West Bank and Gaza

Gaza Central Desalination Program: Associated Works Phase I (P168739)

Executive summary of the Environmental and Social Impact Assessment

October 2019

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1. Introduction

1.1. Background and context

The Gaza strip is suffering structural water scarcity and the degradation of ground water resources, which is affecting the quality of municipal water supply services. The main source of water in Gaza is groundwater from the Coastal Aquifer. The aquifer relies on rainfall for recharge, which has dropped by 10-20 percent in the last five years. The increased demand and over-abstraction of ground water has caused saline intrusion and, consequently, most of the 260 wells managed by municipal service providers have salinity and nitrate levels above the thresholds set by World Health Organization (WHO) guidelines for drinking water.

The Palestinian Water Authority (PWA) has formulated the Gaza Sustainable Water Supply Program (GSWSP) to tackle this challenge. The GSWSP proposes diversifying the water resources mix, increasing sea water desalination production capacity and the volume of drinking water purchased to the Israeli bulk water supplier (Mekorot), while reducing groundwater abstractions. By 2030, when all GSWP infrastructure works are meant to be completed, 110 MCM/year -i.e. approximately 73% of the bulk water that will distributed to municipalities in Gaza- will be produced at the so-called "*Gaza Central Desalination Plant*" (GCDP, still to be developed). Out of the remaining 40 MCM/year, 9% will be produced in 3 Short Term Low Volume Desalination Plants (STLVs), two of which are already under operation (i.e. the Khanyounis and Deir Al Balah desalination plants); 13% will be purchased to Mekorot; and just 5% is expected to be coming from the aquifer. The GSWSP also considers activities aimed at improving the efficiency of municipal services providers and at reducing their unaccounted-for-water levels.

The GSWSP also contemplates the construction of interconnection and bulk water storage infrastructure, which is referred to as the "Associated Works". The Associated Works component will allow for an overall improvement of the bulk water quality -mixing water from different sources-; as well as for an optimized and more equitable distribution of bulk water across municipalities; and for increasing the resilience of their drinking water distribution systems. This component comprises the facilities listed here below and represented in figure ES.1:

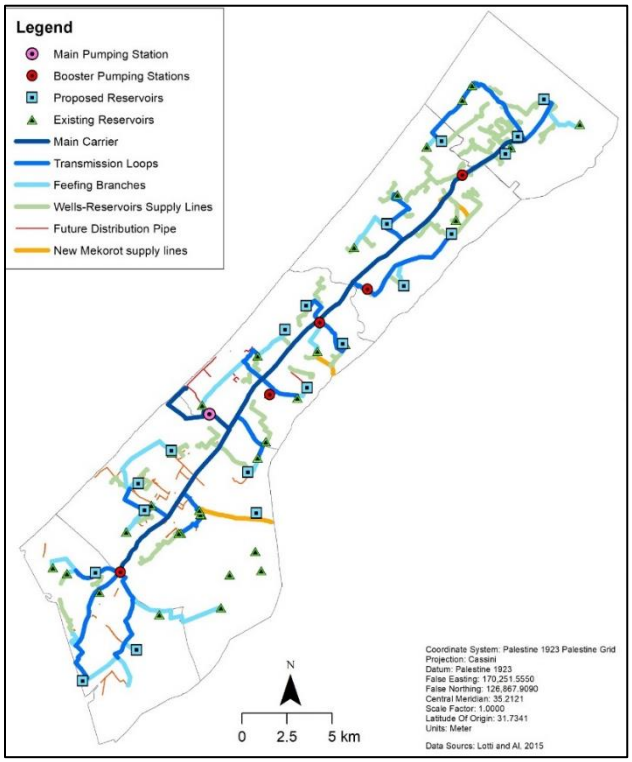

Figure ES.1: Associated Works facilities

(i) *North-South main carrier and associated pumping stations*. A 42.5 km long and 200-1600 mm diameter transmission pipeline through which high quality bulk water produced in desalination facilities will be distributed to the blending reservoirs.

(ii) *Construction of new and reconfiguration of existing Mekorot water supply lines*. Three new supplies lines will be constructed at Bani Saed, Bani Suhila and Al Montar. The Distribution system of those municipalities in the Middle and

Khanyounis Governorates that receive water from Mekorot will be reconfigured as needed to absorb increased water imports.

(iii) *Transmission loops, storage and blending reservoirs.* Transmission loops with a total length of 110 km and diameters ranging from 150 mm to 700 mm will be constructed to feed with desalinated water the blending reservoirs in the north, middle and south governorates of the Gaza Strip. 20 new reservoirs will be constructed at the head of municipal distribution systems. The minimum storage capacity will be in a range of 11 to 16 hours.

(iv) *Reconfiguration of water supply distribution systems*. Approximately 10 km of old or undersized distribution pipelines will be reconfigured and/or replaced to adapt drinking water distribution systems to the new bulk water supply system. Likewise, 116 km of pipelines will be constructed to feed blending reservoirs with water coming from selected wellfields. Existing reservoirs will be retrofitted, along with the existing wellfields that are meant to continue in service. The rest of the wellfields will be decommissioned.

1.2. Environment and Social Impact Assessment (ESIA) Objectives and Scope

This Environmental and Social Impact Assessment (ESIA) covers the pre-construction, construction and operation of the infrastructure to be developed under the "Associated Works" component. The ESIA: (i) investigates and records existing environmental, economic, and social conditions in the project area; (ii) identifies potential environmental and social impacts -both positive and negative- of the activities proposed under the Associated Works component; (iii) presents an environmental and social management plan (ESMP) to manage, mitigate, and monitor any potential negative impacts; (iv) assesses the capacity of PWA to implement the measures proposed under the ESMP; and (v) proposes measures to overcome identified capacity gaps.

The proposed World Bank-financed Project will finance part of the infrastructure covered by this ESIA. A phased approach has been adopted for the implementation of the "Associated works", with the first phase being co-financed by the World Bank (WB) under the proposed Project**.** The "Associated works Phase I" project ("the Project") will be co-financed by the WB and the Kuwait Fund for Arab Economic Development (KFAED) and will include in its scope under component I:

(i) The construction of the southern segment of the main carrier (from the main pumping station to Rafah), with the associated transmission loops and reservoirs, which will enable PWA to convey up to 7.3 MCM/year of desalinated water produced at the two STLVs currently in operation to the water reservoirs to be built in the Khan Younis and Rafah Governorates;

(ii) The construction of the Bani Said and Bani Suhaila Mekorot water supply lines, along with the associated reconfiguration of the the water distribution network in the middle and Khan Younis Governorates.

(iii) Reconfiguration of water supply distribution systems in Southern and Middle Governorates of Gaza to adapt them to the new bulk water supply system.

Under Component II the Project will provide capacity building and supervision support to PWA, along with financial assistance to operate and maintain the bulk water management infrastructure that will be developed under the Project and the Khanyounis and Deir Al Balah STLVs. This financial support to operation and maintenance will be provided on a declining basis.

The Project has been classified as Category A as per applicable WB Safeguards Policies. The overall Project impact is expected to be positive due to the improvements that it will bring in terms of drinking water quality and availability and the reduced pressure on groundwater resources. Main negative impacts are expected to be minor, temporary, manageable and concentrated during the construction phase. Nevertheless, the Project has been classified as category A because it spans through a large portion of south and middle Governorates of the Gaza Strip with multidimensional environmental, social, and contextual risks. The Project entails a temporary loss of livelihood for merchants of a market located in Khan Younis city, as well as land acquisition activities for two of the twelve sites selected for the construction of the required reservoirs and pumping stations. These sites are being acquired using land-swapping mechanisms. Compensations for land acquisition and for merchants' temporary loss of income are not dealt with by this ESIA but rather through a dedicated Resettlement Action Plan (RAP) prepared according to WB policies and disclosed on PWA and WB external site. Safeguard Policies are applicable for all Project activities regardless of the source of funding.

The STLVs which operation and maintenance will be partially funded through the Project are covered by two dedicated ESIAs. These ESIAs covered construction and operation environmental and social impacts and proposed mitigation measures for these impacts. ESMPs were prepared as part of the ESIAs which were adequate to address the anticipated risks and impacts. Since the two STLVs were already established, the operational performance of these two STLVs and their compliance with the relevant provisions of their ESMPs and with relevant World Bank safeguard policies has been assessed through an environmental and social audit commissioned by PWA. The audit identified some gaps between the requirements and the actual implementation. PWA prepared a time-bound Action Plan which covers all ESMP and Bank's policy requirements including, but not limited to, water quality monitoring and public and occupational health and safety. The Action Plan also determined the resources needed to implement each of the identified actions. This action plan, as part of the environmental and social audit of the STLVS, serve as one of the safeguard instruments of the Project and as such, has been disclosed in PWA webpage and in the external site of the World Bank.

While this ESIA covers the entire scope of the "Associated Works" component of the GSWSP, its executive summary focuses on the results of the assessment related to activities financed under the World Bank Financed Project. Table ES.1 here below illustrates the scope of the Associated Works Program, indicating the activities covered by this ESIA, the environmental and social management audit and the World Bank financed Project.

	Infrastructure	Covered by this ESIA	Covered by the Environmental and Social Audit	Constructed under the World Bank Financed Project	Operated under the World Bank Financed Project
Associated Works Program	Northern segments of the North-South Carrier	✓			
	Al Montar Mekorot water supply line	✓			
	Transmission loops and mixing reservoirs connected to the northern segments of the N-S Carrier	✓			
	Reconfiguration of municipal drinking water distribution systems connected to the Northern segment of the N-S Carrier	✓			

	Southern segments of the North-South Carrier (South & Middle Governorates)	✓		✓	✓
	Bani Saed, Bani Suhila Mekorot water supply lines	✓		✓	✓
	Transmission loops and mixing reservoirs connected to the southern segments of the N-S Carrier	✓		✓	✓
	Reconfiguration of municipal drinking water distribution systems connected to the Southern segment of the N-S Carrier	✓		✓	✓
STLV	Khanyounis STLV desalination Plant		✓		✓
	Deir Al Balah STLV desalination plant		✓		✓

Table ES.1: Scope of the GWSP, the ESIA and the World Bank financed Project

2. Policy, legal and administrative framework

2.1. Policy, legal and regulatory framework

The Palestinian national legal and regulatory framework ruling the preparation of this ESIA and the implementation of the Project is defined by:

- The Palestinian Environmental Law (PEL) No. 7 1999
- The Palestinian Environmental Assessment Policy (PEAP) approved by decree No: 27- 23/4/2000;
- The Palestinian Water Law No. 3, enacted on July 2002;
- Palestinian Public Health Law (PPHL) No. 20, enacted on 2004;
- Palestinian Cultural Heritage Legislation, which comprises exclusively the British Mandate Law of Antiquities of 1929;
- Existing Palestinian policy and legal framework for land acquisition, with comprises the Land Ownership Law 3/2011 and the Land Expropriation Law2/1953.

World Bank Safeguard policies. The preparation of the ESIA and the implementation of the Project are also ruled by the following WB Operational Policies (OP) related to environmental and social safeguards, which shall complement -and supersede in case of contradiction- the provisions included in relevant national legislation and regulations:

- Environmental Evaluation OP 4.01, dated January 1999. The proposed project activities span large portions of the densely populated Gaza Strip with multidimensional environmental and social risks, therefore, the project has been assigned Environmental Category "A" which requires full environmental and social assessment.
- Involuntary Resettlement OP 4.12, December 2001. This policy has been triggered because the Project will entail a temporary loss of livelihood to merchants in the Khan Younis city market during the construction of the main carrier and a permanent loss of land associated to the construction of reservoirs and pumping stations.

- Projects in International Waterways OP7.50. This policy was triggered since the Project entails the decommissioning/rehabilitation of wells that tap into the transboundary Coastal Aquifer that spans across the Egyptian border with Gaza.

