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**GAZA SOLID WASTE
MANAGEMENT
PROJECT, GSWMP**



**MUNICIPAL
DEVELOPMENT &
LENDING FUND**

ENVIRONMENTAL & SOCIAL MANAGEMENT PLAN

**CLOSURE DESIGN & POST-CLOSURE PLAN
FOR DEIR AL BALAH SANITARY LANDFILL**

PREPARED BY(JV):



راي كونسلت
RAI Consult



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List of Abbreviations

ARA	Access Restricted Area
EIA	Environmental Impact Assessment
ESIA	Environmental and Social Impacts Assessment
ESMP	Environmental & Social Management Plan
EQA	Environmental Quality Authority
GRM	Grievance Redress Mechanism
GSWMP	Gaza Solid Waste Management Project
JSC-KRM	Joint Services Council of Khan Younis, Rafah and Middle area
JCP	The Job Creation Program
L/C/D	Liter/ capita/ day
LGU	Local Government Unit
MOLG	Ministry of Local Government
MOP	Ministry of Planning
MOPW	Ministry of Public Works
MOTA	Ministry of Tourism and Antiquities
MDLF	Municipal Development and Lending Fund
PCBS	Palestinian Central Bureau of Statistics
PWA	Palestinian Water Authority
SWM	Solid Waste Management
UNDP	United Nation Development Programme
UNRWA	United Nation Relief and Works Agency
WHO	World Health Organization

1 Introduction

Gaza Strip has been facing many of the escalating environmental threats occurring over the decades associated with the instability to financial and economic stress reflecting the development of the infrastructure sector. As a result, solid waste management (SWM) sector has presented huge challenges to manage, in a sound manner, the environment and the public services' provision.

Waste is currently collected and hauled to the three main landfills currently operating in the Gaza Strip; Johr al Deek (Gaza) Landfill located in Gaza municipality; Deir Albalah Landfill located in the east side of Deir Albalah municipality (non-operational since July 2019); and El-Fukhary sanitary landfill located in east of Khan Younis and Rafah.

1.1 Gaza Solid Waste Management Project Background (GSWMP)

GSWMP is a comprehensive strategic infrastructure and capacity building project, where MDLF is managing the southern component of the project covering 3 of 5 governorates in Gaza Strip, namely the Middle Area, Khan Younis, and Rafah Governorates that comprising approximately 64% of Gaza Strip's total geographic area inhabited by 46.3% of the total Gaza Strip's population, or approximately 921,056 people according the 2019 Palestinian Central Bureau of Statistics (PCBS) projections. The GSWMP is aiming at improving solid waste management services in the Gaza Strip through the provision of efficient and environmentally and socially sound waste disposal schemes and initiating measures to improve overall solid waste management systems. Through the GSWMP, a sanitary landfill was constructed in the southern region of Gaza Strip with capacity to serve the 3 governorates until year 2025, and to serve the entire Gaza Strip until the year 2040. As well transfer stations were constructed in Khan Younis and Rafah, waste vehicles and containers were provided, and access roads of landfill and transfer stations were constructed.

1.2 Description of Deir Albalah Landfill Site

Deir Albalah central landfill was built in 1995 and extended in 2002 by the support of the Federal Republic of Germany. The landfill is located on the eastern part of Deir Albalah City directly near the border line (the 1950 armistice line) with Israel. The total dumping area of the landfill in the first phase was 34,900 m². The landfill was extended in 2002 bringing the total dumping area (footprint of the landfill) to 59,900 m² and reached nearly 34 m of waste height. This landfill has a gravity leachate collection system in two ponds where the leachate is recirculated again onto the landfill surface according the original design. The first leachate pond was constructed in 1997 on an area of 1,000 m² with volume 2,400 m³, whereas the second pond was constructed in 2002 and has 1,500 m² with 3,600 m³ volume. The landfill utilized asphalt liner system with leachate collection pipe dissecting the 5-7m deep landfill bottom.

The landfill reached more than its capacity and exceeds its boundary over the adjacent lands, Northern and western side slopes of waste are currently spreading over the border of the disposal cell, and general side slopes are too steep (about 1 Horizontal : 1 Vertical).

1.3 Landfill Closure Project

Through the GSWMP, Closure of two dumpsites will be achieved (old Al-Fukhary dumpsite and Deir Albalah Landfill). The Municipal Development and Lending Fund (MDLF) is the delegated agency to implement both closure projects in Al-fukhary (Sofa) old dumpsite, and Deir Al-Balah Landfill. The following is a short summary of both projects:

- *Closure of Deir Al-Balah Landfill:* The closure works will include stabilizing the side slopes, covering the whole body of waste with a final cover, and construct the required channels in order to drain the storm water out of waste properly. As well, Gas collection system and flaring unit will be constructed. The closure project aims at ending the environmental impacts of the overloaded landfill e.g. the odor, pests, formation of new leachate, and waste burnings/smoke.
- *Closure of Al-Fukhary (Sofa) Landfill:* the dumpsite received the waste from Rafah governorate for more than 20 years (1996 – 2019). The first part of closure works was started during the construction of the adjacent Al-Fukhary (Sofa) sanitary landfill by gentling the side slopes and applying the first layer of the final cover (clay layer). The remaining closure works will be initiated at the end of 2020 with a different contractor and the works will include applying the remining final cover layers, gas collection system and flare unit, and installing the stormwater channels.

2 ESMP Objectives and Methodology

The ESMP is necessary to satisfy Palestinian Environmental Law and World Bank safeguards policies; the World Bank Operational Policy 4.01 (January 1999 and revised April 2013). The project will invest in activities that support the improvements of an existing facility. Construction-related activities include, rehabilitation, maintenance, levelling, installations and other construction activities. Cut and fill activities, re-disposal of wastes inside the site will be handled and managed through the ESMP. The project is expected to have an overall positive impact the surrounding environment. Potential negative impacts that are localized and limited in nature will be avoided by providing instructions in the contract document, which specifically address environmental issues in a manner acceptable to the World Bank Policies, as well as following Good Management Practices during construction and post closure phases.

The closure assignment will utilize and refer to the project's 2012 Feasibility Study and Detailed Design and the Environmental & Social Impact Assessment (ESIA), in addition to the original design documents of Deir Albalah Sanitary Landfill, given that the landfill was commissioned in the mid-1990's, whereas Deir Albalah Landfill served as a Sanitary Landfill with leachate collection system and bottom liner. Closure detailed designs and post-closure plans will comply with the World Bank Environmental and Social Safeguards (OP.4.01) and (OP.4.12) and in line with the Palestinian Regulations.

The final draft of the ESMP will be disclosed in electronic format on MDLF website; JSC Facebook page; and the World Bank website. The ESMP document in hard copy format will be available in MDLF office – Khan Younis Branch; and JSC-KRM main office.

2.1 ESMP Objectives

The features of the ESMP are an assessment of the proposed project components with an assessment of potential impacts and mitigation measures. Based on the assessment, an ESMP is prepared highlighting the following main elements:

- Outline key environmental and social issues through an environmental and social assessment of the proposed activities during planning, implementation and post closure phases;
- Review the World Bank safeguard policies, taking into consideration the environmental and social regulations of the Palestinian Environment Quality Authority (EQA), and comply with the World Bank Environmental, Health, and Safety (HSE) guidelines (2007);
- Ensure adequate public consultation during the assessment process (in general and in specific events, i.e. World Bank Group's Operational Response to COVID-19, 2000);
- Define the potential environmental and social impacts;
- Develop the ESMP and propose the necessary mitigation measures to cover the various stages of implementation, With defined timelines and specific roles and responsibilities.

2.2 Methodology of the ESMP

The scope of work for this consultancy services involves developing the most environmentally sound, cost-effective closure detail designs and post-closure management plans for Deir Albalah landfill: with final design drawings, construction details, cross-sections, quantities, cost

estimation, technical specifications and tender documents. In order to prepare the ESMP and achieve its objectives, the consultant carried out the following activities:

Data Collection

Desk Review and Field Investigation. The review includes the preliminary closure plans, post-closure management plans, alternatives, the associated cost estimates, laws, regulations, guidelines, standards, existing studies conducted on the environmental situation in the project area, and the ESIA of the GSWMP.

Consultation

The study team conducted consultations with different groups and entities in order to collect the necessary information and complete the project description and their impacts; facilitate consideration of alternatives, mitigation measures and tradeoffs; reduce conflict through the early identification of contentious issues; provide an opportunity for the public to influence project design in a positive manner (thereby creating a sense of ownership of the proposal); improve transparency and accountability of decision-making; and increase public confidence in the ESMP process. The consultation activities included:

- a) Meetings with the JSC, municipalities, local engineers, and municipal staff to get more details about the project area, priorities, level of services, and to arrange the site visits to project locations and understand the local environment and community behavior.
- b) In close coordination with JSC representatives, site visits were arranged to the proposed project site. The site visits were very essential in order to observe the current conditions and practices, and to draw a comprehensive overview of the project site and its surrounding environment.
- c) Workshop with the key stakeholders and community representatives, to present the project objectives, alternatives, action plans as well as the potential impacts. On 26 December 2019, the consultant in coordination with MDLF, JSC KRM, Deir Albalah Municipality and Wadi Al-Salqa Municipality conducted a consultation workshop. The workshop attended by farmers working around the landfill, representatives of Deir Albalah and Wadi Al-Salqa Municipalities, local community members, local farmers and land owners, local NGOs, MDLF staff, JSC KRM staff. The consultant presented the design, alternatives, operation sequences as well as the details of the ESMP. The participants were consulted to highlight their expectations for other potential impacts and mitigation measures that could minimize any impact in the project vicinity.

Impact Assessment

- The study team conducted the environmental and social assessment, and evaluated the environmental impacts of the projects during all development stages; Planning and Design, Construction and Operation Stages.
- The potential impacts of each activity / phase are described and evaluated, mainly for the construction and post-construction stages of the project in order to identify the mitigation measures which should be stated in the project contract documents and must be enforced by the responsible authorities.

ESMP Development

Based on the collected data and reports, site visits, consultations, interviews with involved staff and consultant's experience, the ESMP was developed for the proposed project activities, which includes feasible and cost-effective measures to minimize or mitigate negative impacts and the actions to be adopted during the screening process and implementation phases of the

project. This ESMP of the project implementation and operation will mitigate the risks to humans, the impacts on ecology and natural resources.

Also, the ESMP is prepared to integrate the environmental and social concerns into the design and implementation of the proposed project. The ESMP includes three basic components; institutional component, mitigations, and monitoring.

3 Legislations and Standards

The current institutional framework has been reviewed concerning related ministries, governmental and non-governmental organizations. The organizations concerned with the planned project have been consulted and their regulations, standards, and requirements were thoroughly studied. Also, the future plans for the areas and solid waste management sector in the Gaza Strip were considered.

3.1 Description of the Relevant Institutional Framework

The following are the key national and international laws, policies, guidelines and standards for environmental assessment that have been considered for the study:

- Environmental laws, strategies and actions plan that was adopted by the Environmental Quality Authority (EQA).
- Environmental Quality Authority (EQA), Environmental Assessment Policy, Gaza, 2000.
- Environmental Quality Authority (EQA), Environmental Law 7, Gaza, 1999.
- The environmental assessment of the project was conducted according to the World Bank Operational Policy OP 4.01.
- The Draft National Environmental Health Strategy (1999)
- Draft Law on Local Government (1996) by The Ministry of Local Government (MOLG)
- Palestinian National Authority Solid Waste Management Bylaw for the year 2012 for the management of solid waste
- Solid Waste Management bylaw by Ministers cabinet decision no. (3), 2019
- Joint Service Council (JSC) bylaw, 2016
- The Bylaw for Joint Service Council for solid waste management in the governorates of Khan Younis, Rafah, and middle area, 2018
- Medical Waste Bylaw, 2012
- National Water Policy for Palestine (Final Draft Water Policy 2013-2032)
- Labor law of Palestine (2000) updated by 2008
- Local Authorities Law (1), 1997
- The Public Health Law No. 20 for the year 2004
- National Strategy for Solid Waste Management in the Palestinian Territory, (2010-2014)
- Palestinian Water Law for the year 2014
- Regulations for Groundwater Pollution Control, law 3, 2002
- Water Pollution Control System, 2002
- Guidelines for Wastewater Reuse in the Gaza Strip, law 3, 2002
- Health and safety regulation, 2000
- World Bank Safeguard Policies and Guidelines;
 - Environmental Assessment (OP 4.01),
 - Involuntary Resettlement (OP 4.12),
 - Access to Information Policy,
 - Natural Habitats (OP 4.04), and
 - Cultural Property (OP 4.11)
 - Pest Management (OP 4.09).
- WBG EHS guidelines for waste management facilities (IFC, 2007) concerns the design, construction, and operation of non-hazardous/hazardous waste facilities¹.

¹ EHS for waste management: <https://www.ifc.org/wps/wcm/connect/5b05bf0e-1726-42b1-b7c9-33c7b46ddda8/Final%2B-%2BWaste%2BManagement%2BFacilities.pdf?MOD=AJPERES&CVID=jqeDbH3&id=1323162538174>

- EU Landfill Directive (1999/31/EC).
- WBG General EHS Guidelines.
- World Health Organization (WHO) Guidelines for Air and Water Quality.
- European Commission Environmental Standards.
- Israeli Environmental Standards.

3.2 Relevant Ministries and Institutions

The following are the key relevant ministries and institutions that were consulted or included in the process of the [project development:

- Environmental Quality Authority (EQA)
- The Job Creation Program (JCP)
- Municipal Development and Lending Fund (MDLF)
- Joint Service Council (JSC-KRM)
- Ministry of Local Government
- Municipality of Deir Albalah
- UNRWA
- Ministry of Health
- Ministry of Agriculture
- Ministry of Labor

3.3 JSC-KRM Institutional Setup and Manuals

The JSC-KRM was established in 1995 to provide solid waste collection services to the Middle area and Khan Younis governorates' LGUs. The scope of services was extended to include Rafah Governorate LGUs. The legal framework for the JSC includes the following bylaws and mandates:

- Joint Service Council (JSC) bylaw, 2016
- Palestinian National Authority Solid Waste Management Bylaw for the year 2012 for the management of solid waste
- Solid Waste Management bylaw by Ministers cabinet decision no (3), 2019
- The Bylaw for Joint Service Council for solid waste management in the governorates of Khan Younis, Rafah, and middle area, 2018
- Medical Waste Bylaw, 2012
- National Palestinian Strategy for Solid Waste Management 2010 – 2014

The JSC-KRM is responsible for the day to day work of managing the collection, transportation, and disposal of solid waste or whosoever it deputizes to do this. The JSC-KRM is responsible for Solid Waste Management for the Local Units of Khan Younis, Rafah and Middle Area which include 17 LGUs (Municipalities). This responsibility includes:

- The operation and maintenance of the Sofa landfill (the "Landfill") and two transfer stations, one in Khan Younes Governorate and the other in Rafah Governorate;
- Closure and Post Closure management of the two closed landfills; Deir Al Balah sanitary landfill and old-al-Fukharri landfill.
- The long-haul transport of waste between the transfer stations and the landfill and, potentially, the secondary collection services from part of the three Governorates; and
- Medical waste collection, treatment, and disposal from selected areas of the three Governorates.

