool, t/year | 13 |

[187] Department of Statistics of Samukh District

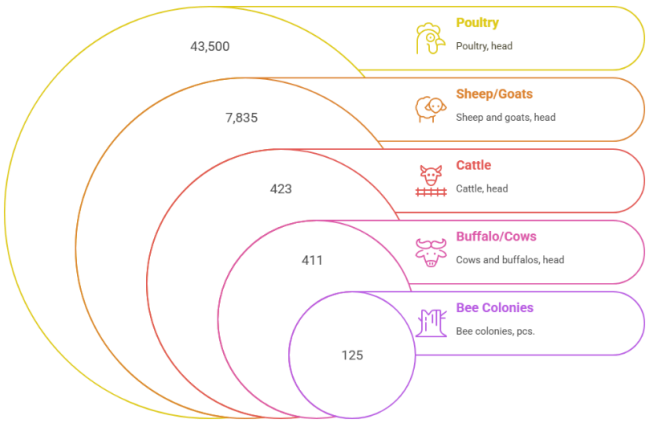



**Figure 57. Number of livestock in households, Garayeri village (2024)[188]**

According to the 2019 census (Figure 58), the educational level of Garayeri village residents is relatively strong, with only 0.1% being illiterate. Over 64% of the population has completed or partially completed secondary education, suggesting a generally educated but not highly specialized labor force. About 20% are graduates of professional schools, indicating a strong base of practical skills that could be applied across various sectors of the economy. Only 4.5% hold university degrees, which may limit access to high skilled professions.

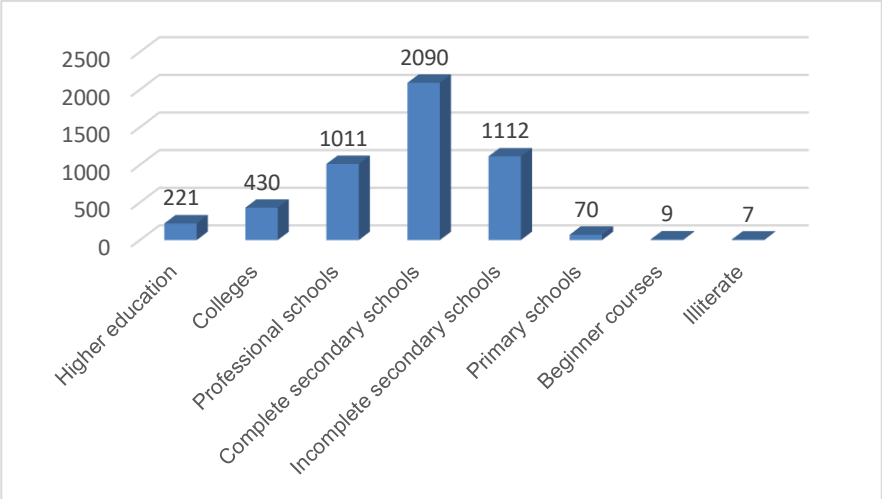



**Figure 58. Education structure of the population, Garayeri village, 2019 Census data**

### *Income and expenditures*

In 2024, the nominal wage of agricultural workers in the Garayeri municipality was 700 manats.

Household spending in the municipality mainly covers basic needs. Families spend the largest share of their budgets on food (45–50%). Other key expenses are utilities and fuel (12%) and farming and livestock costs (10%). Spending on clothing (8%), education (5%), and health care (4%) is quite low. About 11% goes to “other expenses,” such as transport, communication, or unexpected costs.

[188] Department of Statistics of Samukh District

### *Social assistance*

In Garayeri village, 915 people receive pensions, accounting for about 14% of the total population. The majority (721) are old-age pensioners, followed by 126 receiving disability pensions and 68 receiving survivor's pension. Out of all pensioners, 847 are not employed, while only 68 continue working. The average monthly pension is 340 AZN.

In addition, 128 residents receive state social benefits, with an average monthly amount of 109 AZN per person.

Around one-fifth of households regularly turn to the municipality for help, most often requesting food, winter fuel, social assistance documents, housing or land support, and medical certificates and assistance.

### *Public utilities and infrastructure*

#### Natural gas and electricity supply

All houses are electrified and use natural gaz.