National and international guidelines and standards. The following guidelines and standards were considered for the preparation of the ESIA and shall rule the implementation of the Project:

- WB Environmental Health and Safety Guidelines;
- Palestinian and WHO Guidelines for Safe Drinking Water;
- Palestinian and 2005 WHO Guidelines on ambient air quality;
- Palestinian and 1999 WHO 1999 Guidelines on noise levels.

2.2. Institutional Framework

The **PWA** is responsible for water resources management and for the governance of water supply and sanitation services. PWA formulated the GSWSP and will be the implementing agency of the Project, which will be co-financed by the **WB** and the **KFAED**. With the support received under component II of the Project, PWA will set up within its organizational structure the Gaza Bulk Water Supply Unit (**GBWSU**), which will be charged with the operation of the STLVs and the infrastructure that will be developed under the Project. the GBWSU is meant to evolve in the long term and become an autonomous state-owned company -the National Water Company (**NWC**)- which mission will be to provide bulk drinking to municipal utilities and service providers on a commercial basis.

The **16 municipal governments of the South and Middle Governorates of the Gaza Strip** that will benefit from increased availability and improved bulk water quality are responsible for the provision of drinking water distribution services. These municipal service providers are regulated by the Water Sector Regulatory Council (WSRC), which is responsible for the issuance of operating licenses and the approval of water tariffs applied by municipalities and any other water and wastewater management service providers.

3. Project Description

3.1. Project Objective and Components

The Development Objective of the prosed World Bank Project is to Improve the quality and quantity of bulk water supplied to the municipalities served in the project area and strengthen the capacity of PWA. The capacity of the Palestinian Water Authority will be improved through: the establishment of a Bulk Water Supply Unit (BWSU) in Gaza to operate the infrastructure developed by the project; and the design and piloting of a National Service Provider Improvement Program that will help municipalities improve the quality and efficiency of their drinking water distribution services, and strengthen their ability to pay for bulk water supply services.

The project comprises three components to: (i) build the necessary water infrastructure for improved bulk water supply by conveying and blending water from various sources in the southern and middle governorates; (ii) build capacity to improve the performance of selected institutions; and (iii) provide project management and implementation support and support the financing of incremental operation and maintenance costs associated to the infrastructure developed under the project and the two STLVs.

3.2. Component 1: Improved Supply of Bulk Water to the southern and middle governorates of Gaza

The "Associated works Phase I" project will finance the execution of sections 1 to 6 of the Main Carrier. These sections, as represented in figure ES.2, go from the STLVs' location to the municipality of Rafah. All these sections of the carrier will run along the route of the old Sikka railroad line, which is owned by the Government. Vent and drain valves will be installed at high and low points of the pipeline profile and will be accessible through manholes. The five transmission loops connecting sections 4, 5 and 6 with blending reservoirs located in Khanyounis and Rafah will also be executed as part of the Project.

Under the Project PWA will also execute the pressurization group of the main pumping station that will feed the southern segment of the main carrier, as well as the Rafah booster station. The main pumping station, referred to as S-MC1, will be located in Al Qarara on a 6,000 m^2 site, will have an installed power of 474 Kw and will be equipped with 5 pumps, three on duty and two on standby. The Rafah booster station will be located on an 1,800 m^2 site, will have an installed power of 49 Kw and will be equipped with two pumps, one on duty and one on standby.

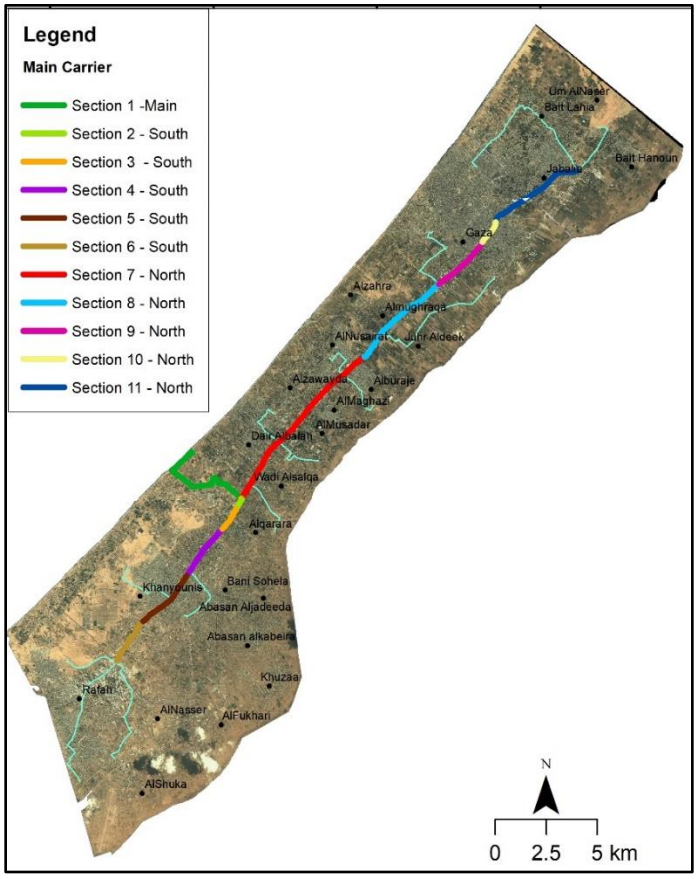

Figure ES.2: North-South Carrier Sections

Ten new reservoirs will be constructed as part of the Project. These will be located in Al Buraij (3,150 m^3 storage capacity), Al Nusairat (3,150m^3); Khanyounis (5 reservoirs with storage capacities ranging from 2,100 to 8,400 m^3); and Rafah (3 reservoirs of 3,000-6,300 m^3). The reservoirs will be equipped with the following facilities: (i) disinfection building with associated chemical feed control system; (ii) supply booster pumps; (iii) distribution booster pumps; (iv) Diesel generator (backup power) and primary power supply and transformer; (v) site utilities; (vi) micro hydropower generators (just some of the reservoirs will be equipped with this device); and (vii) A local SCADA-ready control and monitoring system connected to the centralized Supervisory Control and Data Acquisition (SCADA) of the whole system.

In the South and Middle governorates, 61 existing wells will be decommissioned under the Project and 80 will be rehabilitated and connected to the mixing reservoirs. Pipelines with diameters ranging between 110-630 mm will be built to connect selected wells to blending reservoirs. The suitability of each well as source of water for blending was evaluated considering WHO limits for Chloride (≤250 mg/l) and Nitrate (≤50 mg/l) concentrations in drinking water; and other important factors such as wells

locations; discharge rate; daily pumping time; aquifer hydraulic characteristics; water table levels and temporal water quality variations.

Mekorot connections will be improved in the Middle and Khanyounis governorates to increase the amount of water received from Mekorot in these two Governorates from 5 to 10 MCM/year. The improvement works include the following main components: (i) supply line from Bani Saed connection up to the existing Al Maghazi junction (1.6 km); (ii) supply line from Bani Suhila connection point to the new reservoir to be built in Bani Suhila (4.3 km); (iii) reconfiguration of downstream systems for those municipalities in the Middle Governorate which receive water from Mekorot (Al Bureij, Al Maghazi, Al Zawaida and Al Nusairat); and (iv) Reconfiguration of downstream system for those municipalities in Khanyounis Governorate which receive water from Mekorot (Bani Suhila, Abasan Al Jadeda, Abasan Al Kabera and Khuza'a).

The Project will also reconfigure distribution networks, install distributed photovoltaic (PV) power generators and develop the SCADA for the control of the new bulk water supply system. The Project will include under its scope the replacement of old or undersized distribution pipelines to adapt municipal networks to the new bulk water supply system; the installation of distributed PV that will serve as supporting power supply for all the pumping stations and reservoirs; and the development of a SCADA system that will allow PWA to monitor and operate the new bulk water supply system that will be developed under the Project.

3.3. Component 2: Capacity Building

This component is designed primarily to create adequate capacity to ensure operations and maintenance of the STLVs during project implementation and subsequently during the O&M of the integrated bulk water supply system implemented by the project. This component will also support the design of a National Service Provider Improvement Program (NSPIP) to improve service delivery in the West Bank and Gaza, and reduce the need for sector subsidies, as well as to prepare priority bulk water investments in the West Bank.

Sub-Component 2.1: Establishment of a unit to operate bulk water supply in Gaza Under this subcomponent the Project will fund the design and implementation of a road map for establishing a unit over the implementation period of this project, and take on gradual responsibility for: (i) operation and maintenance of the STLVs; (ii) monitoring and management of bulk water purchases from Israel; (iii) management and operation of groundwater wells in the middle and southern Gaza governorates to be utilized for blending; (iv) blending of these bulk water sources for distribution and onward sale to municipalities (the SPs); and (v) billing and collection (on behalf of PWA) for bulk water sales to municipalities. In line with PWA's long-term plan to create the NWC, this unit will eventually scale up its roles and responsibilities to be the Gaza nucleus of the NWC proposed in the 2014 Water Law. As part of the establishment of the Bulk Water Supply Unit enhancement of the opportunities for female employment will be undertaken, to utilize the untapped resource that highly educated and skilled women represent.1 This sub-component will also fund a study of private water vendors' livelihoods and potential mitigation measures.

[1] This will include support to the PWA gender unit.

Sub-Component 2.2 - Design of a National Service Provider Improvement Program (NSPIP). will fund the design of a national program to improve the operational and financial performance of service providers across the WB&G. The NSPIP will set out a framework of incentives that will: (i) support SPs to move up the performance ladder; (ii) separate water service provision from other municipal services; (iii) where appropriate, support clustering of SPs to achieve economies of scale and work towards the establishment of regional utilities; and (iv) promote future public private partnerships (PPPs) to the extent feasible, either through performance based contracts to reduce NRW, meter reading, billing and collection, or more comprehensive management contracts. As part of the development of NSPIP, pilot measures for improving cost recovery will be tested in a) the municipalities in Gaza targeted by the infrastructure improvements in component 1 and b) selected service providers in West Bank. This sub-component will include support for municipalities to engage consumers in the process, and to ensure that consumers' voice is represented both in the policy discussions on how to develop the NSPIP and will also include training, complemented with technical assistance to municipalities, on engaging with water consumers. Linked to these actions, representatives of women's groups will be consulted in the design of the NSPIP and opportunities for empowering young women across the water supply and sanitation value chain will be explored through innovative partnerships with the private sector. There is consensus among donors of the importance of such a program. It is envisaged that the implementation of this program will be funded by a future Bank/donor supported project.

Sub-Component 2.3: Priority investment planning for bulk water supply in the West Bank. This subcomponent will finance: (i) updating the water sector policy and strategy; (ii) an integrated bulk water master plan for the West Bank, which will identify and prioritize investments to set up a bulk water supply and conveyance system for the West Bank; and (iii) prepare detail designs and ESIAs for the identified priority investments related to distribution of water brought in from Mekorot. It is envisaged that the implementation of this investment will be funded by a future Bank/donor supported project.

3.4. Component 3: Project Management and Implementation Support

Under this component the Project will partially finance the operation and maintenance costs of the infrastructure developed under component 1 on a declining basis. It will also fund costs associated to project management and project supervision activities.

This component will also fund part of the operation and maintenance costs of the South STLV and Deir Al Balah STLV. The South STLV is located at the municipal boundary of Deir Al Balah and Al Qarara municipalities, at Al Rasheed street. This reverse osmosis (RO) desalination plant is fed through four beach wells, currently produces 6,000 m^3/day of desalinated water and it is being expanded to reach a capacity of 20,000 m^3/day. The Deir Al Balah RO STLV is located at the Al Bassa area, at the northeast of Deir Al Balah Municipality. It was constructed in three stages: stage I produces 600 m^3/day, stage II produces 2,000 m^3/day, and stage III produces 3,400 m^3/day. Stages I and II are fully operational and stage III is currently in the testing and commissioning period.