Moreover, the JSC-KRM has several manuals to facilitate the management of day-to-day activities and to perform according to the standard operation procedures of and best international practices. These manuals include:

- Medical Waste Management Pilot Project in Joint Service Council of Khan Younes, Rafah, and Middle Governorates: JSC-KRM Medical Waste Operations Manual
- Gaza Solid Waste Management Project: Transfer Stations Operating Manual (September 2018); and
- Gaza Solid Waste Management Project: Landfill Operations Manual (September 2018).

3.4 Grievance Redress Mechanism

Grievances Redress Mechanism (GRM) will be activated for the local community to receive any complaints related to the closure works either during the construction phase or the post closure phase. The system includes different channels, most importantly:

- 1- **Online application:** a website for the JSC was created and it contains a window to an online grievance application to be filled by the different communities all the time. <http://jsc-krm.ps/ar/Home/Apply>
- 2- **Using the Facebook page (/jsc-krm):** by inviting the people to send their complaints using the JSC Facebook page since the website is still under construction, and the Facebook page will be announced in all the public meetings and on a board located besides the complaint box at the landfill camp.
- 3- **Phone calls and emails:** the instruction board above the complaint box will contain the contact details of JSC-KRM. Those will also be disseminated to the public through the Project Facebook page and in community meetings. **(JSC administration building phone: 082052793)**

Even anonymous grievances can be raised and addressed when the complainer use the phone call or the Facebook page. Complainer can inform about the complaint without more details about his name or mobile number if he prefers to hide these details.

Acknowledgment for receiving the complaint will be offered to complainant in 2 business days from receiving and then 5 business days will be taken to resolve and close the complaints under the direct control of the projects and the contractors. Longer period might be needed to address complaints that are not under the direct autonomy of the project and in such cases, the complaint will be diverted to the concerned parties and feedback will be offered to the complainant accordingly. As soon as the grievance received the following steps will be followed to apply the process:

- 1- **Sort and process:** the grievance will take a serial number. The complaint urgency will be checked using the priority sheet.
- 2- **Acknowledge and follow up:** the complainant will receive a confirmation SMS that his/her complaint was received and is being handled using the GRM process.
- 3- **Verify, investigate and act:** the PDSU-MDLF, and TOU-JSC teams will verify and investigate about the grievance in the field and send a reply back to the complainant to inform about the response and the solution, this will be according a certain time plan for every action as mentioned above.
- 4- **Monitor and evaluate:** the JSC-KRM social specialist will check the satisfaction of the complainant through monitoring plan and then record all the process in the monthly report.
- 5- In case, the complainant can declare about his/her dis-satisfaction with the response of the tier one channels mentioned above and submit another complaint for a higher level in the

JSC-KRM. The IT staff will report about the problem, its solution, the person/the department who contributed to solve the problem and then the comments of the complainant on the provided solution. The executive manager of the JSC-KRM will receive the report and investigate it, then take an action, and report it to the chairman of JSC-KRM, to be involved in the action.

Note: the chairman of the JSC-KRM is a Mayor who had authorization to take any action in the southern and middle governorates with cooperation with any other entity (municipality, governmental associations, NGOs,..), so involving the chairman will ensure the fairness of the solution.

4 Project Details and Alternatives

Deir Albalah Landfill Located in the eastern side of Deir Albalah municipality. It has an area of 60 dunums. It is equipped with soil protection measures. It serves 13 municipalities and village councils in Khan Younis and the Middle area Governorates. It is estimated that the amount of waste disposed of in the landfill is more than 90,000 ton/year. The disposed Wastes comprises around 95 % MSW and 5% other. The landfill is the first one constructed in the Gaza strip with sanitary protection facilities; including bottom lining and leachate collection system. The landfill reached more than its capacity and exceeds its boundary over the adjacent lands, northern and western side slopes of waste are currently spreading over the border of the disposal cell, and general side slopes are too steep (about 1 Horizontal: 1 Vertical).

4.1 Technical Alternatives of the Landfill Closure

Closure of this old landfill is one of the main infrastructure activities of the GSWMP. Closure alternatives of Deir Albalah landfill were investigated technically and financially. The following is a summary of the closure alternatives including the locations, and technologies.

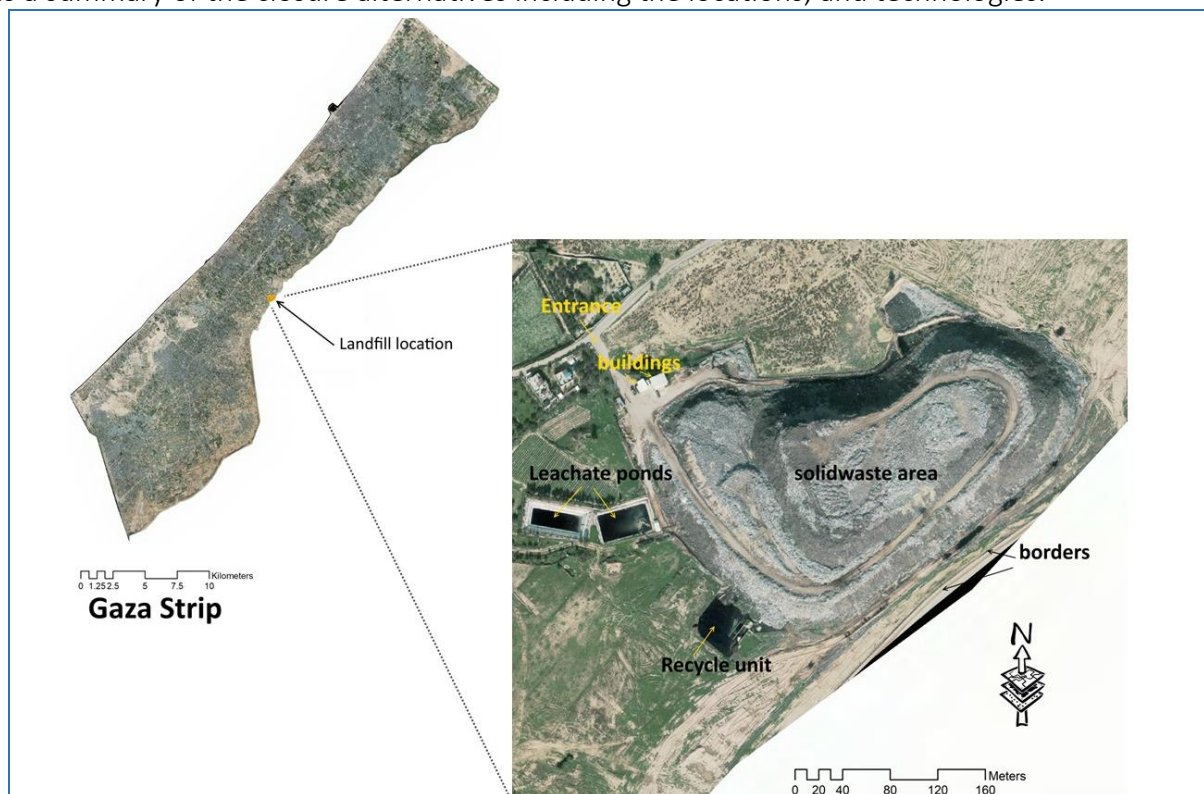


Figure 1: Deir Albalah Landfill location

Alternative	Details
Alternative 1	The first scenario considers the existing lining limits except the shown hatched areas in Figure 2 . It needs extra lining area to sustain the extended waste (for 2,000 m ²) including a simple leachate collection system and 150 m of 5m-retaining wall.
Alternative 2	In addition to alternative 1 consideration, alternative 2 takes into account extending the waste to available area within the fence boundary shown in Figure 3 . It needs extra lining area to sustain the

extended waste (for 6500 m²) including a simple leachate collection system and 150 m of 5m-retaining wall.

Alternative 3

In addition to scenario 2 consideration, alternative 3 added around 320 m of 5m-retaining wall to increase the capacity of the reshaped layout as shown in **Figure 4** It needs extra lining area to sustain the extended waste (for 6,500 m²) including a simple leachate collection system and 470 m of 5m retaining wall.

Alternative 4

Alternative 4 promotes the need for new land to accommodate the waste without the need for waste transfer outside the site as shown in **Figure 5** It needs extra lining area to sustain the extended waste (for 11,600 m²) including a simple leachate collection system whereas there is no need for retaining walls.

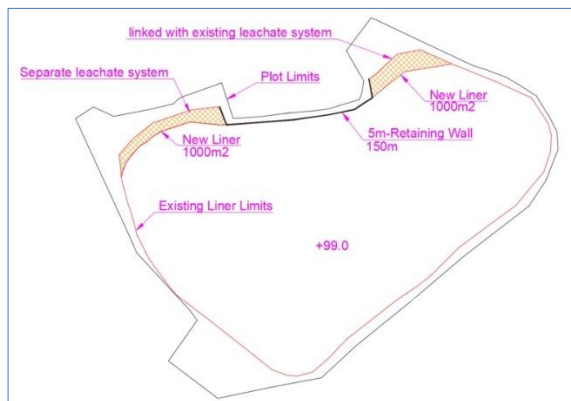


Figure 2: Layout Alternative (1)

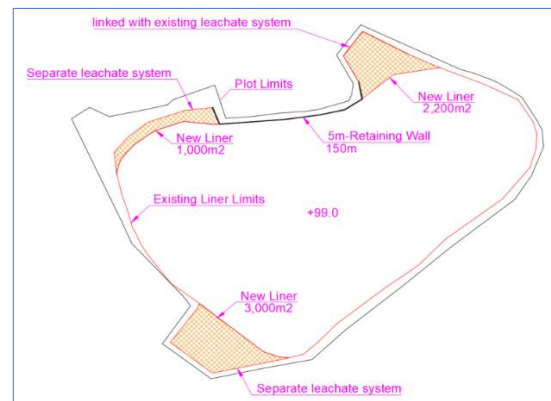


Figure 3: Layout Alternative (2)



Figure 4: Layout Alternative (3)

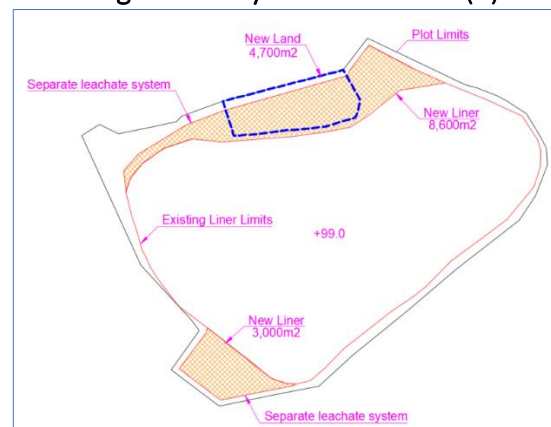


Figure 5: Layout Alternative (4)

4.2 Selected Optimized Alternative

This optimized scenario takes into account different raised issues related to:

- Preventing the need for waste transfer outside the site as well as facilitating the construction works. Transferring large quantity of waste for more than 15 km will have a significant environmental impact.
- Promotes the crucial need for a new land acquisition to accommodate the waste without the need for waste transfer outside the site as shown in **Figure 6**. Land acquisition process were clearly achieved, and the landowners were satisfied with the offer they received without any pressure. Some of other alternatives required more

than section of land to implement the closure plan, so that it was better to deal with one section of land.

- It needs extra lining area to sustain the extended waste (for 13,800 m²) including leachate collection system.
- Adding three berms is required to facilitate the construction works especially for long steep slopes (more than 45m in some sides).
- This approach is a lesson learned from Sofa landfill. **Figure 6 and Figure 7** shows the main layout contours of the selected scenario and illustrates the main ramp and the added new berms.
- The optimum selected alternative is not only the alternative with less cost estimations, but also it is the alternative with less environmental and social impacts.

Figure 8 shows the two main sections of the reshaped layout.