#### Water consumption and wastewater disposal

The main water sources in Garayeri village are artesian and subartesian wells (used by 50–60% of households), a centralized water supply system (20–30%), springs and open sources (10–15%), and rainwater or collected water (5–10%) as backup. Drinking water mostly comes from artesian wells, supplied only a few hours daily (2 hours in the morning and 2–3 hours in the evening). Irrigation depends on both the Shamkir Canal and artesian wells. On average, residents use 70–100 liters of water per day. The village has no sewage system.

Residents report serious water-related problems. Reliance on artesian wells carries the constant risk of pump failure, leaving farmers without water for days. The Shamkir Canal is not a reliable alternative due to irregular supply and higher costs: *«Today, it is widely recognized that there are significant problems with irrigation water. When relying on artesian wells, there is always the risk of pump failure, which can leave farmers without water for several days. Water from the Shamkir Canal is not a reliable alternative, as supply is irregular and the cost is higher. As a result, some farmers are forced to use water from the drainage canal, which raises concerns about the quality and safety of agricultural products*"[189]

A major issue is untreated sewage from Ganja, discharged into an open channel passing through the village: "*Untreated sewage from Ganja is discharged into an open channel that passes through our village. This channel emits a strong and foul odor. It is also important to note that some farmers use this water to irrigate agricultural land. In such cases, the unpleasant smell spreads over long distances, causing significant concern among residents.*

*The constant flow of sewage near our homes is deeply troubling. Beyond the offensive odor, we are seriously worried about the potential spread of infectious diseases*"[190].

### Roads and transport accessibility

Garayeri village is connected to Samukh and Ganja by public transport via the Samukh–Ganja road. Buses to Ganja run every 20–30 minutes, while transport to Samukh operates 3–4 times a day. In addition, private drivers provide transport services for schoolchildren, taking them to school in the morning and bringing them home in the afternoon.

[189] Minutes of the scoping meeting with residents of the Garayeri village (02.08.2025)

[190] Minutes of the scoping meeting with residents of the Garayeri village (02.08.2025)

### Social Infrastructure

The Garayeri village has a range of public and community facilities, including a library, cultural center, post office, and sports ground. Household infrastructure is relatively well developed. Residents have access to tailoring services, shoe and clothing repair, a café, a restaurant, and three large markets. There are also specialized shops selling furniture, electronics, building materials, footwear, and clothing. In addition, the village has two pharmacies, both offering baby food sections.

The number of mobile subscribers in the area is 5,114.

Health care facilities include a hospital with 21 beds and an outpatient center. The capacity of outpatient and polyclinic institutions is 32 visits per shift.

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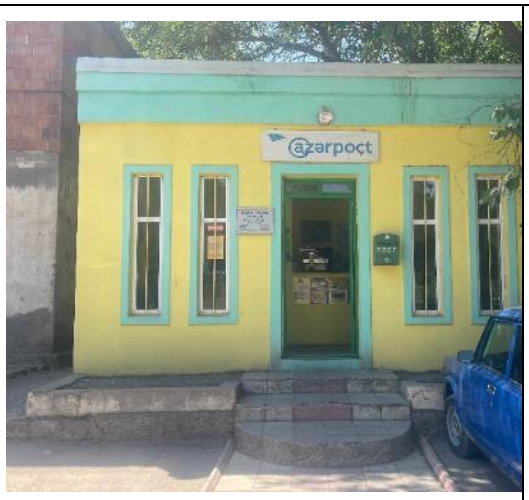
<tr><td>  </td><td>  </td></tr>
<tr><td>Post</td><td>Market</td></tr>
<tr><td>  </td><td>  </td></tr>
<tr><td>Playground</td><td>School</td></tr>
</table>

**Figure 59. Social infrastructure of Garayeri village**

### Sarkar village

#### *General information*

Village Sarkar is an administrative unit of Samukh District. It is one of the largest (according to square and total number of population) in the Samukh District. The village is located in 5 km from the district center. The total area of the village is 1,924 ha[191].

#### *Demography*

The total population of Sarkar village is 5,314 persons (01.01.2024), including men – 2,588 (48.7%) and women – 2,726 (51.3%)[192]. The proportion of the population aged (25-44 years) is predominant and amounts to 22.6% (**Figure 60**). Young (ages 0–14 and 15–24) and older residents (65+) are represented almost equally. The age distribution is highly balanced.