4. Alternatives considered for the Project.

During the formulation of the GSWSP different water resources mix alternatives were considered. At this stage the possibility of tapping on surface water resources was disregarded due to insufficient rainfall,

insufficient water volumes, poor water quality and pollution risks. The option of keeping higher groundwater withdrawals and introducing brackish water desalination facilities was also discarded due to the fragility of the Coastal aquifer and the poor quality of groundwater. The possibility of having greater bulk water imports from Israel was also disregarded since these additional volumes would also be secured through sea water desalination and therefore would entail similar environmental impacts to the alternative of constructing desal facilities in Gaza; and would reduce the resilience and independence of the new bulk water supply system.

At the design stage, PWA considered alternative alignments for the main carrier and alternative locations for the pumping stations and reservoirs. Alignments and locations selected were those minimizing the negative impacts of the Project while ensuring the functionality of the system. As per the retained alignment, the southern segment of the main carrier will run along the right of way of the Sikka route (old railroad line), which crosses areas with different characteristics, including agricultural land, peri-urban areas and urban areas of Khanyounis and Rafah cities. As for the pumping stations and reservoirs, of the 12 sites selected for their construction, ten sites are either government or municipal owned. The land acquisition is in progress for the sites in Al Buraij and Al Qarara and is being processed according to the RAP developed for the Project.

The "No Project Scenario" was also analyzed. Under this scenario bulk water would continue being injected into distribution systems directly from groundwater wells with no previous blending with desalinated water or bulk water purchased from Mekorot. This scenario would leave communities with a source of water that is saline, high in nitrate and chloride concentrations, which would not meet WHO quality standards. Moreover, the ground water over-abstraction issue would be exacerbated due to population growth and the associated increased demand for water. As a consequence, saline intrusion would continue increasing and the quality of water distributed by municipal supply systems would decline.

5. Environmental and social baseline

5.1. Location and land use

Land use in selected sites and Project areas. All pipelines to be laid under the Project are to be constructed in the right-of-way of public roads, and their construction will entail works in the vicinity of some critical facilities such as schools, road intersections, the Khanyounis Market and the Al Taleem Park. While being state-owned, the sites selected for the main pump station and the Rafah booster station are located in an agricultural area and are being cultivated by local farmers with seasonal crops. As for the reservoirs, key information on the sites selected for their construction is summarized in table ES.2 below.

*Table **Error! No text of specified style in document.**:Key information on the sites selected for the construction of mixing reservoirs*

Reservoir	Location	Land ownership	Land Use
ST-001C	Al Buraij camp, about 2.3 km from the eastern border	Al Buraij Municipality (land-swapping agreement)	The site area is 2,600 m^2, located in flat agricultural land. The site is surrounded by open agricultural lands cultivated with olive and citrus trees Residential buildings border the site on the northeast side

ST-006B	Al Nusairat Municipality.	Municipal land	The site area is 1,000 m^2, located in agricultural land. The site is surrounded by citrus and olive orchards. Al Nusairat Vegetables Market and a reservoir under construction are located about 100 m to the north east of the site. A private small desalination unit is adjacent to the north eastern border of the site
ST-007	Al Zawaida Municipality, about 840 m to the west of Salaheldein Road.	Municipal land.	The site area is 840 m^2, located in agricultural land and surrounded by mixed agricultural lands A residential building is located about 20 m to the north eastern border of the site.
ST-009	Al Qarara Municipality, about 1.1 km from the eastern border of the Gaza Strip.	Governmental land	The site area is 1,600 m^2, located in a flat agricultural land. The site is surrounded by open agricultural lands Two residential buildings are located about 20 m and 40 m to the northwest and to the northeast of the site, respectively.
ST-011	Khanyounis, about 1 km to the west of the Sikka Road	Governmental land	The site area is 2,880 m^2, located in a flat empty sandy land. Khanyounis cemetery is only 10 m to the south of the site. A mosque is located about 60 m to the east of the site Residential buildings are found to the north and the north west of the site.
ST-017	Abasan Aljadeeda Municipality, about 900 m from the eastern border of the Gaza Strip Access road is sandy and is 6 m wide.	Municipal land	The site area is 1,200 m^2, located in a flat agricultural land. The site is surrounded by agricultural lands from all sides. The nearest residential building is about 110 m away.
ST-033B (Al Israa)	Khanyounis, about 1 km to the north west of Hamad City residential compound	Governmental land	The site area is 3,000 m^2 located in a sand dunes flat land Greenhouses are found about 260 m to the south of the site. A residential complex is about 300 m to the south east of the site. Recreational resort is located about 400 m to the west of the site.
ST – 015B	Rafah, about 750 m to the north of Salaheldein Road Access road is sandy, 8 m wide and passes by two primary schools.	Governmental land	The site area is 1,800 m^2, located in flat sandy land. The site's western border is adjacent to a primary school. Surrounding areas to the south, east and north are mainly agricultural lands (open and greenhouses) with some scattered residential buildings; the nearest building is more than m away from the site.
TRC (ST-039B)	Rafah, 100 m to the north west of Muraj road Access road is paved and is 8 m wide.	Governmental land	The site area is 1,800 m^2 and is mainly sand dunes. Adjacent to an existing water reservoir. Areas to the north and west of the site are either sand dunes or agricultural lands, while areas to the north and east of the reservoir are agricultural and residential areas. No residential buildings exist at distance less than 150 m.
ST-015A (Al Salam)	Rafah, about 200 m away from the southern border of the Gaza Strip	Municipal land	The site area is 1,500 m^2, located in flat agricultural land The surrounding areas are mixed agricultural residential lands. Residential buildings are found 40 m from the south eastern border of the site

5.2. Physical Environment

Climate. The climate of the Gaza Strip is characterized by short, mild winters with rainy periods and a hot, dry summer. The Gaza Strip forms a transitional zone between the semi-humid coastal area in the north, and the semi-arid Sinai desert to the south. The average daily mean temperature ranges from 26.5 to 13.8 ˚C, depending on the season. Winds are predominantly onshore from the Mediterranean and in late spring the Sirocco hot dry wind blows from the desert in the south. The daily relative humidity fluctuates between 60% and 85%. Over the Gaza Strip rainfall mainly occurs in the winter months, with peak months for rainfall being December and January, and the average annual precipitation being 360 mm/year, decreasing notably from north to south. The average annual evaporation rate is around 1,900 mm/y (5.2 mm/day).

Geology, soils and topography. The geology of the Gaza Strip is composed primarily of calcareous sandstone from the Pliocene Pleistocene age, unconsolidated sands, and layers of clay. In terms of topography, the area is characterized by elongated ridges and depressions, dry streambeds and shifting sand dunes. The ridges and depression generally extend in an NNE-SSW direction, parallel to the coastline. The general geological formations for the proposed reservoirs and pumping stations sites are very similar among each other: flat areas with a superficial layer of sand, clay or clayey sand is found underlain by a Kurkar layer (calcareous sandstone), which overlies a sandstone layer.

Ambient air quality. According to the existing limited data available, values for NO_2, SO_2 and CO air concentrations were significantly below the limits set by the applicable national and international (European Union) standards. However, considerably high levels of PM_{10} and $PM_{2.5}$ were recorded at all sampling stations. According to the study conducted by the Environmental Protection and Research Institute (EPRI, 2006), the annual SO_2 concentration over the Gaza Strip ranges between the 60 µg/m^3 recorded in Khanyounis and the 180 µg/m^3 registered in the Gaza Governorate, the most densely populated Governorate in the Strip and the one that concentrates most of the industrial activities.

Noise. Reservoirs and pumping stations sites are located in open rural suburban areas, with no major industrial or traffic activities identified in the vicinity of the sites. Similar to the main carrier line, the locations of network pipes to be constructed or replaced will have a range of different noise levels, and as these are located within existing roads, it is likely that there is an existing high level of traffic noise at some locations on the larger roads. In general, the lowest noise level reached in locations with similar conditions of the proposed sites are above the Palestinian Standard for Outdoor Noise and the guidelines set by WHO for different receptors; 55 dB day time and 45 dB night time when the receptor is residential, institutional or educational and 70 dB at all times when the receptor is commercial or industrial.

Surface water bodies. There are three wadis, crossing the Gaza Strip at different locations: between Gaza city and the Middle Governorate (Wadi Gaza), the southern part of the Gaza Strip (Wadi Al Salqa), and the northern part of the Gaza Strip (Wadi Beit Hanoun). None of these wadis are crossed by the southern segment of the main Carrier that will be constructed under the Project.

Groundwater. The Coastal Aquifer Basin stretches along the eastern Mediterranean coast from the northern Sinai Peninsula in Egypt, via the Palestinian Gaza Strip into Israel. Being located downstream, the general direction of groundwater flow in the Gaza Strip follows the dip of the aquifer towards the coast. The western boundary of the aquifer follows the coastline, where both outflows of freshwater to the sea and inflows (intrusion) of seawater are observed. Local aquifer recharge in the Gaza Strip is very limited

and natural groundwater recharge from different sources is estimated to be around an average of 55-60 MCM/year. The groundwater level over the aquifer lies at depths varying between a few meters from the surface up to 90 m. A cone of depression is present in the aquifer in Rafah, with water level depth of about -19 below msl. The cone of depression in the southern Gaza Strip near Rafah and Khanyounis extends across the southwestern border of the Gaza Strip, thus potentially accelerating groundwater inflow from Egypt. There are significant existing groundwater quality problems in the Gaza Strip, caused by high salinity (Chloride) and high Nitrate (NO_3) concentrations.

Seismology. The Gaza area lies in a considerable distance from the Jordan rift area. According to the seismic hazard distribution map, prepared by the WHO (WHO, 2010), the seismic hazard in the Gaza Strip is medium with a peak ground acceleration (PGA) factor of (0.8 - 2.4) meter per second squared (m/s^2).

5.3. Terrestrial biological resources

No specific significant floristic species are witnessed in the Project area area, other than the regular common species (trees, shrubs and herbaceous plants) in addition to many agricultural fields that provide refuge to wildlife species, especially birds.[2] The sites selected for the construction of reservoirs and pumping stations are either inhabited, habited by short-lived herbs which have no conservation value or cultivated by farmers with seasonal crops.

Wild mammals. Most of the mammals recorded in Gaza are rodents. The Palestine Mole-rat *Spalax leucodon ehrenbergi* is an endemic species to the area. The Red Fox *Vulpes vulpes* has also been found to breed in many localities in the Gaza Strip. Long-eared Hedgehog Hemiechinus auritus and Ethiopian Hedgehog Paraechinus aethiopicus are sometimes trapped or hunted for food purposes. While the Palestine Mole-rat has not yet been evaluated by IUCN Red List of Threatened Species, the Red Fox V. vulpes, the Ethiopian Hedgehog P. aethiopicus and the long-eared Hedgehog H. auritus were all of least concern with stable population trend.

Wild birds. Surveys of bird fauna revealed the occurrence of about 50 passerine and non-passerine bird species (Table 5-5), Many of these bird species are commonly and illegally hunted in the Gaza Strip for different reasons including game, trade and food. These include: The Common Quail *Coturnix coturnix, Chukar Alectoris chukar*, Doves *Streptopelia* spp., Finches *Carduelis* spp., and many others. The Lesser Kestrel *Falco naummani* and the Common Kestrel *Falco tinnunculus* are globally threatened species and they are commonly hunted by local bird hunters. Many of these species nest in the wetlands of the Wadi Gaza, located to the North of the Project area.