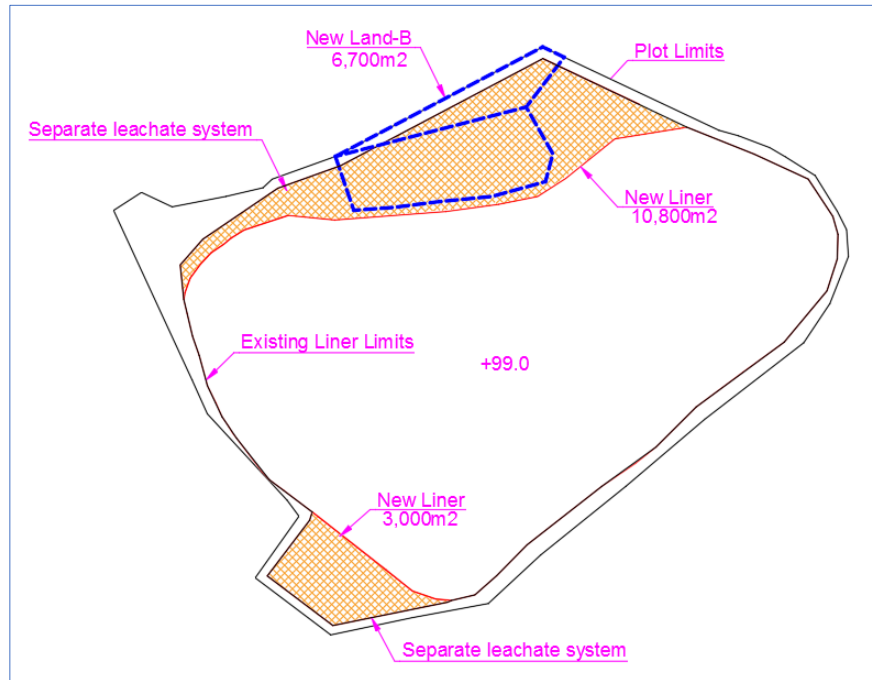


Figure 6: Optimized alternative layout

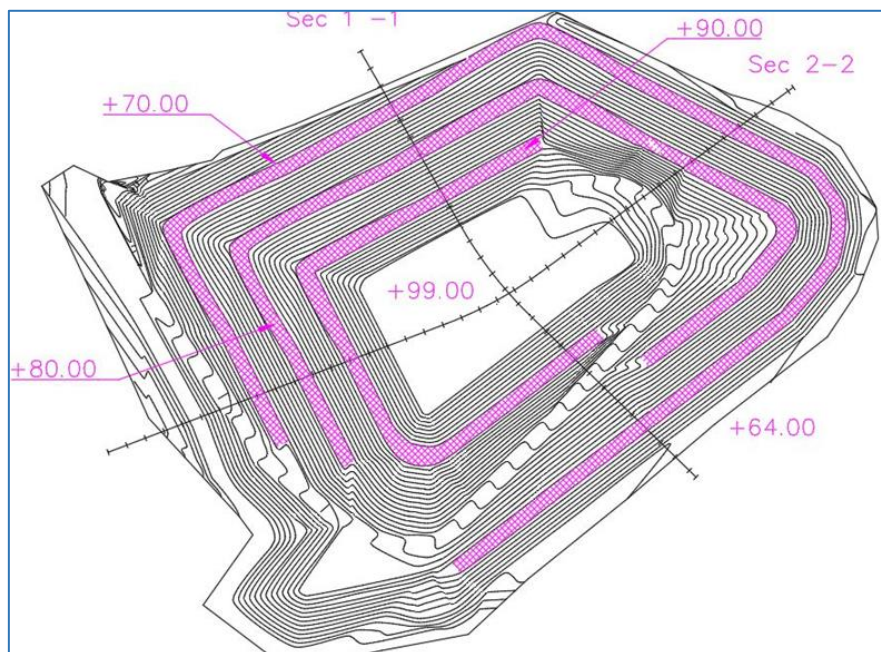


Figure 7: Main layout contours of the optimized alternative

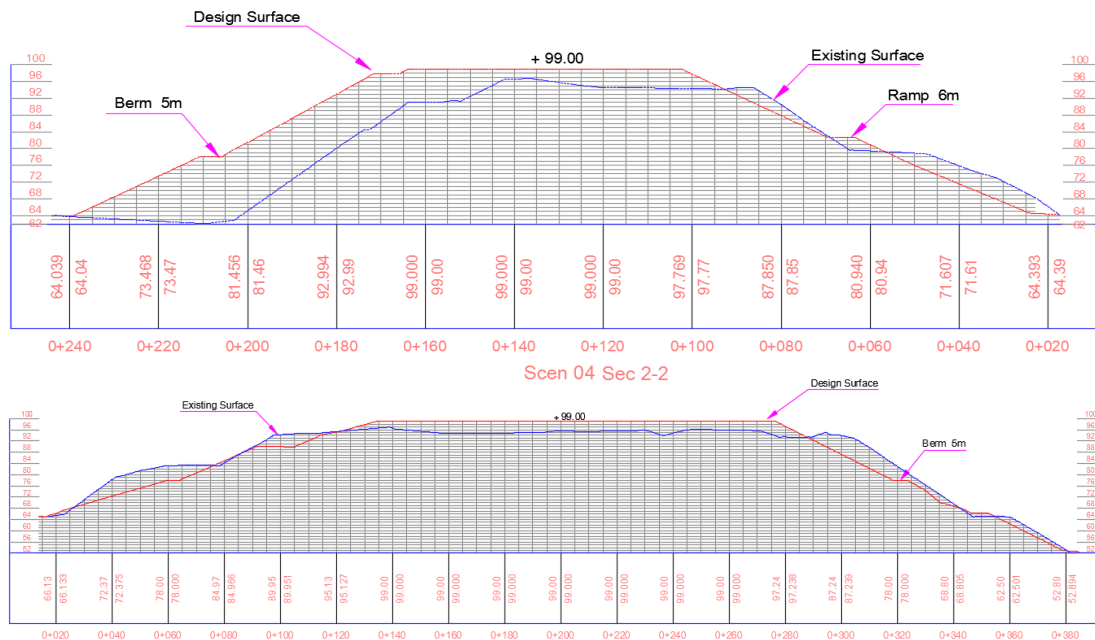


Figure 8: Sections of the reshaped layout

4.3 Key Activities in relation with Closure Works

Closure of Deir Albalah landfill was designed to be in line with the international standards in term of environmental aspects, the closure works will include:

- Reshaping of waste body in order to gentle the side slopes with acceptable level of stability;
- Applying the final layers over an area 71,000 m² (landfill surface);
- Installation of the gas network and flaring system;
- Installation the stormwater drainage system;

4.4 Workforce and Equipment

The closure key activities are expected to be lasted for 6 months, but with limited workers. It is not expected to have more than 15 workers at the site for any moment (max number of workers will be occurred during the lining of the final cover). All workers should be provided by a special PPEs and should be covered by a valid insurance, knowing that the nature of key activities especially the reshaping period could be considered as a medium risky works, in addition to the location of the site which is located adjacent to the Border of Gaza Strip. Workers are not expected to communicate with the local community as they will be instructed to stay at the site location during the daytime and to leave together at the end of the day.

Heavy machinery is expected to be used for reshaping activities such as large excavators. Installation of the final cover and the gas system will be required some of light equipment. All equipment should be covered by an insurance. Equipment is expected to be left at the site at the nighttime.

5 Environmental and Social Baseline Information

This section assembles, evaluates and presents relevant baseline data on the environmental characteristics of the study area, Deir Albalah landfill. Different issues related to the project area are discussed in more details wherever possible. The baseline information for Gaza Strip in General, and the project area in specific, considered the environmental issues listed below:

- Location and Topography,
- Climate,
- Air Quality,
- Land Use and Resettlement,
- Transportation,
- Soil and Vegetations,
- Water Resources and Quality,
- Wastewater Services.
- Solid Wastes Generation and Composition,
- Biological Habitat and Species,
- Population and Houses,
- Economic Situation (Employment and income),
- Current Crisis and Humanitarian needs,
- Public Health, and
- Archaeological Resources, Recreation and Tourism.

5.1 Location and Topography

Deir Albalah is located over 14.6 km south of Gaza City, and 9.7 km north of Khan Younis city on the coordinates (31°25'08" N) and (34°21'06" E), along the coastline of the eastern Mediterranean Sea. Its city center is about 1700m east of the coast. The city's municipal borders stretch eastward toward the border with Israel, its an urban area does not extend beyond the main Salah AlDin Highway to the east. Its bounded by Nusirat Camp and Bureij Camp in the north, Maghazi Camp in the northeast, Wadi Al-Salqa in the south, and Khan Younis in the south. Figure 9 shows the location of Deir Albalah.

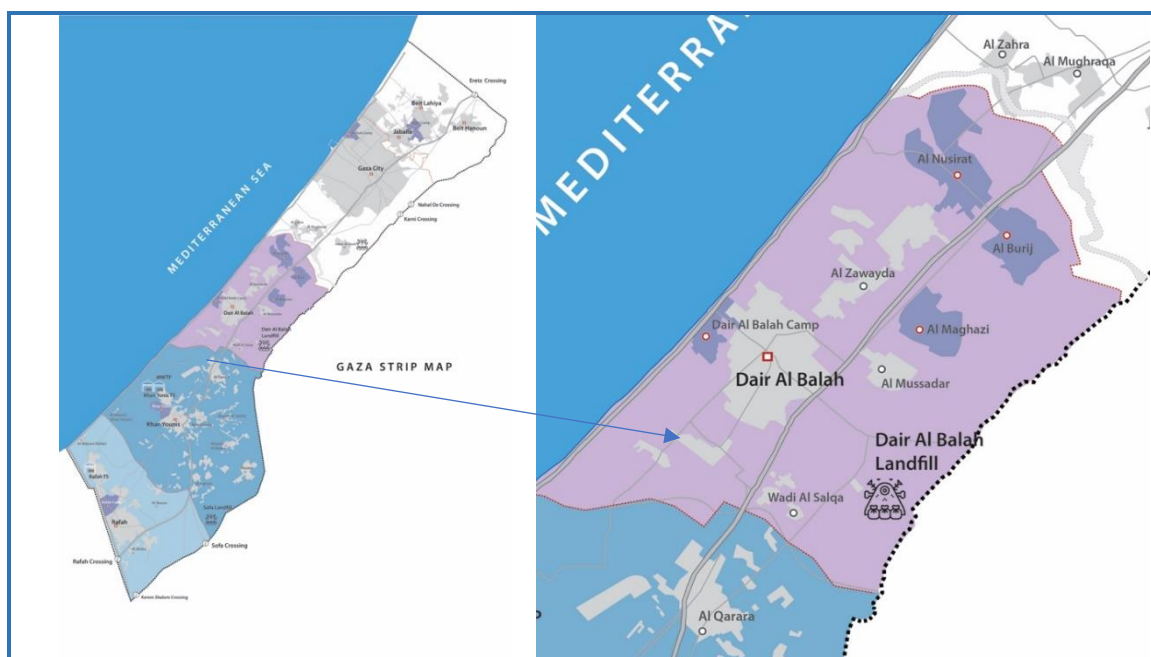


Figure 9: Deir Albalah Location

The Gaza Strip is relatively flat, with elevations ranging from 0-110 meters above sea level. The highest areas are found in eastern parts of Khan Younis Governorate. The lowest areas are in the west, and along the border between Gaza and Deir Albalah governorates (Wadi Gaza).

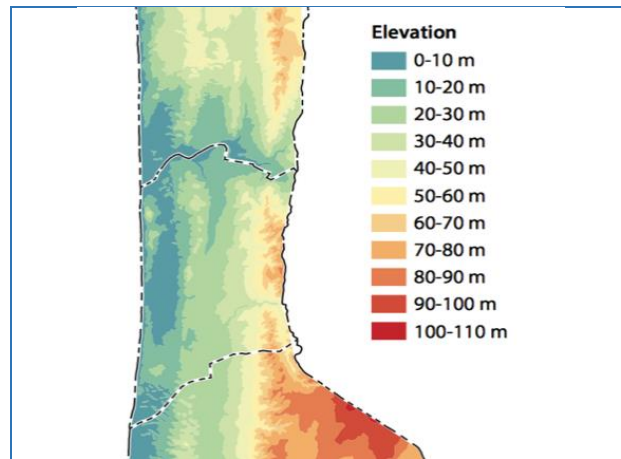


Figure 10: Middle Area Elevation

Deir Albalah Landfill is located in the eastern side of Deir Albalah Municipality, with the boundaries of Wadi Al-Salqa municipality. It has an area of 60 dunums (volume 800,000 m³). The project area is elevated about 56m above mean sea level.

5.2 Climate

The Gaza Strip has a semi-arid climate with a short and mild rainy season and dry summer. Deir Albalah has a typical Eastern Mediterranean climate with hot dry summers and mild winters.

- **The Temperature:** The temperature gradually changes during the year. The main findings of the time series indicate that the daily mean of air temperature ranges between 12°C and 25°C. The temperature gradually reaches its maximum in August (summer) and its minimum in January (winter); the average daily maximum temperature ranges from about 18°C in January to 31 °C in August while the average daily minimum temperature for January is about 7.0 °C and 20 °C for August (Weather statistics for North Gaza, 2018).
- **Humidity:** Daily relative humidity fluctuates between 60% and 85% in the daytime in the summer and between 60% and 80% respectively in winter (CMWU, 2016).
- **Wind:** At summer time, sea breeze blows all day long while the land breeze blows only at night. At noon, wind speed value reaches its peak and starts to decrease at night. Whereas in winter wind stream blows mostly from the Southwest. The average wind speed reaches 15.12 km/hr. In summer wind stream blows roughly only at precise hours. The average wind speed in summer can reach 14.04 km/hr. daily coming from the Northwest direction. On the other hand, in winter a maximum hourly wind speed of 18 m/s have been observed (CMWU, 2011).
- **Evaporation:** In Gaza Strip, evapotranspiration measures based on 25 established records, mark that the strip has possible evapotranspiration of almost 1,291 mm/yr. The highest evaporation rate was observed and measured during July and August, the hottest months

in the Gaza Strip with an evaporation rate of nearly 138 mm. whereas the minimum evaporation rate happens in January with a rate of 63 mm. (Sirhan, 2014).

Table 1 : Gaza Strip Climatic Data

Gaza Strip												
Months	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Tmax oC	18.0	18.4	19.6	24.7	24.8	27.1	29.8	31.9	30.0	27.6	24.2	20.8
Tmin oC	10.3	11.4	11.9	15.8	18.6	21.6	23.2	25.0	22.7	20.4	17.4	12.7
Mean rainfall (mm/month)	75.9	71.7	27.7	5.5	0.2	0.0	0.0	0.0	0.0	26.2	55.8	52.0
Dew oC	8.0	9.0	9.0	14.0	17.0	20.0	22.0	23.0	20.0	17.0	16.0	10.0
Mean relative humidity %	66.0	69.0	64.0	67.0	73.0	77.0	76.0	75.0	65.0	66.0	72.0	62.0
Wind (m/s) (10m height)	2.7	2.8	2.72	2.8	2.52	2.4	2.3	2.1	2.2	2.2	2.24	2.4
Pan evaporation (mm/day)	2.5	2.9	3.7	4.6	5.4	6.0	6.3	6.1	5.6	4.2	3.3	2.6
Global solar radiation, (MJ/m ² /day)	9.5	12.5	16.9	21.2	25.2	27.4	26.5	24.0	20.8	15.4	11.4	9.0

- Rainfall:** The winter is the rainy season, which stretches from October up to March. Rainfall is the main source of recharge for groundwater. The average annual rainfall declines from 400 mm/yr. in the north to 200 mm/yr. in the south (around 314 mm/yr. for Deir Albalah area). The average rainfall for the hydrological years from 1976 to 2017, as measured at Dier Al Balah meteorological stations (closest station to Deir Albalah landfill) is shown in **Figure 11**.

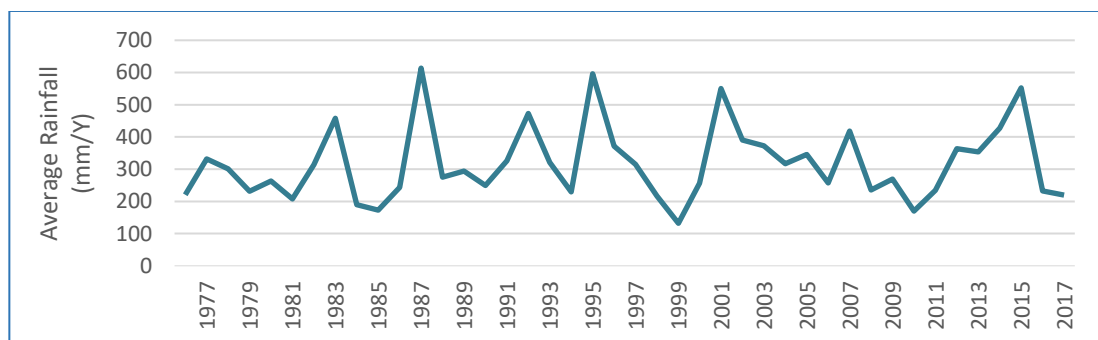


Figure 11: Average rainfall intensity for the hydrological year 1976-2017

5.3 Air Quality

In general, air quality, with the exception of fugitive particulate emissions, the ambient air quality appears to be acceptable. This is because the Gaza Strip is well ventilated with ample dispersion of emissions from the primary air emission sources, namely trucks and automobiles. Winds are either from the Mediterranean or from the Negev desert, neither of which is a source of anthropogenic emissions. Particulate matter appears to be principally in the form of dust from disturbed surfaces. The streets, paved and unpaved, are sources of particulates that are entrained into the air from motor vehicle tires and the wind. This occurs because the streets are not cleaned, there is little groundcover, and street drainage is poor, resulting in thick layers of silt deposits. In the project area, the main sources of dust or particulate matters in general is the traffic, agriculture activities and the activities inside the landfill. Frequent fires and smokes from the landfill are often seen. There are several noise sources due to human activities and nature in the area of concern.

