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Non-Technical Summary

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LIST OF ACRONYMS

List acronyms by alphabetical order

AES	Amman East Power Plant
CSR	Corporate Social Responsibility
DoA	Department of Antiquities
E&S	Environmental and Social
EBRD	European Bank for Reconstruction and Development
EHSS-MS	Environmental, Health, Safety and Social Management System
EIA	Environmental Impact Assessment
ESAP	Environmental and Social Action Plan
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
EU	European Union
GAM	Greater Amman Municipality
GHG	Greenhouse Gas
HM	Heavy Metals
HSE	Health, Safety and Environment
IUCN	International Union for Conservation of Nature
JEPCO	Jordanian Electric Power Company
LFG	Landfill Gas
LFGERA	Landfill Gas Explosion Risk Assessment
MoA	Ministry of Agriculture
MoEnv	Ministry of Environment
Mol	Ministry of Interior
MoMa	Ministry of Municipal Affairs
MSW	Municipal Solid Waste
MW	Megawatts
NGO	Non-governmental Organisations
NTS	Non-Technical Summary
SEP	Stakeholder Engagement Plan
SOP	Standard Operating Procedure
WAJ	Water Authority of Jordan
WTS	Waste Transfer Station
WWTP	Wastewater Treatment Plant

1. Introduction

1.1 Overview and Background

The Greater Amman Municipality (GAM) is responsible for providing municipal services within its jurisdiction which is stretched over an area of 1,265 km² consisting of 22 city districts. These services include the municipal cleaning, waste collection, transportation to the existing Shaer Waste Transfer station (WTS), and final disposal of waste to the Ghabawi Solid Waste Landfill managed by GAM.

An overview on the Waste Supply Chain in Amman is shown in figure below:

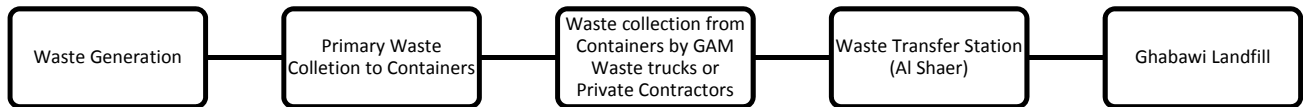


Figure 1: Overview of Municipal Solid Waste Management and Waste Supply chain in Amman

The Ghabawi Municipal Solid Waste (MSW) landfill is located within the Greater Amman Municipality (GAM) specifically in Al Madouneh, around 40 km from Amman in the Eastern Desert (refer to Figure 2). It receives waste from GAM areas as well as other municipalities that are not within GAM’s regularised boundaries such as: (i) Sahab, Muwaqar and Naour Municipalities; (ii) Zarqa and Russaifah Municipalities; (iii) Private sector; (iv) the army and others.

It was designed as an engineered landfill in 2001 under a grant from the French Ministry of Finance and included nine (9) engineered lined cells; three (3) of which are closed and capped, one that has been recently closed but not capped yet (cell 4), and one active cell currently receiving waste (cell 5). Other components of the landfill include leachate evaporation lagoons¹, maintenance workshop, administrative buildings, landfill gas (LFG) flaring unit² and other.

In 2005, the “Environmental Impact Assessment Regulation No. 37/2005” was issued and requires that an Environmental Impact Assessment (EIA) study is conducted for waste management facilities such as landfills. Since the Ghabawi Landfill was constructed between 2001 and 2003 and pre-dated the EIA Regulation, no actual EIA study was carried out. However, as part of the World Bank (WB) loan in 2009 to finance a landfill gas recovery system at the Ghabawi Landfill, an EIA assessment was conducted which only covered part of the landfill components. In 2015, the European Bank for Reconstruction and Development (EBRD) provided a loan to finance the implementation of a comprehensive landfill recovery programme, accordingly GAM shall obtain an environmental permit for the Landfill for the whole lifetime of its service. In line with national legislation requirement and good international practice, GAM commissioned ECO Consult to conduct a comprehensive Environmental and Social Impact Assessment (ESIA) which covers the complete planned developments for the whole lifetime of the landfill. The ESIA was approved by the Ministry of Environment on January 21st, 2019.

The ESIA Report contains more detailed information on the Project and the environmental and social issues considered. It includes a description of the need for the Project; details of the Project and the main alternatives considered; the assessment of the potential effects from the proposed development upon the environment and community; and details of any required procedures to mitigate significantly adverse environmental effects.

The lifetime of Ghabawi Landfill can be partitioned into 4 intertwined phases: (i) Site Selection and Planning (1997 – 2001); (ii) Landfill Establishment and Early Operations (2001 – 2007) in which the design and preparatory work at the selected location to establish the required infrastructure such as roads, sanitary cell took place; (iii) Landfill Development and WB Loan (2008 – 2014) in which the landfill expanded into new cells (Cells 2, 3, and 4/A) as well as LFG management, capping of cells, leachate control and management; (iv) Recent Activities and

¹ Leachate evaporation lagoons are lined ponds in which leachate extracted from cells is collected for evaporation.