Reptiles. The arid to semi-arid nature of the Gaza Strip attracts many reptilian species, consisting of principal categories such as snakes, lizards and turtles. The Greece or Spur-thighed Tortoise *Testudo graeca* is a commonly occurring species. It is commonly caught and reared as a pet animal in many Palestinian homes. Lizards are very common in both wild and agricultural places in the Gaza Strip. The Desert Monitor *Varanus griseus* is the largest lizard species in the Gaza Strip. According to IUCN Red list criteria the Spur-thighed Tortoise, *T. graeca* was identified as globally vulnerable, an animal species that is likely to become endangered. Agama and Palestine Viper were both categorized as of least concern with

[2] The only critical location in the Gaza Strip is the Wadi Gaza, which is designated as environmentally protected area. However, the Wadi is outside of the area of influence of the works included in the scope of the "Associated Works Phase I" Project.

a stable and an unknown population trend respectively. Other reptiles have not been evaluated by IUCN Red List yet.

5.4. Historical and cultural Heritage

No archaeological sites are found in the proposed locations for different Project components. Based on desk study review, observations from the conducted site visits, and consultation with the stakeholders, it is confirmed that no traces of archaeological and cultural heritage have been found at the proposed project sites. It is therefore considered that no historical or cultural resources will be affected in the site locations. However, if any archaeology is discovered during construction, the chance find procedures will be used; work activities will to be stopped immediately and the responsible competent authority (MoTA) needs to be contacted. Work will not be allowed to proceed without a written approval from the relevant agencies.

5.5. Existing infrastructure

Energy and electricity. Currently Gaza Strip is undergoing a chronic electricity crisis, as rolling power cuts occur from 12 to 18 hours daily leading to a very unpredictable and discontinuous supply. The three sources of electricity supply in Gaza Strip (connections from Egypt, Israel and the Gaza Power Plant (GPP)) only meet around 45% of the estimated 470 MW per day electricity demand. This is a critical constraint to the proposed projects because the existing power supply is inadequate and unreliable to provide the required electricity to ensure the full and reliable operation of the proposed pumping stations, reservoirs, internal networks and supporting facilities.

Solid waste management. Dumping waste in open landfills is the current practice of waste disposal in Gaza Strip. Three central dump sites are located in the eastern part of the Gaza Strip: Johr El Deek landfill, located southeast of Gaza municipality (unprotected dump site); the Deir El Balah landfill (lined but exceeding maximum capacity), which is located east of Deir Al Balah municipality; and the Al Fukhari landfill located east of Rafah municipality (unprotected dump site).

Sanitation. In general, the Gaza Strip wastewater network is developed as conventional, gravity systems. They are designed to be separate from storm drainage. However, the separation is not fully effective and storm flows do enter the sewers in the frequent winter storms. According to the National Water and Wastewater Strategy for Palestine (PWA, 2013), the coverage of the wastewater network in the Northern area is around 80%, Gaza City around 90%, the Middle area 75%, Khanyounis 40% and Rafah 75%.

5.6. Water supply services in the project area

Groundwater from the coastal aquifer forms the main source of water in the Gaza Strip. This resource provides about 89% of all water supplies. There are 25 municipalities responsible for providing domestic water through municipal wells distributed over the Gaza Strip municipal areas. Water quality is far below the internationally recommended standards for certain parameters and is considered to have severe negative impacts on the public health. Only 19.3% of the municipal wells register chloride concentrations below the 250 mg/l threshold set by WHO. As for Nitrates only 12.4% of municipal wells complied with the concentration limits recommended by WHO. Moreover, water availability is also an issue, service is

intermittent and the distributed volume in Rafah and Khanyounis municipalities is below the 70 liters per person per day.

Due to the poor quality of municipal water supply services, the majority of the population relies on the private sector to satisfy their drinking water needs, using piped water for other domestic uses. The price of this water varies from plant to another and from distributer to another. The current cost per 1 m^3 of purchased desalinated drinking water from private vendors is approximately 30 NIS. There are 154 working private desalination units, with different capacities, distributed along the five governorates of the Gaza Strip. The number of operating staff ranges between 1 to 15 workers for each plant. The majority of these units are located in Gaza Governorate (33.1%). Only around 31% of the working active plants are licensed by PWA, of which only 10% have valid license up to 31-December 2015. The main reason is the costly complicated procedure and requirements for licensing these plants. The estimated daily average production of all the plants in summer is 13,128 m3/d and in winter is 8,656 m3/d. The produced water is distributed to consumers by plant distributors (owner tanks) or by water vendors (private trucks owners) or both.

5.7. Socio-economic conditions

Population and demographics. The total population in the Gaza Strip reached 2,015,644 inhabitants at the end of 2016. The highest population is found in Gaza governorate exceeding 778 thousand inhabitants, followed by approximately 391 thousand inhabitants in Khanyounis governorate while the lowest was reported in Rafah with more than 250 thousand inhabitants. The population of the northern governorates reached nearly 328 thousand inhabitants and 283 thousand inhabitants in the Middle Governorates (MoI, 2016). The average annual population growth is 3.41%. The growth rate is expected to slow down slightly as a result of changes in education and family structure, as has been observed in other Mediterranean countries. Individuals aged 0 to 14 have the highest percentage among other age groups in the Gaza Strip as they account for 44.78% of the total population. The elderly population aged 65 years and over constituted 2.54% of the total population.

Education. The 2017 overall illiteracy rate in the Gaza strip has reached around 2.8%. The rate among Palestinians aged 15 and above amounted to 4.7% of the population, 2.9% for males and 9.1% for females. The prevailing social, economic, and political circumstances force many to discontinue formal education. In Rafah governorate, illiteracy rate of 3.8% has been reported which is considered high compared to Gaza 2.4% and the Northern governorate 2.8%.

Public Health. Waterborne diseases have very high incidence in the Gaza Strip. Hepatitis A remains a major cause of morbidity among reportable infectious diseases among the refugee population of the Gaza Strip (UNRWA, 2011). On the other hand, recent reports show a clear increasing trend in the incidence of diarrhea between 2009 and 2013; and was the highest self-reported disease in Gaza city in 2006. Parasitic infections are also a public health problem in Gaza. Other diseases with high morbidity rates in the Gaza Strip include the blue baby syndrome (associated with high nitrites concentrations in water); Typhoid fever; meningitis and kidney failure.

Employment and work force. Unemployment in the Gaza strip has been persistently high. In 2017 the general unemployment rate was 44%, 71.5% of unemployment rate among the female population and 36.2% for males. The majority of the employed young people work in the service sector, followed by

commerce and agriculture. Many jobs are characterized by daily wages and short-term contracts. In 2017, the average daily wage recorded in the Gaza Strip was NIS 59.5 per day. Although this might be a relatively higher rate compared to other developing countries, it is still too low to allow families to meet daily basic needs, given relatively high prices for basic commodities. The incidence of extreme poverty in Gaza is over 65%. The number of people receiving financial support from international relief agencies is more than a million, which represents 50% of the population in Gaza.

Economic activities and sectors. The agriculture sector has been the largest economic sector in the Gaza Strip and still plays an important role in the economy. According to records over the past 20 years, the cultivated land area in the Gaza Strip covers 8.4% of the entire cultivated land in the Palestinian Territories. Irrigated agriculture comprises about 45% of the cultivated land in Gaza and consumes about 60% of the water abstracted.

6. Environmental and social impact assessment

6.1. Impacts of land use and land ownership

Reservoirs and pumping stations. Official land-swap agreements between the municipalities and the land owners of the previously privately-owned lands have been made to guarantee appropriate compensation from loss of cultivated land and a potential source of income. During the construction of the 10 proposed reservoirs and the 2 pumping stations, localized impacts are anticipated on land use within the proposed sites and surroundings. Small scale agricultural areas will be lost at 6 reservoirs and the 2 pumping stations as these sites are currently used for agricultural activities. These 8 sites are scattered all over the South and Middle Governorates of the Gaza Strip and have small areas per site ranging from 840 to 2,600 m^2 for the reservoirs and from 375 to 6,000 m^2 for the pumping stations sites. The proposed sites are mostly cultivated with seasonal crops. The total agricultural area that will be permanently lost for the construction of the 6 reservoirs and the pumping stations is 16,540 m^2. This area is relatively small and scattered along the Gaza strip. Reservior ST-011 in Khanyounis is just opposite to an Islamic cemetery. Reservior ST – 015B in Rafah is adjacent to a primary school. The function of these facilities may be negatively affected during construction activities. However, appropriate mitigation measures and monitoring will minimize these impacts.

Pipelines. The main carrier will pass through the Khanyounis Wednesday Market where the pipeline will extend for 450m. Construction activities in this section will disturb business activities in the area. However, this disturbance is of localized nature and will last for a limited time. The proposed transmission loops and the internal network replacements will be within the public right-of-way of existing roads. The existing roads are either paved, unpaved or interlock; with or without sidewalks. Excavated roads will be temporarily blocked; however, they will be reinstated to their original status within the trenched area, after the installation of the water pipes.

6.2. Impacts on the physical environment

Air quality. Potential impacts during the construction phase include: (i) dust generation and gas emissions leading to the reduction of air quality; (ii) nuisance to the local community in the vicinity of the construction sites; (iii) indirect impacts on human health: (iv) dust accumulation on adjacent vegetation;

and (v) limited odors release caused by construction vehicles. The workers and construction staff will be at *high risk* due to proximity and long period of exposure to the *health hazards* of *dust* and gas *emissions*. The neighborhood public, the pedestrians, and the temporary workers will be at *low risk* due to the short time and lower frequency of exposure to the dust and gas emission *health hazards*. During the operational phase, the impact on air quality is associated to the operation of the standby power generators installed in the pumping stations and reservoirs sites. The use of these generators is meant to be limited, as all of the pumping facilities in the project sites will be equipped with photovoltaic energy generation systems.

Noise. Potential impacts of noise during construction and operational phases include: (i) nuisance and health impacts on workers and local residents; and (ii) disturbance to terrestrial fauna. The workers and construction staff will be at *high risk* due to proximity and long period of exposure to the health hazards of *noise*. The neighborhood public, the pedestrians, and the temporary workers will be at *low risk* due to the short time and lower frequency of exposure to the *noise health hazards*.

Soil contamination. Potential impacts on soil during construction include: (i) loss of vegetation cover and soil erosion by wind and water due to soil structure disturbance by excavation; (ii) landslides and other types of soil movements in work areas; and (iii) possible soil pollution due to spillage from machinery and construction materials. There is no impact on soil quality during the operation phase.

Groundwater. Potential impacts on groundwater during construction include potential pollution of groundwater from excavations or from pollutant spillages during construction. Groundwater will be at *low risk* of pollution from the exposure to *spillage hazard*s due to the shallow excavation and deep aquifer in all the project areas. During the operation phase the project is expected to contribute to reduce the volume of groundwater withdrawals and, indirectly, mitigate the saline intrusion phenomena and the degradation of groundwater quality.

Surface water. Proposed works under the Project are not located in the vicinity of any of the wadis crossing the Gaza strip. Therefore, no impacts to surface water resources are anticipated.

6.3. Impacts of biological resources

Potential impacts on biological resources are considered as an insignificant risk. No traces of significant or sensitive biological resources or habitat or species of high conservation value (flora or fauna) have been found within the proposed project sites, nor along the route of the pipes. Most of the excavation works for network pipeline installations will be in urban areas that lack significant flora or fauna diversity. Most floristic species identified are herbal types that are characterized by short-lived style and rapid ecological colonization. With regard to faunistic species, there is potential that some common species of no conservation value will lose access to habitat during construction on the proposed project sites. There are slight chances of encountering smaller resident mammals such as birds, hedgehogs, and reptiles such as desert monitors in the proposed sites of reservoirs and pumping stations.