5.4 Land use

The total area of Deir Albalah city is 15,300 dunums according to the municipality's master plan for 1997, which constitutes 30.4% of the area of the Middle area governorate and 4.25% of the total area of the Gaza Strip. The majority of land in Gaza is privately owned (63%). Around 2% of the land is classified as Waqf (properties donated for religious or charitable purposes). The remaining 35 % are public lands.

45% of Gaza Strip is covered by buildings and roads, while 42% is agricultural land. Bare land (12%) is found mainly in the Access-restricted Area (ARA) along the border. Data discrepancies occur for the abandoned settlement area in Khan Younis (16) and Rafah (23), (source, Gaza Urban profile, 2014, UN Habitat).

The general land use of Deir Albalah city is divided into Residential areas and agricultural areas. At Deir Albalah area there are 8,275 building, distribute as 108 villa, 5824 house, 2033 building, 424 establishment, 190 under construction building, and 92 others and not stated.

The number of housing units in Deir Albalah is 15,861, about 13,174 is used for habitation only and 26 for habitation and work, 54 for work only while the rest is vacant, closed or Deserted². The majority are low-quality houses with poor provision of services such as water and electrical supply (Diagnostic report, 2018). Deir Albalah includes Deir Albalah camp in the western part, close to the beach, which is very poor and marginalized vulnerable area. **Table 2** shows the land use plan proposed in the master plan.

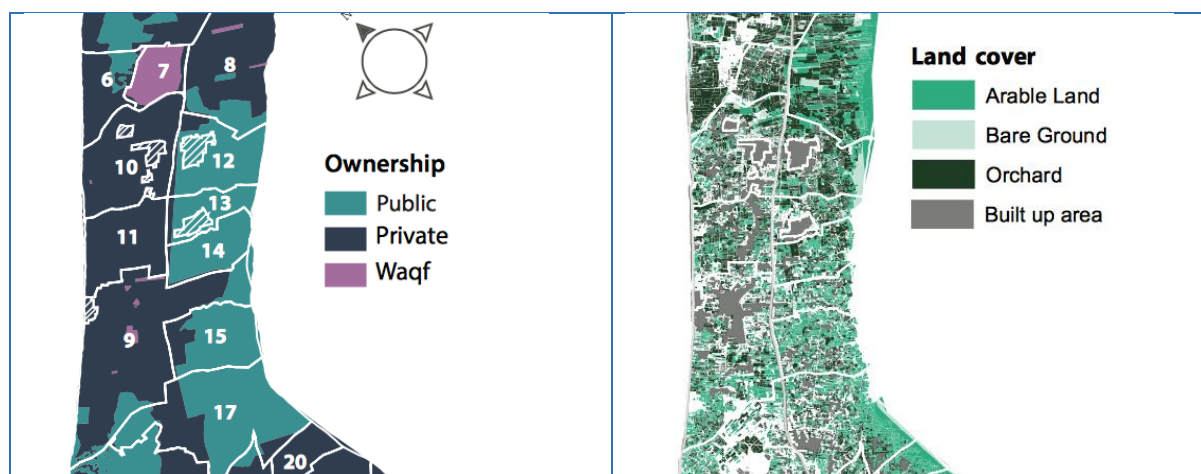


Figure 12: Land ownership and land cover in the Middle Area

Table 2 : The Land Use Plan Proposed in the Master Plan of Deir Albalah

#	Sector	Total Area(Acres)	Total %
1.	Agricultural land area	3440	22.5%
2.	Area of Assisted Agricultural Land	1100	7.2%
3.	Residential land area	5850	38.2%
4.	Industrial Land Area	350	2.3%
5.	Commercial land area	520	3.4%
6.	Area of land used for sport facilities	350	2.3%
7.	Tourist land area	980	6.4%
8.	Beach Campus Area	204,9	1.3%

² PCBS, 2017

#	Sector	Total Area(Acres)	Total %
9.	Area of Islamic cemeteries	132	0.9%
10.	Green Areas	600	3.9%
11.	Public building space	1038	6.8%
12.	Services area	15,8	0.1%
13.	Old city	110	0.7%
14.	Others	609.3	4.0%
The total area of the city (acres)		15,300	100

Involuntary resettlement may cause severe long-term hardship, impoverishment, and environmental damage unless appropriate measures are carefully planned and carried out. In order to ensure compliance with guidelines, the World Bank developed the Operational Policy (OP 4.12) - Involuntary Resettlement. All project activities related to the excavation and construction will be within the boundaries of the landfill. The minor extension will be very close to the landfill. In other words, no new land outside the project area is required for these components and no resettlement is expected. In summary, all project components will not include impacts such as:

- Loss of shelter leading to the relocation
- Loss of assets or access to assets
- Loss of income sources or means of livelihood.

In contrast, the project may influence the local farmers to re-cultivate their lands in the project area.

5.5 Transportation

The regional (north-south) transportation is limited to Salah Aldin road, Al-Rasheed Coastal road and road #4 at some areas. The classification of road system in Deir Albalah governorate consist of 25km regional roads, 70.5 km main roads, 156.5 km minor roads, and 131 km unpaved roads. The main access road to the landfill extends from the Deir Albalah intersection at Salah Aldin road to the eastern border. This road is deteriorated.

5.6 Water Resources and Quality

In General, Gaza Strip is located on the extreme western edge of a shallow coastal aquifer. The water resources in Gaza are limited. The coastal aquifer is considered the only source of freshwater for the Palestinian population in the Gaza Strip with the thickness of the water bearing strata ranging from several meters in the east and south-east to about 120-150 m in the western regions and along the coast. Gaza has a water crisis and faces serious challenges for the future sustainability of water resources. Deir Albalah as the same to the whole strip, the Coastal Aquifer is the only natural source of water supply for all activities (domestic, irrigation and industrial supply). The yearly recharge volume, equaled to the sustainable yield for this limited volume aquifer, is in the range of 55-60 MCM/yr. The Palestinian utilization from this aquifer in Gaza Strip is about 185 MCM in 2012.

Deir Albalah city is located on an underground reservoir extending along the coastal strip of the Strip in general. Deir Albalah, according to the classification of cities in the sector currently according to its water conditions from the areas of surplus water where the population gets their water needs continuously from local or municipal sources. The water table in the city is

estimated between 10-60 m. The domestic and agricultural demands are covered by several wells distributed in the city. (Diagnostic report, 2018).

Based on PWA records over the past eight years, the municipal water abstraction has been increased based on the population growth. Since the year 2000, the agricultural activities have been shrieked due to the Israeli Military activities along the eastern border of the Gaza Strip, which consequently decrease the agricultural demand. But since the year 2006/2007, a jump in the total irrigated area was observed as a result of the induced efforts of NGO's to replant the uprooted lands of citrus and olives, but unfortunately, most of the new shrubs were uprooted again especially in the buffer zones and borderlands.

The groundwater quality is monitored through all municipal wells and some agricultural wells distributed all over the Gaza Strip by CMWU, UNRWA, PWA and others. Gaza Strip is experiencing serious wastewater-driven problems, characterized by high levels of nitrates in the groundwater. Hence, the Palestinian Standard of Chloride concentration is 600 mg/L, whereas the major parts of the aquifer have a chloride concentration ranging between 600-2000 mg/l, while along the coastal line chloride concentration exceeds 2000 mg/l and can reach more than 10,000 mg/l at some spots due to effect of the seawater intrusion related to the type of aquifer and soil formation of the area (PWA. 2017). The groundwater salinity is increasing significantly in most of the water wells. The magnitude as well as the attitude of that increase varied from well to well as well as from area to area, depending on different hydrogeological factors.

5.7 Wastewater Services

The recent data indicate that 75% percent of the Deir Albalah population lives in areas served with sewage networks, while the other 25% use cesspits. The existing swage network size varies between 6" to 12". Deir Albalah municipality estimated that the average discharged wastewater quantity in Deir Albalah is 8750 m3/d, and only 7000 m3/d is drained by the existing sewage network.

5.8 Solid Wastes Generation and Composition

The PCBS estimated, in 2005, that the total waste municipal generation in the Middle area and Khan Younis would be about 0.67 kg per person per day. Based on field assessments, interviews and calibrations, it is was expected that the per capita waste generation for the Deir Albalah including household waste generation as well as street littering will gradually raise to a maximum of 1,05 kg by the end of 2018. Nowadays, Deir Albalah Landfill receives around 450 ton/day. The total generated waste from the Middle area is illustrated in **Table 3**.

Table 3: Khan Younis and Deir Albalah Governorate Solid waste Generation (Ton /day)

Year	Household	Commercial	Market	Total
	Waste	waste	waste	ton/day
2018	492.2	19.3	25.7	537.2

In 2012, UNDP has performed 116 physical sampling analyses of about 100 kg each at different locations in Gaza, and has compared these with the compositions measured directly by other researchers. The average composition figures of municipal waste streams in Middle Gaza are presented in **Table 4**.

Table 4: Waste composition in Middle Gaza

Waste Component	Middle Gaza
Paper	7.96
Plastic	13.03
Yard waste (non wood)	10.68
Organic Food waste	31.19
Wood	1.12
Textile	3.26
Diapers	9.67
Other Organics	1.73
Ferrous	2.1
Aluminum	0.05
Glass	2.04
Sand/fine materials	13.87
Other inorganics	3.28
Total	100

Another three studies (MOP 2010, EQA 2017, and UNDP/DHV 2011) on the waste composition for the Gaza Strip (UNDP, 2012) reflected a high organic content of around 65%. This percentage will be significant when calculating the density of the waste and the amount of gas which will result from aerobic and anaerobic chemical decomposition.

The leachate quantities reaching to the pond are affected by rainfall rate, evaporation and amount of solid waste, that is reflected by higher leachate quantities in the rainy season in compare with those in the dry season. There are two ponds 3600 m³ and 2400 m³ with total volume of 6000 m³. The average monthly of leachate for 2017 was 1462m³ (total of 17,550 m³ for year 2017), with average 38 m³ of recycled quantity onto landfill surface. The maximum reported volume of leachate was in February 2017, 2070 m³. The leachate color varies from dark green olive to very dark green, whereas the turbidity remains dark during the period of investigation, the smell was also the same as well.

5.9 Soils and vegetation

The soil in the Gaza Strip is composed mainly of six types: loess soil, dark brown/reddish-brown, sandy loess soil, loess sandy soil, and sandy loess soil over loess and sandy regosol (PEPA-EQA, 1996). Sand dunes that lie along the coastal side of the Gaza Strip are the main soil type in the Strip. The thickness of the dunes ranging between 2 m to nearly 50 m and expands up to 4-5 km in the north and south regions, and less at the core of the strip. Furthermore, the loess soil which thickness reaches up to 25-30 m is located around the Wadi. While dark brown soil which is clay is situated in the northeastern parts of the strip.

Major agricultural products in Deir Albalah include citrus, dates, and olives. Irrigated crops (e.g. potatoes, cabbage, peas) as well as the rainfed crops are common. Vegetation, which is dominant in and around the project site, include mainly vegetables, rainfed crops, and some fruits. No forests or jungles were seen in the area. Shortage of water and export restrictions have had severe negative impacts on the sector's productivity and economy. In this area in specific, the Israelis restricted the activities, which considered as a buffer zone.

Figure 13 presents the primary crop of Middle Area governorate. (Gaza Urban Profile, 2014, UN Habitat)

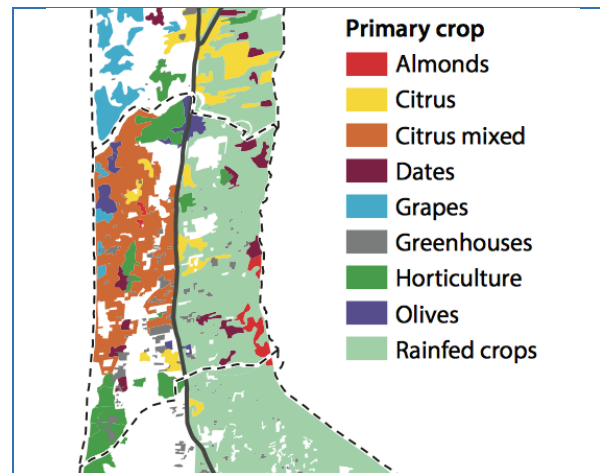


Figure 13: Type of crops in the Middle Area Governorate.

5.10 Biological Habitat and Species, Fauna and Flora

Fauna

Wild Mammals: Data collected around the project area, showed the occurrence of wild mammals. Many of these animals, mainly rodents (gerbils and mole rats) are harmful and cause problems and damage to agricultural crops. However, the main natural enemies for these rodent species are snakes, owls and monitors. The key mammals include; Hare, European hedgehog, Dog, Bat, mongoose, Gerbil, and Mole rat. The populations of some mammalian species such as Hedgehogs, Hares and carnivores were known to diminish in eastern Gaza Strip due to poaching, hunting and habitat modifications. Many mammals have been hunted for the supply of Gaza zoos. Examples are the Golden Jackal (*Canis aureus*) and the Jungle Cat (*Felis chaus*). The Egyptian Mongoose (*Herpestes ichneumon*), Egyptian Fruit Bat (*Rousettus aegyptiacus*), Palestine Mole-rat (*Spalax leucodon ehrenbergi*), House Mouse (*Mus musculus*), and the Commensal Rats (*Rattus* spp.) are by far considered as pests and they are usually combated by the local community; especially farmers using different control means.

Domestic animals: Apart from wildlife, many domestic mammals are commonly seen in or around the project area and the surrounding agricultural fields; these are donkeys, horses, mules, cows, sheep, goats, and camels. Most of the population their own cows, donkey or horses.

Birds: Birds are very sensitive to any change in their habitat or environment. People are not certain about the extinction of certain species of birds from the area but they are sure about the reduction of most of their populations due to many factors. The intensive use of pesticides, over-hunting, noise, and destruction of their habitats are some of these factors. More than 80 bird species are recorded in the literature to happen in the Gaza Strip (Abu Shammalah and Baha El-Din, 1999). The surveys of bird fauna in the areas of the proposed projects in the Gaza Strip pointed out the occurrence of a considerable number of both resident and migratory bird species. Hunting of passerines and non-passerines including raptor species is a common practice in eastern Gaza.