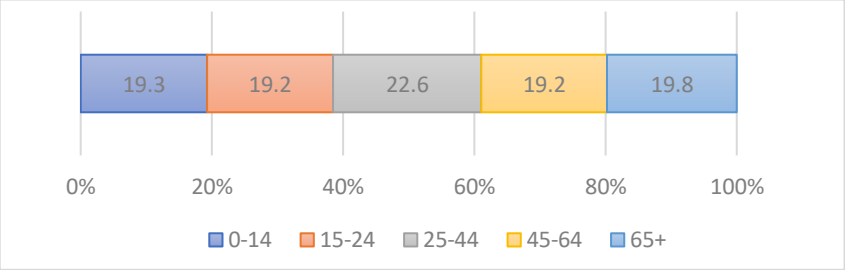



**Figure 60. Age population of Sarkar village**

There are 1,110 households in the village, of which 923 are private homes. A total of 260 residents are registered with the executive authorities but live outside the republic. In addition, 156 internally displaced people live in the village, 7 of whom have acquired private real estate.

#### *Economy and employment*

Sarkar village hosts several enterprises that play an important role in the local economy. These includes two mineral water bottling plants, dried fruit processing facility, a poultry farm, a 300-ton refrigerated warehouse and 36 retail shops. The mineral water industry is significant: water from the Sarvan spring is widely recognized in the region for its therapeutic effects on gastrointestinal diseases and is bottled at two local plants.

The dried fruit facility is one of the largest employers in the village. It employs about 90 people year-round, and the number of workers can grow to 200 during the fruit-picking season. Its production – mainly dried apples, persimmons, pears, and other fruits – is supplied both to domestic and international markets.

Seasonal employment plays a major role in the village economy. Many residents are temporarily hired for agricultural work in Sarkar and neighboring Shamkir district – particularly in greenhouses, strawberry plantations, and potato fields. Up to 15% of the male population and 20% of the female population engage in seasonal work for 2-3 months each year. In total, more than 300 villagers work on farms outside the Sarkar.

In 2024, the labor force in Sarkar village was 4,146 people, of whom 3,862 were employed, giving an employment rate of about 93%. The number of unemployed was relatively low at 271

[191] Department of Statistics of Samukh District

[192] Department of Statistics of Samukh District

people (around 6.5% of the labor force). Only 33 new jobs were created during the year (Table 78).

**Table 78. Labor market in Sarkar village, 2024[193]**

| Indicators | 2024 |
|---|---|
| Number of labor force, people | 4,146 |
| Number of employed population, people | 3,862 |
| Number of newly created jobs | 33 |
| Number of unemployed population, people | 271 |
| Number of economic entities: | |
| legal entities | 9 |
| individuals | 31 |

Most adults have completed secondary education (2,090 people, 48.7%), followed by incomplete secondary education (1,112 people, or 25.9%) (Figure 61). College graduates account for 10 % (430 people) (10%), while professional school graduates account for 269 people (6.3%). Only 121 people (2.8%) have a higher education.

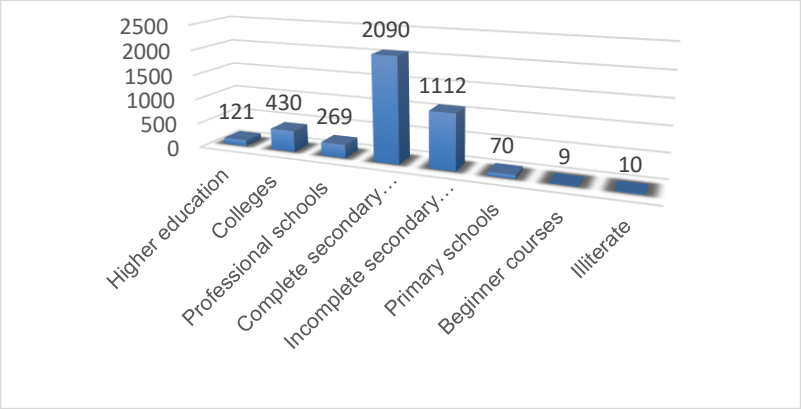



**Figure 61. Education structure of the population, Sarkar village, 2019 Census data**

As a result of land reforms, households in Sarkar received individual plots, which they use for crop cultivation and livestock breeding. Agricultural production is diversified, with grain, vegetables, fruits, fodder, and oil crops – mainly alfalfa for cattle feed and sunflower – being cultivated. Households also raise poultry, cattle, sheep, goats and bees (Figure 62, Table 79).