6.4. Impact of the transboundary Coastal aquifer

The Project activities will not adversely affect the quantity or quality of groundwater flows to other riparian country in any significant way and will not be adversely affected by the other riparian's possible water use. The PWA conducted two groundwater model simulations related to the aquifer and the results indicated an average transboundary flow across the border with Egypt of around 0.5 MCM annually

considering the current withdrawals from the 141 municipal water wells that are operated in the middle and southern governorates in Gaza, including 4 wells in proximity of the border (within 1 km distance). The model incorporated water withdrawals data on the Egyptian side from the year 1973 with a linear extrapolation based on agricultural and urban growth collected from historical data and recent publications. The abstraction from the aquifer in the modified water supply scheme that will be implemented through the Project, will drop from the current value of 33.1 MCM annually to a value of 18.65 MCM once the project implementation is complete. A net reduction of around 44% of the current abstraction is expected to make the transboundary flow across the border closer to zero.

6.5. Impacts on cultural heritage

Risk of potential impacts on cultural heritage is considered low. Potential impacts on cultural heritage during construction include: (i) disturbance to culturally valuable areas to the local community; (ii) disturbance to unknown / buried archaeology during excavations. No traces of archaeological and cultural heritage have been identified in the sites where project activities will be implemented.

6.6. Impacts on existing infrastructure

Utilities and public services. Potential impacts on existing public service utilities during construction include: (i) the interruption of public service supplies due to accidental damage during excavation to buried utility installations; and/or (ii) risk on public health and surrounding environment due to the spill of raw sewage from damaged sewers.

Potential impact on roads and traffic. Potential impacts on existing roads and traffic during construction include: (i) damage to road infrastructure from excavations and construction traffic especially the movement of heavy machinery; and (ii) disruption of traffic including vehicles and pedestrians' movements and risking public safety. The *risk* of traffic to be interrupted due to the construction works of the main carrier and the main transmission pipes is assessed to be as *high risk*. Accordingly, the *risk* of accidents between vehicles and accidents with pedestrians is assessed as *high risk*.

Energy and electricity. Potential impacts on electricity supply during construction are related to accidental damage during excavations to existing electric utilities infrastructures such as electrical cables and poles. Potential impacts on energy use during operation include: (i) increased demand on energy to operate the pumping stations; (ii) shortage of electricity supplies if the additional demand of the new pumping stations is solved at the expense the local community: (iii) failure to provide sufficient power supply to ensure the operation of the proposed facility; and (iv) interruptions in power supply could cause damage to the project infrastructure due to surges or loadings.

Solid waste management and disposal. Potential impacts of solid waste during construction include: (i) the generation of demand for additional landfill capacity that could eventually not be satisfied; (ii) harm to human health or the environment from improper handling, transport and disposal of waste: and (iii) unfavorable impact on the aesthetics of the area due to solid waste accumulation. There are not expected to be any particular significant issues for solid waste disposal during operation phase.

Hazardous materials and waste. Two possible sources of hazardous waste are expected during the construction of the project components under this project; presence of old Asbestos Cement (AC) pipes

and use of epoxy paint for the insulation of the internal surfaces of the reservoirs. Potential impacts of hazardous material and waste during construction include: (i) harm to human health from contact with substances and waste; and (ii) indirect impacts on surface or groundwater quality from accidental discharge of hazardous waste. As for the operational phase, the only chemical of concern in the operational stage is sodium hypochlorite that will be used as a disinfectant in the proposed reservoirs to be constructed under this project. Exposure to sodium hypochlorite may cause skin and eye irritation or other allergic responses. Long exposure to this chemical may lead serious allergies especially to the respiratory system. The proposed automated chlorination feed equipment will control the dosing of the chemical via feed lines, minimizing the direct contact of the operator with the chemical.

Sanitation and wastewater generation. Potential impacts on wastewater infrastructure during operation include the risk of overloading the existing wastewater infrastructure due to additional wastewater generation as a result of the increased water supply after the construction of Project. A considerable increase of water supply will take place (around 50% increase) and the NRW is expected to be reduced to 20% by 2035 compared to the current rate of 40%. Based on these estimates, it is expected that some parts of the existing wastewater collection system will need to be upgraded in the medium term to be able to accommodate the additional flow. PWA is already working in the engineering designs for increasing the capacity of the Rafah wastewater treatment plant.

Drinking water supply. The project will contribute to significantly improve drinking water quality and availability. Potential impacts on water supply and water quality during construction include: (i) interruption of water supply services to local communities; and (ii) risk of water pollution from wastewater leakage or oil spillage from construction equipment. These risks are however classified as low.

6.7. Disturbance of the visual landscape

Impacts on landscape during the construction and operational phases relate to potential visual intrusion. The main concern about the landscape during operation is the architectural shape of the new facilities (reservoirs and pumping stations). As illustrated in site descriptions, most of the sites are either located in an agricultural area or a sand-dune lands. Thus, the architectural design of these facilities should harmonize with the surrounding landscaping. Moreover, the facilities if not maintained will cause serious visual intrusion and discomfort for the surrounding community.

6.8. Socio-economic impacts

The project will have both positive and negative socioeconomic impacts in the short term during the construction phase. The main carrier line will pass through the Khanyounis market where several merchants could be affected by construction activities. On the positive side, construction activities are expected to generate considerable positive impact through job creation. Employment will also be generated in the long term for the operation and maintenance of the new bulk water supply system.

The population of the Southern and Middle Governorates of the Gaza strip will benefit from the improvement of the quality, continuity and affordability of drinking water supply. On the other hand, these benefits for the wider population could have a negative impact on the owners and workers operating privately owned desalination facilities and water trucking services. The latter may progressively

loose part of their clientele and revenue stream as families could increasingly use the municipal water network as their main source of drinking water as services improve. This negative impact is not expected to materialize in the short or the medium term due to the timeframe required for the implementation of the Project and, more importantly, the timeframe required to build citizens' trust on municipal service providers.

The positive impacts of the project could be limited by the potential failure of beneficiaries to pay water tariffs and to maintain their internal household plumbing system in proper condition. The project aims at providing safe water for the targeted families. This however, is not possible when internal household water network is not maintained. On the other hand, while the significant capital expenditures required for the Project are covered by the donor community, to ensure the sustainability of bulk water supply system the running cost must be at least partially covered through tariff revenues. This will require important improvements in commercial management practices of municipal service providers.

6.9. Cumulative impacts from proposed projects

Cumulative construction impacts from the simultaneous construction of multiple projects. Individual minor construction impacts from multiple projects in the same area may collectively impose more significant cumulative impacts. The construction of the proposed Project may coincide in time with other major infrastructural projects conducted by other funding agencies in Gaza Strip as part of the Gaza Recovery Plan, or with the implementation of other components of the GSWSP. These other parallel GSWSP interventions could be the construction of the GCDP or the expansion of the Deir Al Balah 6000 m^3/d STLV desalination plant for an additional capacity of 14,000m^3/d (project financed by EU, currently in the design stage).

Cumulative impacts from integrating new water supply infrastructure facilities. The proposed Project will have a *high significant beneficial cumulative impact* together with other projects considered under the GSWSP, as they will significantly improve overall water supply services in Gaza Strip and therefore the livelihood of benefiting communities.

7. Public consultations

Relevant project stakeholders and project affected people and communities were consulted during the formulation of the ESIA. These included representatives of public institutions such and ministries, municipal governments and others; managers and directors of schools and health centers located within the area of influence of the project; local leaders; civil society and community organizations; and owners business that could be potentially affected by the project and owners and workers of privately-owned desalination units and associated water distribution business (truckers). Different mechanisms were used to gather the inputs and feedback of Project stakeholders for the formulation of the ESIA, These included consultation sessions -both in the scoping phase and after the preparation of the first draft of the ESIA-, semi-structured interviews, and key informant meetings.

Consultations performed during the ESIA scoping process. the first public consultation session was conducted on October 13, 2017 at Roots Hotel in Gaza to identify the issues to be covered by the ESIA and to gain an understanding of the concerns of the stakeholders. The session was attended by 50 representatives of relevant Palestinian authorities, international Non-governmental Organizations and

local civil society organizations representing local community groups that are directly involved in or affected by the proposed Project components. The results from the discussion during the Scoping Session were evaluated and compiled into a scoping document and were considered during the preparation of the first draft of the study.

Surveys interviews and meetings. A field survey was undertaken to identify business of the Khanyounis Market that could be affected by the construction of the south segment of the main carrier. Semi-structured interviews were conducted with identified business owners, as well as with owners of privately-owned desalination units.

Consultations of the first draft of the ESIA. The second public consultation session was conducted on December 11, 2017 at Roots Hotel in Gaza, after the preparation of the first draft of the ESIA report. The session was attended by about 65 participants from different groups who are directly or indirectly affected by the project. The session served for participants to present and discuss their concerns about the potential impact of the project, clarify their doubts and gather their inputs for the finalization of the ESIA and the ESMP. These inputs were incorporated in the final version of the ESIA.

8. Grievance redress mechanism

A grievance redress mechanism (GRM) has been developed to manage and address questions, concerns and complaints that may be risen by Project Affected Persons (PAP) during project implementation. This GRM was developed to deal with grievances associated exclusively with this specific Project. The main components of the GRM system are: (i) the complaint receiving and processing center; (ii) the complaints receiving channels; (iii) the different levels of complaint escalation and treatment; and (iv) the complaints handling mechanism. Each of these elements are briefly described here below.

Complaints receiving and processing center. Project Management and Support Unit (PMSU) at PWA will be responsible for managing the grievance redress process. A complaint office will be established at the project sites to receive and process the complaints from PAPs. The complaint office will be headed by a grievance redressal officer (GRO) assigned by the PMSU.

Complaints receiving channels. PAP will be able to communicate with the GRO through the following channels: (i) telephone (both mobile and landlines); (ii) fax; (iii) email; (iv) Facebook and other social media; (v) through the social management specialists appointed by contractors during the construction phase or through the operators during the operational phase; and (vi) through the workshops, meetings and events organized by the GRO in different Project locations. PAP will be informed through local media, social media, community leader offices, signs installed in project sites and selected shops and community centers about the existence of the GRM and the different ways available for them to reach the GRO.

Levels of complaint escalation and treatment. PAPs will be able to escalate their complaints to higher levels of management if they are not satisfied with the response/solution proposed by the GRO. Thus, the project level grievance redressal system is composed of two complaint levels: (i) the GRO level; and (ii) the grievance redress committee (GRC) level. The GRC will be integrated by the head of the PMSU at PWA, the GRO and an external independent expert specialized in the areas related to the specific complaint. Moreover, besides the Project GRM system, PAPs could address their complaints to alternative mechanisms of resolution such as the civil courts.

Complaints handling mechanism. The main steps of the following: (i) reception and recording of the complaint in a dedicated database managed by the GRO; (ii) screening and assessment of the complaint to ensure that is related to the Project and that it is meant to be addressed through the GRM; (iii) taking a decision and formulating the response; (iv) communicating the response/proposed solution to the affected people; and (v) tracking and evaluating the results.

9. Environmental and social management plan (ESMP)

The ESMP identifies feasible and cost-effective measures required for monitoring, preventing and/or minimizing potential negative environmental and social impacts during project implementation. The ESMP: (i) proposes mitigation measures to avoid, reduce, minimize, compensate or offset significant adverse risks and impacts identified and assessed in the ESIA; (ii) identifies the responsible party for

implementation and for supervision of the implementation of proposed mitigation measures; (iii) defines the time frame for implementation, monitoring and assessment of the results of the proposed mitigation measures; (iv) proposed the required monitoring and assessment methodology and indicators; and (v) estimates the budget required for its implementation. Tables ES.3 and ES.4 located at the end of the executive summary summarize the key risks and impacts, along with the associated mitigation measures proposed by the ESMP. The estimated budget required for its implementation is US$199,000.