The presence of the landfill promotes the presence of many raptor species as well as Cattle Egret, Hooded Crow, and many passerine species. The Black Kite (*Milvus migrans*) is usually counted in hundreds.

Reptiles: Reptiles are a characteristic feature of arid and semi-arid lands in spite of their presence in other environments. Gaza Strip, is a home to a variety of reptiles which comprise such principal categories like snakes, lizards and turtles. Many species of snakes are prevalent there. They are known to cause injuries and psychological problems to people, mainly children when walking with bare feet.

Flora

The vegetation cover of the Gaza Strip is so important to wildlife. It provides food, shelter, protection, breeding, nesting and resting sites for most Palestinian wildlife species. The Gaza Strip harbors a diversity of wild vascular plant species (Subkingdom Tracheobionta) belonging to the Divisions: Coniferophyta (conifers) and Magnoliophyta (flowering plants), and including trees, shrubs and herbs. Many Olive, Plum, Almond, Citrus agricultural fields or orchards have been encountered in the vicinity of the landfills.

5.11 Population and Houses

In general, Deir Albalah people are enduring a serious humanitarian crisis brought on by more than 14 years of blockade. According to PCBS in 2019, the population of the Deir Albalah by the end of 2019 is 85,985 persons living in 15,300 acres distributed as 50.3% males and 49.7% females with a growth rate 1.03% (Deir Albalah local development plan, 2018-2021). In general, Deir Albalah landfill served 13 villages in the Middle Area (56 Km²) and Khan Younis Municipality (108 Km²). The PCBS estimated, in 2017, the total population for the middle area to be 273,200 capita while, and for Khan Younis Municipality 364,195 capita.³

The local community of the Deir Albalah governorate is considered to be relatively young with a number of youths under 17 years old of 124,124 persons (46%) while those between 18-29 years old are 63,327 (23.5%) persons and the people who are over 60 years old are 12,795 (4.7%).⁴ The average household size is 5.7 in the Gaza Strip.⁵

In addition, the fertility rate amongst the Palestinians is relatively high in comparison to the surrounding countries. The high fertility rate is attributed to the tendency of early marriage among young females, and the local customs and traditions-oriented trends of reproduction rates. Nonetheless, such numbers have seen a drop according to PCBS that showed that the number of new-borns has dropped from 59,000 in 2010 to 58,000 in 2017 in Gaza Strip.⁶

The Palestinian Territories and the Gaza Strip in particular, are considered a very densely populated area. The population density in the Palestinian Territories has reached 672 capita/km² in 2010. However, this number exponentially increases in the Gaza Strip to reach 5,203 capita/km² by the end of 2017 making the Strip one of the most densely populated areas in the world.⁷

The municipal reports showed that 98% of the households live in houses that are connected to the public water networks and 91% have access to the public electricity grid. There is incremental increase in the number of populations. Such an increase requires an action plan

³ PCBS, 2017

⁴ Diagnostic report, 2017

⁵ PCBS, 2018

⁶ PCBS, 2017

⁷ PCBS, 2017

and huge efforts from the Palestinian Authority, NGOs, and INGOs in order to ensure providing health, educational, housing, and infrastructure services.

Deir Al-Balah Landfill is located at the border of Gaza Strip without any buffer zone, the access to that area is not allowed due to the political situation, even farmers are not able to reach to their agricultural lands adjacent to the landfill. The nearest residential area is far more than 500 m, and the nearest agricultural area is far about 100 m from the boundary of the landfill.



Figure 14: Vacant Lands adjacent to the landfill

5.12 Economic Situation

Gaza Strip underwent significant economic, political, and security developments during the last 14 years that directly affected economic activity and growth; especially in light of number of measures that largely impacted the living conditions and humanitarian and economic conditions. Among the measures were 30% to 50% cuts of Gaza Strip civil servants' salaries and imposing forced retirement on thousands of them in accordance with Law 17 of 2017 published on July 22, 2017 concerning early retirement of civil servants. The measures went on in 2018 and the cuts rate increased making most of Gaza Strip civil servants earn 50 % of their salaries. GDP per capita declined by 1.3% compared to 2018 due to the natural population growth with a pace higher than the growth in GDP. Accordingly, the first quarter of 2019 witnessed a decline in the real GDP by 3.3% compared to the fourth quarter of 2018. The decline continued during the second quarter of 2019 by 2.0% compared to the first quarter of 2019.⁸

Unemployment in Gaza reached 52 % in 2018, an increase of almost eight % since 2017 and of more than 20 % since Israel imposed the closure in 2007.⁹ In Gaza Strip, Khan Younis governorate registered the highest unemployment rate with about 58% followed by Deir

⁸ Performance of the Palestinian economy during 2019, PCBS

⁹ <https://gisha.org> , 13 March 2019

Albalah with a rate of about 57%, while the lowest rate was in Gaza governorate with a rate of about 48%.¹⁰

the relative poverty line and the deep poverty line according to consumption patterns (for reference household consisted of 2 adults and 3 children) in Palestine in 2017 were 2,470 NIS (USD 671), and 1,974 NIS (USD 536) respectively. The poverty percentage among Palestinian individuals according to consumption patterns was 29% (14% in the West Bank, and 53% in Gaza Strip). Data revealed that 17% of the individuals in Palestine suffered from deep poverty in 2017, according to consumption patterns (6% in the West Bank, and 34% in Gaza Strip).¹¹

The economic variations reflect tragic scenarios in poverty, unemployment rates and income levels. Therefore, it is fair to assume that people will tend to look for the least expensive services to the commodities of their life such as clean water. However, paying the bill for the municipality might not be always possible in light of the prevalence of extreme poverty, which might lead to rearranging payment priorities and neglect paying the bills.

5.13 Current Crisis and Humanitarian needs

Following violent conflict since September 2000 and nearly three aggressions on Gaza Strip during the last twelve years, which has caused severe damages to the Deir Albalah's physical and institutional infrastructure, including housing, public facilities, as well as vital water, wastewater and electrical networks, public services and networks suffered from direct damage and negligence. During the last aggression in 2014, more than 557 structures were damaged in Deir Albalah, including 46% were fully damaged, 16% damaged partially, while 38% had a minor damage.¹²

And based on the Human Rights associations report about the physical losses during the aggression in 2014, the report mentioned that 4664 houses were destroyed in Deir Albalah governorate, 15 industrial facilities, 175 commercial facilities, 1917040 m² of agriculture lands, 191 animal and birds' houses, 34 water wells, and 109 vehicles.

5.14 Public Health.

All two million people in the Gaza Strip are negatively affected by ongoing deficits and needs in the WASH sector. This includes 983,623 women and 991,428 children who are exposed to public health risks associated with poor water quality, poor wastewater collection and treatment, lack of storm water infrastructure and lack of proper hygiene practices.

In the Gaza Strip, the only natural source of water is the coastal aquifer, which is fed only by rainwater, and the population currently extracts almost three times the aquifer's sustainable annual recharge. Over-pumping has led to increased saline contamination from the Mediterranean (sea intrusion), compounded by the infiltration of raw sewage and nitrates from fertilizers, posing a serious public health risk. As a result, over 96 % of groundwater in Gaza is unfit for human consumption. Recently, the access rate to safe drinking water through the public water network is only 10.5 %.

Around 140 critical water desalination and sewage treatment facilities in Gaza rely on the UN facilitated emergency fuel programme; however, additional facilities also require assistance but are unsupported due to limited funding. A failure to continue this programme would reduce the average water quota from 80 L/c/d to 45 l/c/d while the World Health Organization (WHO) recommends a minimum of 100 liters per capita per day (L/c/d) as a standard for individual

¹⁰ Press release On the occasion of the International Workers' Day, president of Palestinian Central Bureau of Statistics "PCBS" Ms. Ola Awad, presents the current status of the Palestinian labour force, 30/4/2019

¹¹ PCBS, On the occasion of the International Population Day, 11/7/2019

¹² Gaza profile, UN Habitat, 2014

water use. Moreover, the water production of 280 domestic water wells and 30 water reservoirs would be reduced from 220,000 m³ to 40,000 m³ a day; and drinking water from 48 public desalination plants would be reduced by 80%, generating only 4,000m³/day of the plants' nominal capacities of 20,000m³/day. In addition, 55 sewage lifting and collection pumping stations in heavily populated areas would be at risk of flooding, with raw sewage overflowing in the streets during cut-off hours. The performance of the existing five-wastewater treatment plants would decrease by 50%, adding to the over 100 million liters of raw untreated sewage that enters the Mediterranean Sea every day.¹³

Water and wastewater networks serve most heavy populated areas in Deir Albalah. In the project area, only cesspits are used for wastewater disposal. The municipality promised to construct the network in the near future. Deir Albalah area is well served by solid waste containers, collection and disposal plan.

5.15 Archaeological Resources, Recreation and Tourism.

The geographical location of the Gaza Strip has contributed to its notable and diverse history and heritage. The five governorates comprising the Gaza Strip contain varying densities of known sites. The beaches along the 40 km of coast of Gaza are the main source of recreation for Gaza population. One of the most important monuments is the Mosque of al-Khidr (also called "Maqam al-Khader") in Deir Albalah was built on the site of a Byzantine monastery. In March 2016, the Ministry of Tourism and Antiquities in the Gaza Strip restored the Mosque of al-Khidr with financial support from UNESCO and the Nawa Foundation and convert the mosque-tomb into a children's cultural library.

¹³ HNO, 2019

6 Environmental and Social Findings

Through the assessment process of the project it is expected that significant benefits would accrue to the population. Significant environmental benefits are expected after implementation of the project components. This optimized scenario takes into account different raised issues related to: preventing the need for waste transfer outside the site as well as facilitating the construction works. This scenario promotes the crucial need for a new land acquisition to accommodate the waste without the need for waste transfer outside the site.

6.1 No-Project Scenario

The landfill reached more than its capacity and exceeds its boundary over the adjacent lands, northern and western side slopes of waste are currently spreading over the border of the disposal cell, and general side slopes are too steep, which makes the closure is a priority. The leachate is not well managed. If the present situation continues, there will be an accelerating load and additional deterioration of the landfill impacts and pollution to the surrounding environment. This will be negatively reflected on the health and wellbeing of the citizens.

On the other hand, without the planned project activities, the impacts on the other environmental items would follow the long-term impacts on groundwater quality due to increasing the generated wastes and leachate as a result of population growth.

The time of air pollution, smokes, particulate matters and noise generated from the landfill is somewhat not short and frequent and hence, their environmental and/or ecological impacts seem to be of great importance. According to the meetings with the local community, the landfill and its activities are severely impacted their living conditions.



Figure 14: Deir Albalah Landfill

The project idea stems from the need to develop the current situation of the solid waste sector in the Gaza Strip in general and the middle and south area in specific which imposes negative impacts on their beneficiaries and the community at large. This situation frequently endangers the life of local citizens and impacts the level of solid waste services. In addition, this also caused psychological distress to aggrieved families. Moreover, the overflow of leachate spread of rodents, dangerous of failure, impacts of fires and smokes will result in large-scale impacts on the environment and community.

6.2 Environmental Benefits

Through the assessment process of the project details, it is expected that significant benefits would accrue to the environment after the implementation of the project. The identified positive environmental impacts would include the following:

- Improvement in the level of solid waste services; secondary collection, transfer of wastes, other future reuse or recycling processes, and disposal procedures to be in line with international standards in the new sanitary landfill “Sofa Landfill”.
- Mitigating leachate-flooding problems by proper management, installation of liner, and construction of storm water collection network.
- The local community will also experience health and environmental benefits from improved activities in the landfill, post closure management, and solid waste services.
- The improvement will lead to a healthy environment. This will enhance the quality of life, health and well-being of the citizens. The incidence of pollution-borne diseases among the community would be reduced. This, in turn, will improve the environmental health situation concerning the reduction of health problems associated with solid wastes.
- After the closure, the implemented project will have limited impacts, on most of the physical environment factors such as land, water, noise, dust, and air pollution.

6.3 Socioeconomic Benefits

Implementing the project components will necessarily help to mitigate the problems identified before and will contribute to achieving the following:

- Enhance the quality of life and well-being of the citizens.
- The project will also significantly release the psychological distress of citizens living in or farming in the vicinity.
- Carrying out such projects with tangible benefits will reflect a positive image of the municipalities and its services and will, therefore, help in encouraging local citizens to pay their bills to the municipality, and then the municipalities will pay simultaneously their bills to JSC-KRM.
- Women and children, as well as most community categories, would benefit from the proposed project components.
- Employment generation will be elevated due to the engagement of many unemployed people in the project construction and operation. The construction and closure works are expected to create about 10 - 15 new job vacancies.
- Economic benefits are gained as short-term job opportunities for local skilled and unskilled laborers. Moreover, the project would include the following economic benefits:
 - Reduce maintenance costs / emergency management for fires and smokes.
 - Opportunities for local private sector participation and development through consulting, contracting, working and manufacturing inputs throughout the project period.
 - Increase revenues generation and greater cost recovery.

- the project may influence the local farmers to re-cultivate their lands in the project area, or influence other farmers, investors, or cooperatives to invest in agriculture activities in the area.

6.4 Environmental Negative Impacts

The environmental, social and health impact identification procedure followed in this report was based on identifying the key environmental and social features from the baseline information. The key physical, biological, socioeconomic and human valued receptors were identified. The potential negative changes resulting from the defined project activities are then described using an impact identification matrix through which aspects and factors are correlated to find interactions that would potentially result in impacts. The predicted impacts are then evaluated using a significance ranking process based on the importance of the impact. Each valued receptor was categorized in terms of its perceived environmental, social and health value. The evaluation of environmental and related socio-economic impacts related to the closure of Deir Albalah Landfill assessed the following:

- Communities attitude towards the site;
- The possibility of the impact to occur;
- The extent of the impact if it does occur, and how significance is it (positive or negative?);
- The timeframe over which the impact is likely to be experienced (long-term, short-term);
- Possible mitigation or preventive measures.

Potential adverse environmental impacts induced by the construction and post-construction (operation) of the proposed closure activities of the solid waste landfill facility include:

- Generation of landfill gas and odors from decomposing process.
- Erosion of soil during construction and closure phases.
- Contaminations of surface and ground water.
- Noise, pest, dust and other disturbances.
- Occupational and public health hazards and safety
- Earthmoving or resurfacing.

Table 5 summarizes the potential environmental impacts. The table classified the significance of criteria into minor, moderate and major. The classification was based on several factors; direct impact, indirect impact, cumulative impact, boundary, and time horizon.