**Table 79. Livestock production by households, Sarkar village (2024)[194]**

| Indicators | Numbers |
|---|---|
| ***Livestock production*** | |
| Meat, net weight, kq | 12,250 |
| Milk, l/day | 8,050 |
| Eggs pcs/day | 20,500 |
| Wool, t/year | 18 |

[193] Department of Statistics of Samukh District

[194] Department of Statistics of Samukh District

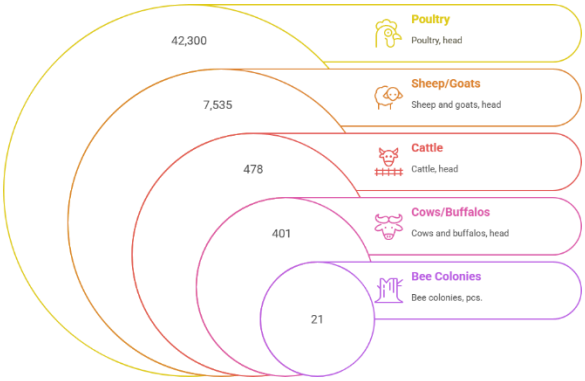



**Figure 62. Number of livestock in households, Sarkar village[195]**

Residents grow food for their own use and for sale. Around 35–45% of the produce is sold, mainly in Ganja and Baku. Key products are milk, cheese, yogurt, eggs, lamb, beef, and poultry.

### *Income and expenditure*

Average monthly income in the village 490 AZN in 2024. Residents of Sarkar village talk about significant economic difficulties: "*Our village faces a high unemployment rate, with many residents compelled to seek temporary work in Ganja and Shamkir. A significant number of households are low-income, and many residents commute daily to these cities in search of employment. However, the wages of temporary workers are low, leaving many families struggling to make ends meet*".[196] This shows the village's dependence on jobs in nearby cities and the vulnerability of households to unstable, low income.

Household spending focuses on basic needs: food (45–50%), utilities and fuel (12%), agriculture and livestock (10%), with smaller shares for clothing, education, healthcare, and other expenses.

### *Social assistance*

In Sarkar village, 774[197] people receive pensions, about 14.6% of the population. Most are old-age pensioners (551), followed by 146 receiving disability pensions and 77 receiving survivor pensions. Of all pensioners, 746 are not employed, while only 28 continue working. The average monthly pension is 340 AZN.

In addition, 128 residents receive state social benefits, with an average monthly amount of 109 AZN per person.

Around 15–25% of families regularly apply to the municipality for social and financial support, both formally and informally. Requests are typically addressed based on written or verbal applications. The most common types of support include: food, documentation for social assistance, housing and land issues, certificates or recommendations for medical support.

[195] Department of Statistics of Samukh District

[196] Minutes of the meeting with residents of Sarkar village within scoping consultations (31.07.2025)

[197] Data from the local executive committee

***Public utilities and infrastructure***

**Natural gas and electricity supply**

All houses are electrified and use natural gaz.

**Water consumption and wastewater disposal**

The main water sources in Sarkar village are artesian and subartesian wells (used by 50–60% of households), a centralized water supply system (20–30%), springs and open sources (10–15%), and rainwater or collected water (5–10%) as backup. On average, residents use 70–90 liters of water per day. The village has no sewage system.

**Roads and transport accessibility**

Sarkar village is connected by public transport to Samukh, Ganja, and Shamkir. Buses to Ganja run every 20–30 minutes, while transport to Samukh operates 3–4 times a day—in the morning, at lunchtime, and in the evening. In addition, private drivers provide transport services for schoolchildren, taking them to school in the morning and bringing them back home in the afternoon. The Samukh–Ganja road links Sarkar with both Samukh and Ganja, while a district road provides access to Shamkir.

**Social Infrastructure**

Sarkar village has several social infrastructure facilities. These include a kindergarten for 35 children, a secondary school with 644 students and 101 teachers, a house of culture with 300 seats, a library, a medical center, and a children's music school with 54 teachers and 297 students, post office. There are also 36 retail shops.

The village also has a sports ground and a mini-park near the house of culture, which serve as public spaces. The school offers extracurricular activities, including a chess club, the football club "Shalinder," and a freestyle wrestling section. The house of culture hosts regular cultural events, and the children's music school participates in all cultural events in the Samukh district.

| | |
|---|---|
|  |  |
| Post office | Medical-akusher point |

| | |
|---|---|
|  |   |
| Market | School |

**Figure 63. Social infrastructure of Sarkar village**