Table ES.3: Summary of Mitigation Measures during the Construction Phase

Chapter	Potential Impact	Mitigation Measures
Land Use, Land Ownership and Private Property	• Loss of existing small-scale agricultural areas. • Effects on local communities that use existing land. • Indirect impacts on other receptors including local communities, agriculture and biodiversity. • Blocking of excavated roads.	• Keep copies of official land ownership documentation at all times in the construction site offices, including agreements on the demolition and removal of obstructing structures. • Verify right-of-way continuously as a follow up to the design and planning phase measures, prior to installation of water pipelines. • Protect and do not remove trees and plants (including root systems). However, if it is necessary to uproot any plant or tree, then it should be replanted in a location that is agreed upon by the appropriate authorities and landowners. • Prohibit filling, excavating, trenching, or stockpiling of materials or waste on private or agricultural land, except as approved by the landowner. Excavated materials should be reused as fill, re-shaping, or restoration purposes wherever they meet the required standards. Refer to the Planning Phase measures regarding informing of landowners. • Minimize dust but applying dust control measures, and avoid leaks and spills of contaminants, so that current and future land use is not endangered. • Restore original site characteristics after the project activities are completed as much as practical. • Reinstate the damaged infrastructures due to the installation of the pipelines in the main paved roads. • Scheduling the construction of reservoir ST–015B in Rafah that is adjacent to the school and Jabalia reservoir BL-T01B adjacent to the kindergarten to be implemented in the summer holiday and /or to limit the daily work activities after the school hours. • Reinstate any accidental damage to existing structures and private property caused by construction activities. Construction activities shall be performed with care and following good practice to ensure protecting existing structures within the vicinity of construction from damage. • Provide a buffer zone from construction sites with clear signage to minimize impacts on local business and recreational activities during construction of the reservoirs and pumping stations.

Chapter	Potential Impact	Mitigation Measures
Physical Environment		
Air Quality	• Dust generation and gas emissions leading to the reduction of air quality. • Nuisance to neighboring local communities. • Indirect impacts on human health. • Dust accumulation on adjacent vegetation. • Limited odors release out of construction vehicles.	• Apply best management practices during construction to minimize the impact on air quality from dust and emissions. • Wet or cover securely stockpiles of materials especially during windy conditions. • Issue site workers with dust masks and appropriate personal protection equipment. • Cover truck loads when transporting fine materials. • Transport spoils piles in covered trucks. • Plan vehicle movements and do not overload vehicles, especially trucks to minimize exhaust emissions. • Water spray construction site and stockpiles to minimize dust generation. • Control the speed of transporting vehicles, select transportation routes to minimize dust impact on sensitive receivers and wash truck tires before leaving the construction site. • Schedule and monitor activities such as excavation and backfilling which have a higher risk of dust release. • Assure the use of well-maintained mechanical construction equipment. • Comply with relevant local emission standards from vehicles and heavy equipment where available and applicable.
Noise	• Nuisance and health impacts on workers and local residents • Disturbance to terrestrial fauna.	• Identify locally sensitive receptors where noise limits shall be monitored and controlled. • Comply with Palestinian Labor Law regarding provision of protective hearing devices and appropriate safety equipment to workers on construction sites, where construction works are expected to produce noise over an appropriate level. • Limit noise to acceptable magnitude and duration, particularly near sensitive receptors. Comply with local standards and regulations regarding noise levels including the Palestinian Standard Institution Noise standard for the Outdoor Environment PS 840 – 2005. • Apply OSHA 1910.95 (a) and OSHA 1910.95 (b) regarding exposure periods to different noise levels. • Provide well-maintained construction vehicles and machinery, in order to minimize noise. Environmental Assessment Report • Give advance warning to residents and business owners when heavy machinery and loud equipment are expected to be used around residents and businesses. • Install and maintain mufflers on construction equipment. • Restrict the movement of machinery within project boundaries and plan vehicle movements to and from sites. • Prohibit operating heavy or noisy machinery between the hours of 6:00 pm (18.00) and 6:00 am during working days and all-day during Fridays or designated local holidays (unless the public will be best served during these hours and approval has been provided by local government and surrounding residents). • Schedule working hours and work days taking into consideration sensitive receptors such as existing places of worship and schools, to avoid using heavy machinery during prayers times and school hours as much as possible. • Coordinate closely with the nearby schools and other public facilities.
Soil Quality	• Loss of vegetation cover and venerability to soil erosion by wind and water due to soil structure disturbance by excavation.	• Install and maintain soil erosion and sediment control measures, such as swales, grade stabilization structures, dikes, waterways, filter fabric fences and sediment basins until erosion concerns are eliminated. • Provide well-maintained construction vehicles and machinery, in order to minimize pollutant spillages. • Control the movement of machinery within the project boundaries.

	• Landslides and other types of soil movements in the works areas. • Possible soil pollution due to spillage from machinery and construction materials	• Protect soil from spills and/or disposal of sanitary, oil, hazardous materials, and any other possible contaminants. • Inform the responsible authorities through PWA immediately if any soil contamination accidents occur. Suitable solutions must be administered to handle the situation in order to avoid risks on human health or the environment. • Abide by local laws concerning weights and speeds of vehicles that transport construction materials to and from construction to avoid top-soil compaction. • Ensure that staging areas used in this project are fenced and marked prior to construction activities. • Lightly compact topsoil during or after replacement over any graded areas to prevent erosion. • Ensure that excavated soils are properly stored for refill and reuse. • Replace topsoil in original locations from all graded or excavated areas that support or could support vegetation or move to an area for potential reuse. • Restore, as far as practical, to the original site characteristics. support or could support vegetation or move to an area for potential reuse. • Restore, as far as practical, to the original site characteristics.
Groundwater	• Pollution of groundwater from excavations or from pollutant spillages during construction	• As built drawing of existing sewage collection system submitted to the contractor wherever is available. • Physical inspection for existing cesspits and sanitary sewers should be performed before excavation works for pipelines to avoid wastewater spillage. • Ensure all necessary equipment is available and in good working condition and well maintained, along with backup power in order to minimize leaks and spills. • Maintain a clean construction site, and dispose of waste material at approved disposal site, to protect the existing groundwater resources from contamination by debris, soil and construction material.
Surface Water	• Hydrological changes linked to flooding and runoff during construction. • Formation of stagnant water ponds due to improper management of construction material storage and waste. • Water quality impacts from excavations or from pollutant spillages during construction	• Ensure that surface water and ditches are protected from spillages, construction waste and spoil, particularly if used as source of water for irrigation. • Ensure no sanitary, oil, hazardous materials, and any other possible contaminants will be spilled or buried in the sites areas. • Inform competent authorities of any spillage or contamination accidents to take appropriate action. • Provide approved designated protected areas for storage of spoil and excavated materials away from surface water. • Ensure that natural storm water flows or storm water systems are not blocked by excavations and constructed pipelines. • Minimize project activities that will create stagnant water ponds in areas susceptible to such impacts in rainy seasons. Drain stagnant water ponds if created. • Address the weather conditions and consider flooding potentials during heavy storms to guarantee the safety of workers and the public from flooding incidents. When necessary, retreat from the project construction area, and resume works when conditions are permissible.
Biodiversity	• Direct habitat loss or disturbance during construction site preparation. • Disturbance to or displacement of faunistic species during site clearance and construction.	• Limit working to daytime hours only because most mammalian species are of nocturnal life styles. • Install fencing or other suitable protection during project construction to prevent exposure of wild and domestic animals to construction hazards. • Prohibit hunting by workers and protect all migratory birds in the project site. • Protect trees and plants (including root systems). However, if it is necessary to uproot any plant or tree, then it should be replanted in a location that is agreed upon by the appropriate authorities and landowners. • Restore original site characteristics as far as possible after the sites are completed.

Historical and Archaeological Heritage	• Disturbance to culturally valuable areas to the local community. • Disturbance to unknown / buried archaeology during excavations.	• Watching brief during excavation work to identify any unknown buried archaeology on commencement of excavations. • If any archaeology is discovered during construction, the chance find procedures will be used; all construction activities will be stopped, and the responsible authority (MoTA) needs to be contacted. • Take all necessary precautions to protect and preserve assumed or identified archaeological and/or cultural sites. (Delineate the discovered site or area, secure the site to prevent any damage or loss of removable objects. In cases of removable antiquities or sensitive remains, a night guard shall be present until the responsible local authorities take over). • Work shall not start until proper authorization from relevant authorities is given in writing.
Existing Infrastructure		
Utilities and Public Services	• Interruption of public service supplies due to: (a) Accidental damage during excavation to existing utilities such as wastewater sewers, water pipes, communications and electrical cables; (b) Reallocation of some utilities to accommodate the new pipes. • Risk on public health and surrounding environment due to the spill of raw sewage from damaged sewers.	• Physical inspection for existing utilities should be performed before excavation works for all pipelines. • As built drawing should be collected and submitted to the contractor wherever is available. • Suggest new pipeline routes in coordination with the design team and local authorities if the relocation of existing utilities is not possible. • Repair the damage done to existing facilities during construction or replace the damaged items if repair is not possible. • Provide emergency services in a timely manner for residents in coordination with local councils. In case of accidental damaged to public utilities and services such as damage to water supply and electricity and disruption occurs for more than 12 hrs. • Utilize local authorities' utility emergency plans when disturbances in services occur. • Apply good practice construction management measures where unpredicted utility structures are encountered during construction. • Coordinating with utility companies (GEDECO, PALTEL, etc.), through PWA, on the removal of obstructions where encountered, prior to commencement of work in the project area if relocation activities are required; relocation activities of electric and telephone poles will not be part of the scope of the contractor's work.
Roads and Traffic movement	• Damage to road infrastructure from excavations and construction traffic especially the movement of heavy machinery. • Disruption of traffic including vehicles and pedestrians' movements and risking public safety.	• Prepare and submit Contractor's traffic plan for the Engineer's approval prior to starting any project activities for each road that will potentially be blocked during construction works. • Special care and planning shall be taken where transmission pipelines excavations and installation will be performed, for tight roads, busy roads and near public buildings such as schools and worship buildings. • Inform residents and the public of work schedules as well as with the management plans prepared by the contractor. • Organize and manage construction activities, so that traffic disruption and delays within construction zones are minimized. Measure shall be coordinated with the Municipality through PWA, for approval and minimal disturbance of local community. • Provide temporary alternative lanes and routes. Traffic shall be managed through or around construction zones to minimize disruptions. • Use flagmen and other appropriate means to direct traffic safely through and around construction zones, and to minimize conflicts between local traffic and construction vehicles. • Reinstate excavated roads up to approximately 1.3 m wide of trenched area after pipeline installation activities. Conform to design recommendations for the types of reinstatement including dirt roads, paved roads, and interlock roads. • Minimize the use of heavy machinery, as much as possible.