Table 5: The Potential Impacts during Construction and Post-Closure Phases

Issue	Impact	phase	Significance Magnitude
<i>Water resources</i>	- Increase of water abstracted from aquifer and over pumping for irrigation purposes by the operator/JSC.	Post closure	Moderate
	- Changing water drainage properties which could divert surface water drainage streams to un-preferred location	Post closure	Moderate
	- Contamination and pollution of surface and ground water may occur (risk of chemicals and fuel/oil/diesel spillage and/or leakage from vehicles and equipment that would be mixed with surface water)	Construction & Post closure	Moderate
	- Infiltration of the leachate to aquifer. - If the leachate is not properly collected from the landfill body it could form stress on the base lining system, and raise the risk for loss of containment. - Soil contamination with leachate migration from the landfill	Construction & Post closure	Major
	- Polluted storm water that accumulates in the winter season in the landfill area that could infiltrate to the groundwater.	Construction & Post closure	Major
	- Over flooding of rain water during peak periods or emergencies	Post closure	Moderate
	- Wastewater generated at the site during construction (generated from workers temporary facilities in the site e.g Toilets)	Construction	Minor
	- The migration of the landfill gas through the soil could cause acidification of the groundwater due to the reaction between carbon dioxide in the landfill gas and the water to produce carbonic acid, especially that carbon dioxide is relatively dense gas that tends to move downwards.	Post closure	Minor
<i>Solid Wastes</i>	- Removal of the old deteriorated metal fences, removal of climbing plants (Vine), levelling the streets, and construction wastes would generate more solid wastes.	Construction	Moderate
	- Generated wastes by workers and visitors during construction	Construction	Minor
	- Illegal dumping (during night-time or weekends)	Construction & Post closure	Minor
	- Transferring the solid waste to other illegal dump sites by municipalities or others	Construction & Post closure	Minor
<i>Air Quality and Noise</i>	- Dust generation, nuisance value that in extreme cases may affect health of population (due to trucks movement, reshaping works, cutting and backfilling, removing scattered waste and construction of peripheral embankments).	Construction	Moderate
	- Effects from emission of greenhouse gases	Construction and post closure	Major
	- Nuisance value that may in extreme cases affect health due to standby-generators generators noise and due to movement of trucks and construction activities (gas emissions from vehicles/ trucks movement)	Construction	Moderate
	- Action of the wind on the stored construction materials	Construction	Minor

Issue	Impact	phase	Significance Magnitude
<i>Odor</i>	- The reshaping works will result in migration of offensive odors due to waste degradation - The odor results from the transferred scattered waste	Construction	Moderate
	- Odor from Leachate ponds	Construction & Post closure	Moderate
	- Generation of odor from decomposing process	Post closure	Moderate
<i>Land use, Topography and soil.</i>	- Unplanned induced urbanization of neighboring areas.	Post closure	Moderate
	- Risk of failure, erosion of soil and soil instability. - Changing the topographic features of the area and disturbance of the soil structure, densification	Construction & Post closure	Major
	- Spillage/seepage of waste / leachate in site and to the surrounding areas	Post closure	Major
<i>Transportation / infrastructure</i>	- Impacts of heavy truck movement (importing sand/clay for coverage and other materials)	Construction	Moderate
	- Obstruct the accessibility or property and impairment of the local traffic in the vicinity of the construction sites. - Damage to the access road infrastructure from excavations, construction traffic and heavy machineries.	Construction	Minor
	- Risk of accidents	Construction	Minor
	- Impact to landscape and disturbance of aesthetic feature.	Construction	Moderate
<i>Aesthetics</i>	- Improper collection of sand and wastes if the roads will not be paved after construction	Construction & Post closure	Minor
<i>Agriculture activities, vegetation and (Flora)</i>	- Potential accidental break of the existing irrigation network.	Construction	Moderate
	- Dust generated from construction activities cause impairment of agricultural activities especially during the flowering period from October until April or May (for the nearby citrus, olive, and vegetables).	Construction	Moderate
	- Dust resulting from construction activities lowers the photosynthetic rate of neighboring vegetation and agricultural crops.	Construction	Minor
	- Damage of agricultural areas according to the construction activities.	Construction & Post closure	Minor
	- Dust generated during construction would cause loss of lower vegetation forms (grasses and herbs) in the project areas (indigenous species)	Construction	Minor
	- Alien plant species may establish on site post closure/ decommissioning of the landfill site. This may interfere with the capping layer making it less able to control the ingress of water, resulting in leachate.	Post closure	Moderate
<i>Wildlife, Fauna</i>	- Spread of rodents and insects in the vicinity	Post closure	Minor
	- Habitat loss / escape of some sensitive bird species from the sub-project sites.	Construction	Minor
	- Earth nests of some terrestrial bird species will be destroyed due to transportation and construction activities. - The activities will impact on the presence of some fauna in the area such as birds, mammals and reptiles.	Construction & Post closure	Minor
	- Potential socio-economic impacts due to the health risk posed to cattle grazing on the landfill	Post closure	Minor

Issue	Impact	phase	Significance Magnitude
<i>Awareness, public health and safety</i>	- Negative publicity and misconceptions of neighbors (Some people reject any solid waste facility, and they may consider the closure as some kind of extension). - Different concerns from the local community towards the project activities.	Construction & Post closure	Moderate
	- High unemployability and willingness to work. The neighbor community is poor and classified as vulnerable area which will lead most of them to request temporary jobs during construction and permanent jobs during operation as guards.	Construction & Post closure	Moderate
	- Lack of acceptance to the project from the side of the local communities	Construction	Moderate
	Unplanned visits of public to the site	Construction & Post closure	Major
<i>Occupational and Public Health / Safety</i>	- Workers' health risks, chronic diseases and epidemics - Workers Conditions	Construction	Major
	Workers' health risks, chronic diseases and epidemics	Construction	Major
	Children working in the project	Construction	Major
	Low level of knowledge of the local community about the health safety mitigation measures.	Construction	Major
	Visiting the site by any un-authorized persons.	Construction & Post closure	Major
	Risk of accidents in the access roads.	Construction	Major
	Risk of accidents and injuries that may occur during the following activities: - Loading up and loading down (lifting) - Trucks movement - Using of sharp materials - Falling - Reshaping activities (cut and backfill) - Construction activities - Electricity chocks	Construction	Major
	- Risks related to injury or gunfire from outside the border	Construction & Post closure	Major
	- Movement of operational vehicles and equipment or danger associated with open areas (trenches, unstable ground etc.) may lead to potential safety impacts to the public if not demarcated as no go zones.	Post closure	Moderate
	- Communication with local community, and bad behavior of workers	Construction	Moderate
<i>Archaeological Resources</i>	- Archaeological remains, antiquity or culturally valuable object could be discovered	Construction	Moderate

6.5 Consultations and Verifications

The study team conducted consultations with different groups and entities in order to collect the necessary information and complete the project description and their impacts; facilitate consideration of alternatives, mitigation measures and tradeoffs; reduce conflict through the early identification of contentious issues; provide an opportunity for the public to influence project design in a positive manner (thereby creating a sense of ownership of the proposal);

improve transparency and accountability of decision-making; and increase public confidence in the ESMP process. The consultation activities included meetings with the JSC-KRM, municipalities, local engineers, and municipal staff. As well Consultations with the landowner was held by a formed committee in order to finalize purchasing the required land (8,000 m²) in order to achieve the project closure activities.

6.5.1 Consultation Workshop

A consultation workshop was conducted on 26th December 2019 in Wadi Al-Salqa Municipality with the key stakeholders and community representatives, to present the project details and validate the findings. The workshop attended by farmers working around the landfill, representatives of Deir Albalah and Wadi Al-Salqa Municipalities, local community members, local farmers and land owners, local NGOs, MDLF staff, JSC KRM staff. The consultant presented the design, alternatives, operation sequences as well as the details of the ESMP. The participants were consulted to highlight their expectations for other potential impacts and mitigation measures that could be minimize any impact in the project vicinity.

The following template was presented and discussed with the participants to facilitate their understanding and collection of opinions concerning the different environmental.

Issue	Construction Phase					Post Closure Phase				
	Impact	Significance	Mitigation measures	Monitoring (Measure and Method)	Responsibilities	Impact	Significance	Mitigation measures	Monitoring (Measure and Method)	Responsibilities

The following are the key issues that were addressed by the participants:

- The participants welcome the project and consider it as a priority for their area.
- The participants confirmed the importance of the project and its expected positive impact on the health and agriculture aspects.
- The participants reported that they sometimes suffer from leachate flooding incidents in the winter.
- Due to the landfill, the community suffers from stray dogs, which affected their cultivated crops.
- The participants issued some recommendations to be considered including: put a warning and directions signs as the landfill located at the border area and plant green belt after landfill closure to absorb the emitted gases and avoid odor.
- Some of the participants had some concerns about the ability to re-cultivate their lands surrounding the landfill, they are expecting that the closure of the landfill will improve their income by enhancing agriculture activities in the area and will increase the price of their lands.



Figure 15: Selected Photos of the Consultation Workshop

6.5.2 Consultation with the land owner

The optimum design of Dier Al-Balah Closure requires to use part of the adjacent vacant land, the required land is (8,000 m²). A committee was formed by MoLG to discuss with the landowners to purchase the land through JSC-KRM. The committee, which was consisted of representative from MoLG, four mayors, and JSC-KRM executive director carried out a meeting with the landowners. The landowners were trying to sell all of their land about (30,000 m²) as one lot. The landowners were also discussed the land price with the committee; they accepted to sell the land, but the value of land is still negotiable issue. Consultation is still progressing and it will be documented in an independent document.

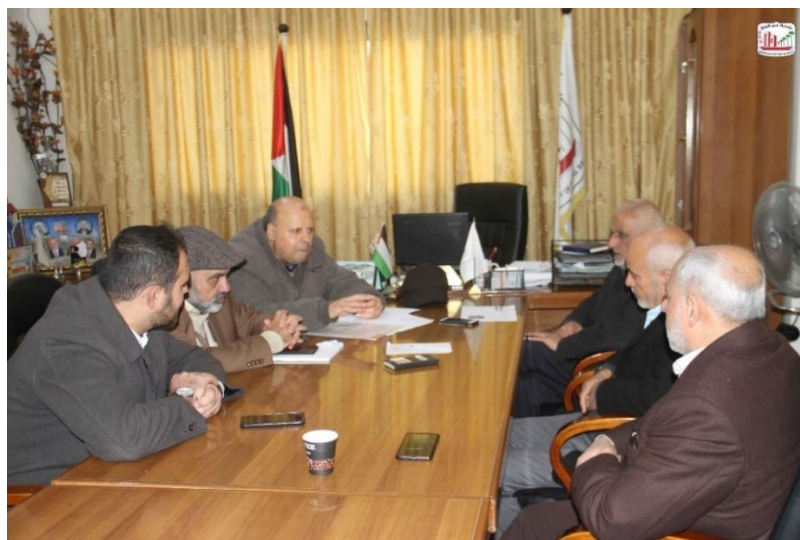


Figure 17: Formed Committee meeting after the meeting with the land owner

7 Mitigation Measures and Monitoring Plan

The purpose of impact mitigation is to look for better ways of implementing the proposed project or associated activities so that the negative impacts are eliminated or minimized, while benefits are enhanced. Impact mitigation requires that the full extent of the anticipated environmental problems are understood. In view of this, this section of the ESMP presents mitigation measures resulting from the impacts identified.

Mitigation measures require a successful impact management plan implemented at the correct time and in a correct way. This usually requires a clearly written and agreed plan of action for managing impacts so that these are kept within the limits of acceptability. The monitoring plan describes how and who will carry out the monitoring activities for addressing the negative environmental issues.

This section aims to coordinate the environmental policies, plans, programs and decisions of the various parties involved in the project, which exercise functions that affect the environment. Environmental monitoring is an important component of the ESMP. It provides the information for periodic review and refinement modification of the ESMP as necessary, ensuring that environmental protection is optimized at all project phases. Through monitoring, unwanted environmental impacts are detected early and remedied effectively. It will also validate the predicted impacts and the effectiveness of the proposed mitigation measures. Lastly, it will also demonstrate compliance with national regulatory requirements. The ESMP aims to minimize the duplication of procedures and provide consistency in the protection of the environment. In order to ensure smooth and uncomplicated achievement of the ESMP components, it would include the following basic components:

- Potential impacts and their mitigation measures
- Environmental monitoring and enforcement
- Institutional component

7.1 Environmental Mitigation Measures

Environmental mitigation includes a matrix identifying the issues, mitigation measures, responsibility for carrying out the mitigation measures and the approximate cost estimates for the actions. Avoiding or mitigation of environmental impacts is by far preferable to compensation or rehabilitation measures after an impact has happened. It is the task of the ESMP to identify significant impacts, to define measures to avoid or at least to minimize these impacts and to take care that these measures are properly applied at all project phases.

The following paragraphs describe the proposed mitigation measures and monitoring actions for each project phase in general before the most significant measures are defined in detail.

- As identified earlier, impacts during construction phase are primarily associated with the construction of the networks and rehabilitation activities. The significant accompanying activities comprise earthworks, material transport and movement of heavy machinery. Such impacts are mostly short-term, local, and caused by the contractor activities at the construction sites and the access roads and can be mitigated through proper construction management in coordination with the contractor and the authorities concerned. The

contractor in cooperation with the monitoring agency is responsible for implementing the mitigation measures during the construction phase.

- Impacts of post-closure phase of the project are primarily associated with air, water resources, soil, public health and land use.

7.2 Environmental Monitoring

Environmental monitoring is the timely and proper survey of the significant environmental impacts of a project during all project phases. Monitoring results help judge the success of mitigation measures in protecting the environment. They are also used to ensure compliance with environmental standards, and to identify necessary changes in the project design or operation.

In order to implement sufficient and adequate ESMP in terms of project monitoring, reporting and supervision, the following actions are recommended:

- Site-specific environmental monitoring review to be conducted at least twice a month for the project site. The screening and review process should be conducted in close coordination with municipalities and other involved parties. Photographic records will support the visual assessment. External auditing may take place at unspecified times. A standard appraisal / mitigation form shall be used. The form should basically include:
 - a) Current environmental problems such as water supply contamination at the site, dust and air pollution.
 - b) Any potential environmental impacts of the project, if any, due to the project.
 - c) Mitigation measures.
- Prepare a monthly progress report (Environmental Audit) addressing the environmental issues, status of mitigation measures taken and recommendations. Landfill Supervisor shall record and report upon environmental management measures undertaken to mitigate assessed impacts upon the environment. The Landfill Supervisor shall maintain detailed records of parameters monitored. These detailed records shall demonstrate the effectiveness of the management actions implemented to mitigate potential impacts. The Landfill Supervisor shall compile an Environmental Monitoring procedure which details the scope, nature, process, schedule and templates for environmental monitoring. Monitoring results and the associated required management and mitigation actions for the coming monitoring period are to be presented in the monitoring section of the monthly/ progress report.

Environmental mitigation and monitoring actions are presented in a simple matrix format. They include identification of the problems, mitigation measures, monitoring responsibilities, and the responsibilities to carry out the mitigation and monitoring measures. All the mitigation measures should be incorporated into the construction and supervision contracts. In addition, JSC-KRM in coordination with other partners is responsible for monitoring and enforcing the various environmental issues as related to the project activities as outlined in **Table 6**. Also, the

JSC-KRM is responsible for executing any necessary measure out of those highlighted in the table according to the prevailing conditions at the site.

7.3 Additional Recommendations

The following are the recommended issues during the implementation phase in order to enhance the social acceptance and maximize the benefits:

- The tangible benefits of the components make it important to start with the implementation phase as soon as possible.
- A rigorous set of safety and security procedures need to be followed whilst implementing the project components of mobilization, construction and rehabilitation to ensure the safety of the workers and citizens.
- The key requirements for closure design include; The project should ensure the mitigation and well management of the identified pollution risk, it also should reduce the infiltration of precipitation into the landfill to control leachate generation, and separates the waste in the landfill from its surrounding environment.
- Taking extra precautions of leaving construction materials, waste or tools that might be of risk to local residents.
- Using proper signs to indicate construction works at nearby areas, inside the site, and clearly makes such signed apparent at nights.
- Make sure that the project components do not violate lands or private properties.
- Striving for excellence and quality of work with an objective of meeting people needs.
- Conducting hygiene, public health and citizenship awareness sessions to local people using proper media and tools.
- The project should include items for removing the old deteriorated fences or materials and ensure the installation of new fences.
- The importance of carrying out a post-evaluation impact assessment / environmental audit upon finishing the project to identify positive impacts and learn lessons from success stories.
- The contractor will be requested to cover the insurance of all employees and comply with the safety and health measures: All risks Insurance schedule policy and workmen compensation insurance policy will be contracted for all the activities above described, and extended to all workers assigned on site: not only for workers directly hired by the contractor, but also by its sub-contractors, and by the MDLF, by JSC, and the supervision team and other visitors.
- The importance of utilizing skilled and unskilled labor from the local area (Middle Area Governorate and from the project area in specific) to work in the proposed project, which should positively reflect an ownership and citizenship feeling amongst residents. Moreover, no workers will be accommodated overnight in the project locations. The contractor will be requested to comply with this ESMP during the construction phase, whereas MDLF and JSC-KRM will monitor the compliance with mitigation measures including the workers' insurance issues and the establishment and the application of a code of conduct for workers.

- Bulldozer, excavator, loaders and trucks are expected to be used during the closure activities, and the contractor will be requested to have insurance for all equipment inside the construction site, uncovered equipment by valid insurance will not be allowed to enter the site, as well as unlicensed drivers or any worker under 18 years old.
- Contractor should comply with the MoH and WHO guidelines related to Covid 19. All protection measures for workers should be followed.

Table 6: Summary of Environmental and Social Management and Monitoring Plan (ESMP)

Issue	Impact	Phase	Significance	Mitigation measures	Significance post mitigation	Responsibility of Execution	Monitoring (Measure and Method)	Monitoring & enforcement Responsibility
<i>Water resources</i>	- Increase of water abstracted from aquifer and over pumping for irrigation purposes by the operator/JSC.	Post closure	Moderate	- Schedule of water pumping to the irrigation networks.	Minor	JSC-KRM	Periodic Readings of Water Meters	CMWU / PWA
	- Changing water drainage properties which could divert surface water drainage streams to un-preferred location	Post closure	Moderate	- Engineering design, shaping and capping the site using appropriate liner, and installation of storm water network.	Minor	JSC-KRM	Monitoring	MOLG, EQA
	- Contamination and pollution of surface and ground water may occur (risk of chemicals and fuel/oil/diesel spillage and/or leakage from vehicles and equipment that would be mixed with surface water)	Construction & Post closure	Moderate	- Apply a geohydrological monitoring program (monitoring boreholes in and off the site and water level measurements must be obtained during every sampling event on the site). - Ensure fuel storage, if any, are enclosed within a bund wall. - Follow operation instructions	Minor	Contractor, JSC-KRM	Monitoring	JSC-KRM, EQA
	- Infiltration of the leachate to aquifer. - If the leachate is not properly collected from the	Construction & Post closure	Major	- A leachate collection system is to be in place and extensively	Minor	JSC-KRM	Monitoring and Readings	EQA, MoAg

Issue	Impact	Phase	Significance	Mitigation measures	Significance post mitigation	Responsibility of Execution	Monitoring (Measure and Method)	Monitoring & enforcement Responsibility
	landfill body it could form stress on the base lining system, and raise the risk for loss of containment. - Soil contamination with leachate migration from the landfill			monitored for 18 months. then periodic monitoring should be applied after that in order to ensure the leachate collection system is working by gravity. - All water from the waste should be kept in an appropriate leachate pond. - Level measurement of the leachate pond and records of pumping station - Schedule a preventive maintenance plan for the leachate collection system				
	- Polluted storm water that accumulates in the winter season in the landfill area that could infiltrate to the groundwater.	Construction & Post closure	Major	- The installation of stormwater system, and must be regularly checked for damage and proper functioning.	Minor	Contractor& JSC-KRM	Monitoring and periodic Readings	EQA, MoAg
	- Over flooding of stormwater during peak periods or emergencies	Post closure	Moderate	- Consideration in the detailed design, - Prepare Emergency Plans	Minor	Consultant, JSC-KRM	Check the design, Site Monitoring	EQA, MoAg

Issue	Impact	Phase	Significance	Mitigation measures	Significance post mitigation	Responsibility of Execution	Monitoring (Measure and Method)	Monitoring & enforcement Responsibility
	- Wastewater generated at the site during construction (generated from workers temporary facilities in the site)	Construction	Minor	- Sewage tanks should be periodically checked, emptied, and sewage should be taken to the WWTP.	Minor	Contractor, JSC-KRM	Site Monitoring	JSC-KRM
	- The migration of the landfill gas through the soil could cause acidification of the groundwater due to the reaction between carbon dioxide in the landfill gas and the water to produce carbonic acid, especially that carbon dioxide is relatively dense gas that tends to move downwards.	Post closure	Minor	- Installation of Gas collection system, degassing system.	- Minor	- JSC-KRM, CMWU	- Keep records of collected gas through the degassing system - Analyze ambient air quality at the borders. - Analyze the acidity and hardness of groundwater taken from monitoring wells on quarterly basis	JSC-KRM, EQA, PWA, CMWU
<i>Solid Wastes</i>	- Removal of the old deteriorated metal fences, removal of climbing plants (Vine), levelling the streets, and construction wastes would generate more solid wastes.	Construction	Moderate	Follow the instructions and prepare a plan for collection, storing and disposal of all materials.	Minor	Contractor	Supervision	JSC-KRM
	- Storage of construction waste	Construction	Low	Taking extra precautions of leaving construction materials, waste or tools that might be of risk to local residents	Minor	Contractor	Supervision	JSC-KRM

Issue	Impact	Phase	Significance	Mitigation measures	Significance post mitigation	Responsibility of Execution	Monitoring (Measure and Method)	Monitoring & enforcement Responsibility
	- Generated wastes by workers and visitors during construction	Construction	Minor	- Domestic waste should be stored in containers and disposed when full up.	Minor	Contractor	Supervision	JSC-KRM
	- Illegal dumping (during night-time or weekends)	Construction & Post closure	Minor	- All existing fencing shall be maintained to prevent access for illegal dumping. - Maintain security at the site for a short period after closure - Installation of a camera surveillance system	Minor	Municipality /JSC-KRM/ Contractor	Monitoring enforcement measures / penalties	Municipality
	- Transferring the solid waste to other illegal dump sites by municipalities or others	Construction & Post closure	Minor	- Monitoring the sites and issuing penalties	Minor	LGUs, UNRWA, JSC-KRM	Monitoring and GRM system	EQA
<i>Air Quality and Noise</i>	- Dust generation, nuisance value that in extreme cases may affect health of population (due to trucks movement, reshaping works, cutting and backfilling, removing scattered waste and construction of peripheral embankments).	Construction	Moderate	- Dust suppressants, proper transporting and storage of construction materials - Proper activity scheduling and working hours and days and limit the activities to day times and prevent any construction activities at weekends.	- Minor	- Contractor	- Site monitoring - Complaint monitoring - Site supervision - Public consultation	JSC-KRM/ Municipality

Issue	Impact	Phase	Significance	Mitigation measures	Significance post mitigation	Responsibility of Execution	Monitoring (Measure and Method)	Monitoring & enforcement Responsibility
				<ul style="list-style-type: none"> - Using relatively new construction and transportation vehicles with lower emissions - Watering the site, and Spraying of water before excavations during strong winds and dry periods. - Issue site workers with appropriate dust masks and safety requirements 				
	- Effects from emission of greenhouse gases	Construction and post closure	Major	<ul style="list-style-type: none"> - Installation of Gas collection system, degassing system. - Installation of gas flaring unit - Proper ventilation - Occupational health and safety procedures - Plant trees as noise/dust barriers at the boundary of the landfill 	- Medium	- Contractor, JSC-KRM	<ul style="list-style-type: none"> - Keep records of collected gas through the degassing system - Analyze ambient air quality at the borders. - Site monitoring 	JSC-KRM, EQA
	- Nuisance value that may in extreme cases affect health due to standby-generators generators noise and due	Construction	Moderate	- Avoid working at night as possible	- Minor	- Contractor	- Regular noise monitoring	JSC-KRM

Issue	Impact	Phase	Significance	Mitigation measures	Significance post mitigation	Responsibility of Execution	Monitoring (Measure and Method)	Monitoring & enforcement Responsibility
	to movement of trucks and construction activities (gas emissions from vehicles/trucks movement)			<ul style="list-style-type: none"> - Use of mufflers and/or noise dampers. - Regular maintenance of construction machines and trucks - Fixed equipment and loading and unloading, stockpiling areas should be located far from sensitive receptor 			- Complaint monitoring	
	- Action of the wind on the stored construction materials	Construction	Minor	- Wet of cover securely stockpiles of materials during windy or rainy conditions	- Minor	- Contractor	Supervision	JSC-KRM
Odor	<ul style="list-style-type: none"> - The reshaping works will result in migration of offensive odors due to waste degradation - The odor results from the transferred scattered waste 	Construction	Moderate	<ul style="list-style-type: none"> - Proper ventilation - Limit the works to day hours. - Ensure that the all workers are wearing the suitable masks during these activities. 	Minor - Moderate	Contractor	Supervision	JSC-KRM

Issue	Impact	Phase	Significance	Mitigation measures	Significance post mitigation	Responsibility of Execution	Monitoring (Measure and Method)	Monitoring & enforcement Responsibility
	- Odor from Leachate ponds	Construction & Post closure	Moderate	- The pond should be surrounded with wind break trees so that to minimize dispersion of odor in the surrounding areas.	Minor	Contractor JSC-KRM	Monitoring	JSC-KRM, EQA
<i>Land use, Topography and soil.</i>	- Risk of failure, erosion of soil and soil instability. - Changing the topographic features of the area and disturbance of the soil structure, densification	Construction & Post closure	Major	- Reduce water flow over bare soil - Reduce velocity of water by using effective contouring to reduce slope grades, ditch blocks to reduce runoff velocities and prompt and effective re-vegetation of bare ground whenever possible, which stabilizes the soil and helps to reduce run-off water velocities - Appropriate measures including provision of berms and silt traps during construction - Storage of soil spoils in flat area close to	- Moderate	- Consultant, Contractor, JSC-KRM	- Proper design - Periodic checks	Municipality and JSC-KRM

Issue	Impact	Phase	Significance	Mitigation measures	Significance post mitigation	Responsibility of Execution	Monitoring (Measure and Method)	Monitoring & enforcement Responsibility
				landfill, away from drainage pattern. - Ensure that the staging areas used are fenced and marked prior to construction activities				
	- Spillage/seepage of waste / leachate in site and to the surrounding areas	Post closure	Major	- Any spillage of waste, caused by any party during the closure activities, shall be cleaned up immediately and appropriately disposed of. The polluted soil shall be rehabilitated or remediated.	- Minor	- Consultant, Contractor, JSC-KRM	- Proper design - Periodic checks	Municipality and JSC-KRM

Issue	Impact	Phase	Significance	Mitigation measures	Significance post mitigation	Responsibility of Execution	Monitoring (Measure and Method)	Monitoring & enforcement Responsibility
<i>Transportation / infrastructure</i>	- Impacts of heavy truck movement (importing sand/clay for coverage and other materials)	Construction	Moderate	<ul style="list-style-type: none"> - Traffic Management Plan - Traffic signs to ensure proper routing and distribution of traffic - Provision of adequate notification procedures for any road closures. 	Minor	Contractor	Site monitoring and Complaint monitoring	JSC-KRM
	- Damage to the access road infrastructure from excavations, construction traffic and heavy machineries.	Construction	Minor	<ul style="list-style-type: none"> - Proper planning of construction activities. - Traffic management (signs, traffic flow) - Speed limits for construction vehicles. - Fixing any damage caused by the contractor. 	- Minor	- Contractor	- Site monitoring Complaint monitoring	JSC-KRM
	- Risk of accidents	Construction	Minor	- Provide insurance for all vehicles inside the site and updated compliance certificates (mandatory	Minor	Contractor		JSC-KRM

Issue	Impact	Phase	Significance	Mitigation measures	Significance post mitigation	Responsibility of Execution	Monitoring (Measure and Method)	Monitoring & enforcement Responsibility
				periodical verifications). - Document and report about the accidents and injuries.				
<i>Aesthetics</i>	- Impact to landscape and disturbance of aesthetic feature.	Construction	Moderate	<ul style="list-style-type: none"> - Landscaping (esp. screening by planting of trees, substitution of cut-down trees) - Following all mitigation impacts that minimize and/or control the dust, odor, noise, and aesthetic features. - Considering of not only onsite but also offsite effects - Proper operations and maintenance management, and reshaping of construction sites - Plant tree-belt around the landfill borders 	Minor	Contractor, JSC-KRM, Municipality	<ul style="list-style-type: none"> - Supervision - Site visits 	JSC-KRM, Municipality