		• Control the movement of machinery within the project boundaries. • Prohibit operating heavy machinery between the hours of 6:00 pm (18.00) and 6:00 am during working days and all-day during Fridays or designated local holidays (unless the public will be best served during these hours and approval has been provided by local government and surrounding residents). • Ensure all safety measures and appropriate engineering practices while performing works on hillsides and steep slippery surfaces. • Abide by the local laws concerning weights and speeds of vehicles that transport construction materials to and from construction, storage and quarry sites, in order to minimize safety hazards, such as traffic accidents.
Energy and Electricity	• Accidental damage during excavations to existing electric utilities infrastructures such as electrical cables and poles. • Relocation of electrical cables and poles during the pipelines installation that will cause temporary interruption to public services.	• Physical inspection for existing electricity utilities should be performed before excavation works for all pipelines to avoid accidental damage of unknown buried cables. • As built drawing of buried electricity cables should be submitted to the contractor wherever is available. • Repair the damage done to existing electrical facilities during construction or replace the damaged items if repair is not possible. • Provide emergency services in a timely manner for residents in coordination with local councils. In case of accidental damaged to public utilities and services to electricity and disruption occurs for more than 12 hrs. • Coordinating with GEDECO, through PWA, prior to commencement of work in the project area if repair or relocation activities are required. • Inform the residents in advance through media and/or the community representatives of any relocation activities that may interrupt the public services. • Interruptions in power supply could cause damage to the project infrastructure due to surges or loadings.
Solid Waste Management and Disposal	• Generating demand for additional land fill capacity. • Harm to human health or the environment from improper handling, transport and disposal of waste. • Unfavorable impact on the aesthetics of the area due to solid waste accumulation. • Additional load on municipal waste management.	• Consider reducing generated constructed waste as much as possible. • Prepare a comprehensive site waste management plan prior to the commencement of construction activities, this should identify expected types and volumes of waste, how it will be stored and when and where it will be disposed of. • Apply good housekeeping practices at all times in all project sites, including approved designated and protected areas for temporary waste storage. • Prohibit filling, excavating, trenching, or stockpiling of materials or debris on private vegetation areas, except as approved by the landowner. Whenever possible, suitable excavated materials should be reused as fill, re-shaping, or for restoration purposes where they meet the required standards. • Ensure that Municipal waste garbage containers are relocated, if necessary, in a safe and accessible location in order to facilitate the work of Municipality for maintaining regular municipal waste collection schedules. • Burning of waste material of any type is prohibited.
Hazardous Material and Waste	• Harm to human health from contact with substances and waste. • Indirect impacts on surface or groundwater quality from accidental discharge of hazardous waste.	• Provide all necessary Personal Protective Equipment (PPEs) for handling hazardous material depending on type and status of material • Perform storage and disposal of residual hazardous material by an experienced professional, in coordination with local and competent authorities to identify appropriate disposal sites. • Identification the AC pipes locations along the construction sites with the help of the local municipalities, and PWA to minimize the risk of accidental crushing of AC pipes. • Seek professional help from specialists, if AC pipes are accidentally encountered. • Apply Asbestos Standards of the Occupational Safety and Health Administration (OSHA) in • 29 CFR 1910.1001 and 29 CFR 1926.1101 during construction activities at all times during handling asbestos material.

		• Asbestos waste of asbestos shall be handled according to NESHAP 40 CFR section 61.141 and labeling requirements in section 61.150 and transferred to the hazardous waste cell upon coordination and approval of competent authorities.
Sanitation and Wastewater Generation	• Accidental damage during excavations to existing utilities and structures, including cesspits and sewer pipes. • Need for relocation or temporary interruption public services. • Spills of raw sewage due to accidental damage of sewer lines or cesspits. • Indirect impacts on public and workers health from accidental raw sewage spills	• Physical inspection and inventory for existing cesspits should be performed before excavation works for all pipelines. • As built drawing for the sewage system should be submitted to the contractor wherever is available. • Repair the damage done to existing sewers during construction or replace the damaged items if repair is not possible. • Provide emergency services in a timely manner for residents with damaged cesspits. • Apply good practice construction management measures where unpredicted utility structures are encountered during construction. • Coordinating with local municipality on the removal of obstructions where encountered, prior to commencement of work in the project area if relocation of sewers is required. • Inform the local community in advance of the planned construction activities.
Water Supply and water Quality	• Interruption of water supply services to local communities. • Risk of water pollution from wastewater leakage or oil spillage from construction equipment.	• Physical inspection and inventory for existing water supply system and other utilities should be performed before excavation works for all pipelines. • As built drawing for the water supply and other service utilities should be submitted to the contractor wherever is available. • Repair the damage done to existing water supply pipelines during construction or replace the damaged items if repair is not possible. • Provide emergency services in a timely manner for residents with damaged water supply connections. • Apply good practice construction management measures where unpredicted utility structures are encountered during construction. • Coordinating with local municipality on the removal of obstructions where encountered, prior to commencement of work in the project area if relocation of sewers is required. • Inform the local community in advance of the planned construction activities.
Disturbance of visual landscape	• Visual intrusion. • Disturbance in existing landscape status.	• Keep construction sites clean and follow good housekeeping procedures. • Following best practices in stockpiling to minimize visual intrusion. • Following best practice procedures in solid waste management at and around the construction sites. • Control the movement of vehicles and equipment to minimize the impact on the landscape features. • Start the process of replanting trees in the fished sites and allow the vegetative cover to be restored.
Cumulative impact from proposed projects	• Cumulative construction impacts from the simultaneous construction of multiple projects. • Cumulative impacts from integrating new water supply infrastructure facilities.	• Collect information about projects that may coincide with this project. Coordinate development actions and construction efforts in order to minimize the impacts of each project and create synergistic benefits. • Coordinate between the various construction teams if two or more projects involve excavation in the same area (especially pipes installation), to minimize environmental disturbances and maximize use of energy and local resources where and when possible. • Verify the status of implementing local and regional plans with PWA and local municipalities against the proposed components of this project. By the time this project is set for tendering, the status of infrastructural settings in the project areas may have changed. Therefore, verify status to integrate different projects smoothly. This would eliminate redundant facilities and provide mechanisms to mitigate or avoid impacts.
Socio-Economic Conditions		

Markets along the main carrier line	• During the construction phase, the customers and sales will be reduced to the permanent shops; in addition, the temporary shops might be lost. • Disturbance to local businesses. • Reduced turnout of local community to local businesses and recreational areas near construction zones. • Reduced income generation from businesses.	• The construction phase should not last for more than ten days. • Good construction and traffic planning; • Phasing of construction work; and • Offering alternative spaces for traders • Provide a buffer zone from construction sites at market areas with clear signage to minimize impacts on local business. • Inform local businesses in the area of the intended construction starting date, schedule and duration prior to commencement of construction works, through flyers, mass media or corresponding Municipality, through coordination with the PWA. • If construction works to be conducted within open market areas coordinate with local municipality, through PWA to provide a temporary location for the merchants to stage stalls. • Avoid staging of construction material and machinery or stockpiling of construction waste outside the construction site in the market area.
Material for Construction	• Increased pressure on construction material demand. • Increased prices of construction material •	• Follow design recommendations where appropriate, as this issue has already been considered during the design phase for the selection of suitable, feasible and available construction material. • Follow lessons learnt and procedures that have been experienced by the previously conducted USAID construction projects in Gaza Strip, regarding coordination of material entry in advance. • Work closely with PWA, which is generally responsible for the coordination efforts for the delivery of construction material through Karm Abu Salem checkpoint.
Public and Occupational Health and Safety	• Physical hazards from falling and injuries. • Risks from movement of heavy machinery. • Physical hazards from contact with hazardous material. • Disturbances and impacts on the wellbeing of the local community. •	• Prepare, submit and implement Contractor's safety plan for Engineer's approval prior to starting any project activities. • Identify and isolate construction zones by using warning signs, pylons, fencing, and ribbon barriers. • Inform residents, and the public and commercial areas of work schedules as well as with the management plans prepared by the Contractor. • Take appropriate measures to prevent unauthorized persons from entering the work area. • Consider maintaining a safely accessible grazing site for herders to reach their regular site or provide an alternative site and route. • Implement safety measures to protect people from injury and adjacent property from damage. • Dispose waste and refuse properly. • Provide temporary bridges, safe pathways, handrails and any other safety measure during pipeline excavations and installation to protect roads' users from injuries as appropriate and needed. • Provide temporary shoring as appropriate and needed. • Provide adequate hearing protection, hard hats, safety goggles, brightly colored vests, and other appropriate safety equipment to protect workers and visitors from injury. • Provide all required safety personal protection equipment and appropriate communication means for divers undertaking regular quality control checks during the offshore construction activities of the brine outfall. • Apply special safety requirements for construction of elevated structures such as tanks. Provide appropriate scaffoldings, guard rails and personal protection equipment. • Apply the OSHA confined space safety measures (29 CFR 1910) and entry permits requirements, during tanks insulation and disinfection process. Ventilation openings, gas detector, ladder and body harness, and reliable communication devices must be provided during working inside tanks and chambers.

		• Apply the OSHA working from height measures (OSHA 29 CFR 1910.23 and 24) during the construction of proposed tanks and the installation of PV systems. Provide ladders, safe scaffolding, harnesses and any necessary PPE. • Provide first aid kits on construction sites and ensure the presence of personnel with the minimum first aid skills at construction site all times. • Include the locations of the hospitals and clinics nearest to the construction site within Contractor's safety plan, in case of illness or a construction accident. • Maintain portable toilet and hand washing area properly, with no leaks or spills to the surrounding area. Waste and refuse needs to be properly disposed of. • Consider suitable engineering and occupational health and safety practices during site preparation in areas where unprotected electrical cables and unstable objects are stored and exist. • Comply with seismic loads in design of tanks. • Provide emergency paths and exits where needed. • Confined Space Work (OSHA 29 CFR 1910) • Use safeguards to confine heat, sparks, and slag, and to protect the immovable fire hazards. • Maintain suitable fire extinguishing equipment in a state of readiness for instant use. • Relocate combustibles, where practicable, • Vent and purge of all hollow spaces, cavities or containers to permit the escape of air or gases before preheating, cutting or welding. Purging with inert gas is recommended. • Keep clear all welding and electrical cables and venting pipes of potential trips and falls. • Wear all proper safety equipment at all times. • Remove all electrodes from holders and the holders carefully located so that accidental contact cannot occur, and the machine be disconnected from the power source when arc welding is to be suspended for any substantial period of time, such as during lunch. • Close torch valves, in order to eliminate the possibility of gas escaping through leaks or improperly closed valves, • • Working near Schools, Hospitals, Mosques, Churches and Public Areas • • When engaged in construction in the vicinity of Schools, Hospitals, Places of Worship and Public Areas, incorporate the following into all activities: • Maintain and consider safe and careful movement and access of heavy machinery and vehicles in access to and operations. • Inform PWA to coordinate with relevant local authorities to announce and inform the public of planned schedule for construction works near sensitive residential areas and open local markets under the jurisdiction of the corresponding local authority. • Provide an appropriate buffer zone from all sides of the entire construction project sites that are located near public areas, to protect the public at all times. • Take appropriate measures to prevent unauthorized persons from entering the work area and construction sites, particularly school students and unattended children. • Adopt appropriate noise and dust control measures near sensitive receptors. • Ensure safe access and passages are provided for the public where construction sites are near sensitive receptors and crowded areas. • Surface crossing of trenches should be discouraged; however, if crossings must be provided for easy access, such crossings are permitted only under the conditions required by the OSHA Excavations Standards 29 CFR 1926.651, in provision of the required safety factor, the appropriate width, fitted standard rails and provide the minimum required extends past the surface edge of the trench.

Public Services	• Temporary loss during relocation of or excavation to existing utilities such as wastewater drainage, water pipes, communications, electrical cables and accesses roads. • Risk on public health and surrounding environment due to the spill of raw sewage from damaged sewers.	• Provide emergency services in a timely manner for residents in coordination with local councils. In case of accidental damaged to public utilities and services such as damage to water supply and electricity and disruption occurs for more than 12 hrs. • Coordinate with community leaders regarding the work plans that may lead to services interruptions. • Communicate with the community leaders to hear their voice, complains, and respond to their demands during the crises. • Compensate the community for any temporary damage during the service loss event. • Utilize local authorities' utility emergency plans in full coordination with the community when disturbances in services occur.