Issue	Impact	Phase	Significance	Mitigation measures	Significance post mitigation	Responsibility of Execution	Monitoring (Measure and Method)	Monitoring & enforcement Responsibility
	- Improper collection of sand and wastes if the roads will not be paved after construction	Construction & Post closure	Minor	Control on roads leading to the project site. Daily Roads cleaning and remove waste and sand.	Minor	Contractor, JSC-KRM, Municipality	- Supervision	Municipality
<i>Agriculture activities, vegetation and (Flora)</i>	- Potential accidental break of the existing irrigation network.	Construction	Moderate	Consideration in the detailed design, construction supervision, in case of damage immediate repair.	Minor	Consultant, Contractor	Investigation of the existing farms	JSC-KRM
	- Dust generated from construction activities cause impairment of agricultural activities especially during the flowering period from October until April or May (for the nearby citrus, olive, and vegetables). - Dust resulting from construction activities lowers the photosynthetic rate of neighboring vegetation and agricultural crops.	Construction	Moderate	- Minimizing the release of dust by using appropriate technology and tools. - Dust generating activities should be avoided during the flowering period as much as possible.	Minor	Contractor	Construction supervision	JSC-KRM,
	- Damage of agricultural areas according to the construction activities.	Construction & Post closure	Minor	- Prevent use of agricultural soil for filling, excavating, trenching or stockpiling of materials	Minor	JSC-KRM, Municipality	Coordination with authorities and local residents	EQA

Issue	Impact	Phase	Significance	Mitigation measures	Significance post mitigation	Responsibility of Execution	Monitoring (Measure and Method)	Monitoring & enforcement Responsibility
				- Check proper implementation before hand over process				
	- Dust generated during construction would cause loss of lower vegetation forms (grasses and herbs) in the project areas (indigenous species)	Construction	Minor	These plant forms have a fast regeneration time. They are found elsewhere. No action is needed here.	Minor	--	Site monitoring	--
	- Alien plant species may establish on site post closure/ decommissioning of the landfill site. This may interfere with the capping layer making it less able to control the ingress of water, resulting in leachate.	Post closure	Moderate	- Maintenance of the site is ongoing until indigenous vegetation has successful established on site. - Any alien plants identified must be removed from site and destroyed. - Care must be taken not to control indigenous species.	- Minor	- Consultant, Contractor, JSC-KRM	- Proper design Periodic checks	Municipality and JSC-KRM
<i>Wildlife, Fauna</i>	- Spread of rodents and insects in the vicinity	Post closure	Minor	- Sanitation and appropriate pest control methods.	- Minor	- Municipality and JSC KRM	- Good planning - Site investigation - Pest control	EQA
	- Habitat loss / escape of some sensitive bird species from the sub-project sites.	Construction	Minor	- Monitoring and avoidance of noise-generating machines and disturbances.	- Minor	- JSC-KRM	- Good planning for activities - Site investigation	Municipality EQA

Issue	Impact	Phase	Significance	Mitigation measures	Significance post mitigation	Responsibility of Execution	Monitoring (Measure and Method)	Monitoring & enforcement Responsibility
	<ul style="list-style-type: none"> - Earth nests of some terrestrial bird species will be destroyed due to transportation and construction activities. - The activities will impact on the presence of some fauna in the area such as birds, mammals and reptiles. 	Construction & Post closure	Minor	<ul style="list-style-type: none"> - Monitoring especially for rare or threatened bird species. - Construction works should be limited to targeted areas only. 	- Minor	- JSC-KRM, Contractor	- Good planning for activities Site investigation	Municipality EQA
<i>Sharing Information with the community.</i>	- Negative publicity and misconceptions of neighbors	Construction & Post closure	Moderate	<ul style="list-style-type: none"> - Conducting hygiene, public health and citizenship awareness sessions to local people using proper media and tools. - Public information campaigns before the project is executed - Information sharing with the community and forming a committee from the local residents for monitoring the construction. - Conduct regular consultation sessions with the stakeholders and the project neighbors. 	Minor	Municipality/ JSC KRM / EQA	Public consultation	JSC-KRM

Issue	Impact	Phase	Significance	Mitigation measures	Significance post mitigation	Responsibility of Execution	Monitoring (Measure and Method)	Monitoring & enforcement Responsibility
	<ul style="list-style-type: none"> - Different concerns from the local community towards the project activities. - Lack of acceptance to the project from the side of the local communities 	Construction	Moderate	<ul style="list-style-type: none"> - Grievance uptake channels to be created in the site for any coming complaints during construction by ensuring significant number of indicative signs around the project site (including contact information, project description, etc.) and using the complaint box located at the landfill camp. - Sort and process the received complaints - Acknowledge and follow up the complaints - Verify, investigate, and act to determine the validity of received grievance 		Municipality/JSC-KRM	Complaint monitoring	
Community Health & safety	<ul style="list-style-type: none"> - Visiting the site by any unauthorized persons. 	Construction & Post closure	Medium	<ul style="list-style-type: none"> - Coordination is required - Restriction the access of unauthorized people. 	Medium	JSC-KRM	Site control and monitoring	Municipality

Issue	Impact	Phase	Significance	Mitigation measures	Significance post mitigation	Responsibility of Execution	Monitoring (Measure and Method)	Monitoring & enforcement Responsibility
	- Risk of accidents in the access roads.	Construction	Major	<ul style="list-style-type: none"> - Design a traffic plan for all the project vehicles in the access road. - Use signs and traffic barriers in the access road. - Limit the road traffic in the rush hours especially at the school time. 	Medium	JSC-KRM	Site control and monitoring	Municipality
	- Risk of accidents inside the site and surrounding areas	Construction	Moderate	- Using proper signs to indicate construction works at nearby areas, inside the site, and clearly makes such signed apparent at nights	Medium	JSC-KRM	Site control and monitoring	JSC-KRM
	- low level of knowledge of the local community about the health safety mitigation measures.	Construction	Major	<ul style="list-style-type: none"> - Design and distribute a fact sheet with the required information for the community. - Consult the neighborhood about the H&S mitigation measures. 	Low	JSC-KRM	- Complaints reports, and consultations recommendations.	JSC-KRM
<i>Occupational and Public</i>	High unemployability and willingness to work. The neighbor community is poor and classified as vulnerable area which will lead most of	Construction & Post closure	Moderate	- The Contractor is advised to hire workers from local community. no workers will be	Moderate	Contractor	Project document (Worker sheet) and site visit	JSC-KRM MDLF

Issue	Impact	Phase	Significance	Mitigation measures	Significance post mitigation	Responsibility of Execution	Monitoring (Measure and Method)	Monitoring & enforcement Responsibility
<i>Health / Safety</i>	them to request temporary jobs during construction and permanent jobs during operation as guards.			accommodated overnight in the project locations				
	Workers' health risks, chronic diseases and epidemics	Construction	Major	- Vaccination against leptospirosis and tetanus of all workers assigned on site	Moderate	MOH	Medical affidavits	JSC-KRM MDLF
	Children working in the project	Construction	Major	- Prevent any child under 18 years old to work in the project activities.	Low	Contractor JSC-KRM	Site control and monitoring	JSC-KRM MDLF
	Health and Safety of workers	Construction	Major	- A rigorous set of safety and security procedures need to be followed whilst implementing the project components of mobilization, construction and rehabilitation to ensure the safety of the workers and citizens	Moderate	Contractor JSC-KRM	Site control and monitoring	JSC-KRM MDLF
	Risk of accidents and injuries that may occur during the following activities: - Loading up and loading down (lifting) - Trucks movement - Using of sharp materials - Falling	Construction	Major	- Follow safety instructions, and worker should wear proper clothing; Personal Protective Equipment (PPE) - Appointing an environmental	Low	- Contractor JSC-KRM	Training program Site supervision Public consultation.	JSC-KRM MDLF

Issue	Impact	Phase	Significance	Mitigation measures	Significance post mitigation	Responsibility of Execution	Monitoring (Measure and Method)	Monitoring & enforcement Responsibility
	<ul style="list-style-type: none"> - Reshaping activities (cut and backfill) - Construction activities - Electricity chocks 			<ul style="list-style-type: none"> monitoring and safety engineer. - Ensure that all the workers (direct and indirect workers) are covered by a valid insurance. All risks Insurance schedule policy and workmen compensation insurance policy will be contracted for all the activities above described, and extended to all workers assigned on site: not only for workers directly hired by the contractor, but also by its sub-contractors, and by the MDLF, by JSC, and the supervision team and other visitors. - A first aid station with trained staff, which is able to coordinate with local hospitals in case of emergencies - Personnel will be trained in 				

Issue	Impact	Phase	Significance	Mitigation measures	Significance post mitigation	Responsibility of Execution	Monitoring (Measure and Method)	Monitoring & enforcement Responsibility
				<p>Occupational and Environmental Health and Safety matters including accident prevention, safe lifting practices, safe chemical handling, proper control and maintenance of equipment and facilities.</p> <ul style="list-style-type: none"> - Adequate sanitary facilities, potable water, and garbage bins should be provided. - Security of the project site should be imposed at all times. - Warning signs and instructions in case of emergencies should be properly displayed, workers must be informed about these precautions. - Requirements of Palestinian Labor Law should be applied. 				

Issue	Impact	Phase	Significance	Mitigation measures	Significance post mitigation	Responsibility of Execution	Monitoring (Measure and Method)	Monitoring & enforcement Responsibility
				- Documenting and Reporting about all accidents and injuries.				
	- Risks related to injury or gunfire from outside the border	Construction & Post closure	Major	- Clear instructions - Coordination with Local Authorities	Moderate	- JSCK RM	Site control and monitoring	
	- Movement of operational vehicles and equipment or danger associated with open areas (trenches, unstable ground etc.) may lead to potential safety impacts to the public if not demarcated as no go zones.	Post closure	Moderate	- The site must have access control. - The public will not be allowed near the working areas. - On site vehicles will be fitted with reversing horn. - Staff on site will wear PPE and reflective clothing. - Open excavations will be marked with danger tape	Low	JSC KRM	Site control and monitoring	
	- Communication with local community, and bad behavior of workers	Construction	Moderate	- Restrict the communication between workers and the surrounding local community. - No camp for accommodation at the night except for the camp guard. - Sexual exploitation and abuse and sexual harassment	Low	Contractor	Site monitoring	- JSC-KRM

Issue	Impact	Phase	Significance	Mitigation measures	Significance post mitigation	Responsibility of Execution	Monitoring (Measure and Method)	Monitoring & enforcement Responsibility
				should be controlled. - A code of conduct of the workers should be prepared and implemented for all workers in the construction camp.				
	- Workers conditions	Construction	Major	- Contractor should comply with the MoH and WHO guidelines related to Covid 19. All protection measures for workers should be followed. - Provide a suitable rest place for all workers in the site. - Give the workers an hour for rest and taking their meal (lunch hour). - Provide hygiene tools for the workers in the site. - Secure good transportation means for the workers to reach the site safely specially it locates near the border line.	Low	Contractor	Site monitoring	- JSC-KRM

Issue	Impact	Phase	Significance	Mitigation measures	Significance post mitigation	Responsibility of Execution	Monitoring (Measure and Method)	Monitoring & enforcement Responsibility
<i>Archaeological Resources</i>	- Archaeological remains, antiquity or culturally valuable object could be discovered	Construction	Moderate	<ul style="list-style-type: none"> - Monitoring of site excavations - In case of findings the contractor is responsible to: <ul style="list-style-type: none"> ▪ Stop work activities ▪ Information should be provided to the supervision team and the concerned agencies (MOTA). <p>Coordinate with the supervision team and responsible agencies to consult an archeological expert at the site in case of chance finds.</p>	Low	Contractor JSC KRM	Site monitoring during excavations	- LGU MOTA

7.4 Institutional Requirements

The Institutional Component details out the responsibilities for management, monitoring, reporting and enforcement of the ESMP components and activities. This section includes any needs for specific setup, capacity building, training or equipment.

Institutional Overview and Strengthening Needs

JSC-KRM can and should be expected to acquire the institutional and technical capabilities required to incorporate ESMP measures, which are integral to the activities which it performs or for which it has responsibility. The mobilization of other national institutions such as municipalities and EQA is necessary. They should have the capacity and strength, which enable staff to be involved in monitoring the project activities. The cooperation of the key parties will ensure proper implementation, smooth follow up of the ESMP issues and know-how transfer.

The Landfill Supervisor has in terms of its environmental management system, a Responsibility Matrix and Organogram. This shall be displayed in an appropriate location. This identifies responsible parties, their contact details, and highlights their roles and responsibilities.

Strengthening Environmental Expertise

The environmental and social department of JSC-KRM has the overall responsibility to monitor and follow up the project implementation activities. Its role includes; identify priorities, establishing criteria for project alternatives, approve project details, participate in bids evaluation, review technical and financial reports as well as daily monitoring, site visits, supervising of the project implementation, monitoring the implementation of the monitoring plan and mitigation measures as well as enforcing the environmental regulations. The JSC-KRM environmental specialist would basically do the following:

1. Conduct environmental review of the proposed packages and monitoring the implementation of the project.
2. Conduct site visits to review progress of and abidance with environmental measures.
3. Coordinate environmental training activities for staff, engineers and contractors.
4. Monitor construction materials transportation and storage and construction activities.
5. Follow up the environmental management plan during construction activities inside the project area.
6. Coordinate and follow up with other relevant agencies; CMWU, MOLG, EQA, LGUs, and the consultant to ensure transfer of knowledge and build up the LGUs capacity.

An environmental advisor(s) contracted from local firms could support occasionally the JSC-KRM staff. The advisor may support in conducting site-specific environmental screening review and assessment of key environmental issues through an environmental audit in the site, and preparation of the progress reports which follow-up the implementation of ESMP and recommendations that rise-up during site visits of the project site.

Environmental Capacity Building and Training Program

The training program would be designed and implemented by the JSC-KRM environmental and social experts in cooperation with the consultants. The training would target the following levels:

1. On-the-job training for JSC-KRM and LGUs staff to direct activity planning, design, and implementation with respect to environmental protection. The training should be provided through short duration seminars and workshops. Oriented site visits and intensive training, should also be provided for selected staff members.
2. Training for contractors should be provided, including one- or two-day's workshops for local contractors, focusing on: preparation and use of the appraisal / mitigation forms use of environmental guidelines, and implementation of mitigation measures. Also, they should be trained on safety measures for construction works, proper waste disposal and cleaning measures during construction.
3. On-the-job training for JSC-KRM and LGUs staff who will be involved in operation phase, post closure as workers, guards and monitors. Oriented site visits and intensive training, should also be provided for selected staff members.

Project Documentation, Reporting and Compliance

The TOR and tender documents of the Project packages should reflect the importance of the environmental management and monitoring plan. The impacts, mitigation measures and responsibility of execution should be annexed to the contract documents and the contractors should be informed that all the possible environmental impacts listed in the ESMP must be avoided by the appropriate identified mitigation measures. According to the ESMP, all the responsibilities of contractors that listed in the ESMP should be emphasized in the contract.

All complaints or communications that are received from Interested and Affected Parties or any other stakeholder must be recorded in a Communications Register. These complaints and communications will be investigated and a response to the Complainant, or stakeholder will be given within a reasonable period. GRM of the JSC-KRM supports this issue.

Environmental documentation, reporting and compliance