Table ES.4: Summary of Mitigation Measures during the Operation Phase

Chapter	Potential Impact	Mitigation Measures
Land Use and land Ownership	• Permanent loss of existing small-scale agricultural areas at locations of the reservoirs and pumping stations.	• At reservoir and pumping station sites suitable fencing should be provided to allow continued use of adjacent agricultural areas. • Operators of the reservoirs and pumping stations sites should properly maintain all structures, observe good housekeeping measures, and keep facilities and sites cleaned and safe. • Prevent access of unauthorized persons and ensure public safety by ensuring that the provided signage at all sites is clear for the public.
Physical Environment		
Air Quality	• Impact on air quality due to the emissions from the standby diesel generators in the pumping stations and reservoirs sites	• Using emissions filter for all the diesel generators in the project. This type of filters is available in the market and has high efficiency of CO, NOx, and PM 2.5. • Using natural gas generators instead of diesel generators if possible. This will considerably reduce the gas emissions (may reach to more than 80% emissions reduction). • Reducing the operating hours of the standby generators by supplying the pumping stations and the reservoirs distribution pumps with electricity connections that enable more supply hours in the Gaza electricity distribution schedule. • Comply with relevant local emission standards from heavy equipment where available and applicable.
Noise	• Nuisance and health impacts on workers and local residents • Disturbance to terrestrial fauna.	• Replace and maintain noise muffling equipped or other used acoustic reduction technologies as needed. • Confirmation of expected noise levels from installed equipment against safe working levels, and provision of warning signs and protective equipment for workers by the operator. • (Mitigation Measures are already considered in the design phase with the selection of pumps with standard specification).

Table ES.4: Summary of Mitigation Measures during the Operation Phase

Chapter	Potential Impact	Mitigation Measures
Groundwater	• Improved water supply infrastructure and additional water resources (desalination and Mekorot connections) will help to reduce over-abstraction from the groundwater. • Improved treated wastewater quality will help to reduce over-abstraction from the groundwater for agricultural use.	• Since the impact will be positive, no mitigation measures are required to reduce operational impacts on groundwater.
Biodiversity	• Once the project sites are operational, there are not considered any potentially significant impacts, positive or negative, on terrestrial biodiversity.	• No mitigation measures are required to reduce operational impacts on terrestrial biodiversity, however the following there are still opportunities to keep and manage any vegetation/floral habitats that naturally develop over time at the project sites during operation.
Existing infrastructure		
Utilities and Public Services	• Occasional need to disturb roads for future maintenance of network pipes. • Additional load on existing sanitation and sewer collection systems and existing wastewater treatment plants. • Additional demand on energy and power supply in the local area where the facilities are proposed especially the boosters and the reservoirs pumping stations.	• Mitigation measures are considered in next related sections.
Roads and Traffic	• Occasional need to disturb roads for maintenance of network pipes in case of damage.	• No mitigation measures are required to reduce operational impacts on roads and traffic, however the following is noted: • Coordination between the PWA with local Municipality regarding possible closure of the road under maintenance and inform the local community in advance to avoid any risk on the public health and safety commercial loss.

Table ES.4: Summary of Mitigation Measures during the Operation Phase

Chapter	Potential Impact	Mitigation Measures
Energy and Electricity	• Increased demand on energy to operate the pumping stations. • Shortage of electricity supplies if the additional demand of the new pumping stations is solved at the expense the local community. • Failure to provide sufficient power supply to ensure the operation of the proposed facility • Interruptions in power supply could cause damage to the project infrastructure due to surges or loadings	• Maximize the use of PV solar system to contribute to power production. • Use of energy efficient equipment. • Follow lessons learnt and procedures that have been experienced previously by PWA with other water supply facilities and projects in Gaza Strip, particularly regarding diesel availability.
Hazardous Material and Waste	• Indirect impacts on human health from contact with chemical substances. • Indirect impacts on surface or groundwater quality from accidental spillage of chemical substances.	• See mitigation measures for occupational health and safety in construction phase for safe handling of chemicals, supply of PPE, and use of safety data sheets: these will continue to apply during the operation phase. Comply with the requirements under the Palestinian Labor Law (No. 7, Year 2000), and its Secondary Legislations particularly regarding dealing and hazardous material and allowable concentrations. • Reservoirs design has incorporated automated dosing equipment to minimize requirements for manual handling of chemicals by plant operators/workers. • Provide a temporary storage facility to contain disposed storage batteries and solar panels ahead of final disposal to EQA approved facility.
Sanitation	• Overloading the existing wastewater infrastructure due to additional wastewater generation as a result of the increased water supply after the construction of phase I of the Gaza Central Desalination plant and this project's components.	• Review and adjust the schedule of the wastewater treatment plants construction phases to be ready in parallel with the construction phases of the additional water supply projects. • Review and upgrade the existing sewage collection networks and set an investment plan for the upgrading works with an implementation schedule that works in parallel with the construction phases of the additional water supply projects. • Plan for the construction of new sewage collection networks and sewage pumping stations according to the approved master plans taking into consideration the additional water supplies in a timely manner.

Table ES.4: Summary of Mitigation Measures during the Operation Phase

Chapter	Potential Impact	Mitigation Measures
Water Supply and water Quality	• Increasing the water supply quantity • Improving water supply quality. • Risks of water contamination during storage, transmission, and/or distribution	• Produce and implement Operation and Maintenance plans and manuals for all project components and assign the parties responsible for maintenance activities. • Train operators of the reservoirs and the pumping stations constructed under this project to comply with operation and maintenance procedures. • Include the new project infrastructure within PWA and Ministry of Health (MoH) monitoring program to test and confirm the supplied water quality from wells to the reservoirs tanks. • Supply water to consumers fairly and uniformly so that the water service will be available to all projected population; at the same tariff; at all times and seasons beyond the projected service year in 2035. • Keep the chlorination units in all the reservoirs well maintained and calibrated according the manufacturer's recommendation to comply with the safe chlorine dosage and to guarantee the residual chlorine concentration to minimize biological pollution risks in the distribution network. • Ensure the automated water quality monitoring system is operational at various stages, to ensure the quality of the desalinated water is suitable to be taken into the supply for blending. This mitigation measure is not covered under this project. It is rather covered in the GCDP project However, the PWA is the party responsible for both projects and should guarantee this issue. • Inspect storage facilities regularly and rehabilitate or replace storage facilities when needed. This may include draining and removing sediments, applying rust proofing, and repairing structures • Test water quality and implement best practices to prevent corrosion, • Prevent cross-connections with sewerage systems. • Separate water lines and sewer pressure mains (e.g., at least 3 m apart or in separate trenches, with the sewer line at least 0.45 m below the water line) • Implement a leak detection and repair program, this includes: - Specialized leak detection equipment in distribution network (≤ 4") (acoustic hydrophones, correlators, infrared thermography analysis); - Specialized leak detection equipment in bulk carrier networks (> 4") (leak detection vehicles, GPR (Ground Penetrating Radar), infrared thermography analysis, ultrasonic investigations with correlators and geophones, camera inspection, etc); - Leaks repair spare parts and tools (repair collars, welding equipment, pressure release valves, UPVC pipe welding equipment, etc); • Reduce residence time in pipes • Maintain positive residual pressure of at least 20 m water column (~2 bar) • Ensure the adequate Implementation of the proposed SCADA system for continuous monitoring of hydraulic parameters, especially the pressure, as well as quality parameters • Ensure adequate residual disinfection levels. Collect samples from several locations throughout the distribution system, including the farthest point, and test for both free and combined chlorine residual to ensure that adequate chlorine residual is maintained

Table ES.4: Summary of Mitigation Measures during the Operation Phase

Chapter	Potential Impact	Mitigation Measures
Surface Water	• Discharges of washout water from tanks or pipelines. • Pollution from fuel spillages. • Flood risks to new infrastructure.	• Fuel storage tanks should be enclosed within a bund and periodic inspections of the tanks should be carried out. • Operational staff should have the needed skills to properly operate different facilities and effectively deal with any pollution incident. • All water produced during the disinfection of pipelines should be neutralized prior to discharging and delivering into an approved washout alignment. • Maintain clean drainage catch basins and pipes within the proposed facilities to ensure continuous flow of storm water and avoid flooding.
Energy and Electricity	• • Increased demand on energy to operate the pumping stations. • Failure to provide sufficient power supply to ensure the operation of the proposed facility • Interruptions in power supply could cause damage to the project infrastructure due to surges or loadings	• Comply with the operational manual and design recommendations for controlled mechanisms to allow safe shut down of facilities in the case of interruptions to the power supply. • Follow lessons learnt and procedures that have been experienced previously by PWA with other water supply facilities and projects in Gaza Strip, particularly regarding diesel availability
Cumulative impacts on the water supply and groundwater aquifer	• A potential cumulative indirect impact on the water supply situation and the groundwater aquifer is anticipated from the construction and operation of several similar infrastructure projects.	• Verify with Municipality the status of implementing local and regional plans against the proposed scope and elements of this project. By the time this project is set for tendering, the status of infrastructural settings in the project areas may have changed. Therefore, verify status to integrate different projects seamlessly. This would eliminate redundant facilities and provide mechanisms to mitigate or avoid impacts . • Collect information about projects that may coincide with the proposed project. Coordinate development actions and construction efforts in order to minimize the impacts of each project and create synergistic benefits. • Coordinate between the various construction crews if two or more projects involve excavation in the same area, to minimize environmental disturbances and maximize use of energy and local resources where and when possible. •
Socio-economic condition		

Table ES.4: Summary of Mitigation Measures during the Operation Phase

Chapter	Potential Impact	Mitigation Measures
Water quality and quantity problems	• Supplied water quality and quantity impacts on the health and wellbeing of the local community. • Occupational health and safety of workers.	• Implement safety measures to protect people from injury. • Dispose of waste and refuse properly. • Train operators to comply with operation and maintenance procedures, develop manuals and safe working practices for operational sites. • Provide adequate hearing protection, hard hats, safety goggles, brightly colored vests, and other appropriate safety equipment to protect workers and visitors from injury. • Apply the OSHA confined space safety measures (29 CFR 1910) and entry permits requirements, during any maintenance for reservoir tanks and relevant parts of the desalination plant. • Apply the OSHA working from height measures (OSHA 29 CFR 1910.23 and 24) for any required maintenance that requires working at height • Provide first aid kits on operational sites and ensure the presence of personnel with the minimum first aid skills at all times. • Continue conducting effective public awareness campaigns by PWA and local civil society organizations to emphasize that water supplied from tanks is domestic non-potable quality.
Gender Related Issues	• An overall positive long term significant impact is expected to take place on women. • The purchasing and transporting of desalinated water for drinking by women and sometimes by children will be stopped. In addition, the project will reduce women workload at household level. • The project is expected to help women in providing high water quality not only for drinking but for other domestic uses such as hair bathing (washing) and dish washing.	• No mitigation measures are required.
Ability, Willingness and Affordability to Pay for Water Services	• Impacts of the project on water pricing, impact on the affordability of water for local communities. • Limited willingness to pay for supplied (non-drinking) water by local communities, leading to lack of opportunity for investment in the project facilities and funding for maintenance in the future.	• Plan for awareness campaigns that give people more understanding and awareness of their responsibilities towards sustainability of water resources. • Ensure financial sustainability by commitment of citizens to pay their water bill fees; primarily by awareness campaigns and secondly by rule-of-law.

Table ES.4: Summary of Mitigation Measures during the Operation Phase

Chapter	Potential Impact	Mitigation Measures
Maintenance of household internal water	• Contamination possibilities from public and internal water networks including the water tanks at house level.	• Improve the community knowledge and awareness towards water problem at macro scale. This can be achieved through public awareness campaigns • The link between water service providers and maintenance of water resources at macro scale and its effects at micro scale should be promoted. • Enhance the community participation in assessing the needs and designing interventions will create better awareness and higher level of success in achieving the project objective.
Private water distributers	• Potential loss of revenue in the long run for the owners of desalination plants enterprises (the plants and vehicles) as a result the project. The actual impact of the intended project is not yet clear at this stage.	• A more in-depth study on the potential long-term impact to the owners and workers of this facilities will be developed as part of the Project
Visual landscape	• Visual intrusion, especially the Sheikh Radwan reservoir ST-045 site.	• Keep the sites of the newly constructed facilities clean and observe good housekeeping and safety procedures. • Keeping the facilities well maintained in terms of the architectural external appearance.