² Landfill gas (LFG) is a complex mix of different gases created by the action of microorganisms within a landfill. LFG main components are methane and carbon dioxide both of which have an influence on climate change. Flaring means the combustion of LFG to reduce greenhouse gas emissions in which methane is destructed into carbon dioxide.

EBRD Loan (2015 – now) in which improvements of different operations at the Landfill with special attention to the Environment and Social (E&S) aspects took place.

This document (the Non-Technical Summary (NTS)) provides a summary in non-technical language of the findings contained in the ESIA Report and shall be disclosed to the stakeholders to provide update about the Ghabawi Landfill Project and the requirements of this ESIA.

It is important to highlight that in addition to the NTS, the ESIA identifies additional documents in order to ensure the mitigation measures and actions included in this ESIA are implemented by GAM. These include an Environmental and Social Action Plan (ESAP), Stakeholder Engagement Plan (SEP), and Community Needs Assessment and Integration Plan.

1.2 Need for Investment

The influx of Syrian Refugees to Jordan in the past eight (8) years resulted in population increases and caused heavy strains on Amman's municipal infrastructure and in particular on the Solid Waste Management (SWM). The Landfill stands as an integral pillar of the integrated Municipal Solid Waste Management (MSWM) system in Jordan serving nearly 50% of the population of Jordan and due to the population increases, currently receives on average between 4,000 and 4,300 tonnes of municipal waste per day (TPD) which was not originally envisaged in the planning and design for the Landfill.

As a response to the Syrian Refugee Crisis, the EBRD set up the Solid Waste Crisis Response Programme in 2016 of Euro (EUR) 50 million (which remains partially uncommitted) that is designed to finance a series of investments aimed at addressing the City's urgent solid waste needs and also to strengthen GAM's resilience as well as to optimise its financing, and allow GAM to liberate urgently needed funds to enable it to deal with the ongoing challenges.

1.3 The Investment

In order to help GAM manage the increased amounts of solid waste, since 2015 the EBRD, with support from the European Union (EU), the United Kingdom the EBRD's Southern and Eastern Mediterranean Multi-Donor Account (SEMED MDA) and Taipei China, has taken several steps to upgrade Amman's solid waste management system. A total of 87 million Jordanian Dinars (JOD) of EBRD loans and grants to GAM are helping improve the city's infrastructure.

This includes the following main components: a) Financing the implementation of a comprehensive landfill gas (LFG) recovery programme for Cells 1, 2, and 3 in the Ghabawi Landfill; b) Purchasing of specialised solid waste equipment and the establishment of a maintenance workshop; c) Construction of Cell 5 in the Ghabawi Landfill and its associated leachate evaporation lagoons; d) Purchasing of 75 refuse collection vehicles and other equipment for use at Al-Ghabawi, Al Shaer WTS and in other solid waste operations in Amman; and e) capping of Cell 4 in the Ghabawi Landfill and subsequently connecting it to the existing LFG recovery system.

1.4 Project Setup and Responsibilities

Different entities are involved in the planning and implementation of the Project. Responsibilities of each entity are listed in the text below along with a general description of their roles.

- Greater Amman Municipality (GAM): Project Proponent and is the owner, operator, and developer of the Project and its several components;
- European Bank for Reconstruction and Development (EBRD): International Financing Institution (IFI) that is providing a loan for a series of investments aimed at addressing the urgent solid waste needs of the city;
- The Ministry of Environment (MoEnv): environmental Regulator and responsible for approval of the ESIA and ensuring implementation of its requirements;

- LFG Operator: LFG recovery and power generation system contractor for Cell 1-3 contracted until around March 2021 after which GAM will assume responsibility;
- IDOM: GAM's Technical Assistance Consultant (Owner's Representative) and the Design-Build Engineer commissioned to improve and expand the Landfill;
- Jordanian Electric Power Company (JEPCO): is one of the Electricity Distribution companies in Jordan, and it will be responsible for connecting the generated electricity to the existing grid
- ECO Consult: the ESIA Practitioner

2. Project Description

2.1 The Ghabawi Landfill

Ghabawi Landfill site covers an area of approximately 2 km² and is located within the Amman Governorate, specifically within the area managed under the jurisdiction of GAM. The Ghabawi Landfill site (31°55'44.0" N and 36°10'56.0" E) lays over a semi-flat area with general average slope of 1.4%, from South East to North West.

Ghabawi Landfill is located in Uhod District around 23 km from Amman in the Eastern semi-arid desert. It is located within the Sahab district according to the Ministry of Interior (MoI) divisions.

Table 1 below provides general information about Uhod District and its population.

Table 1: General Information about Uhod District and Its Population (ECO Consult, 2018)

#	Item	Description												
1.	Area of Uhod	250 km ²												
2.	Uhod Population (GAM, 2015)	46,636												
3.	Population Projections for Uhod based on a (2.55%) population increase (GAM, 2018)	<table border="1"> <thead> <tr> <th>2016</th> <th>2020</th> <th>2025</th> <th>2030</th> <th>2035</th> <th>2040</th> </tr> </thead> <tbody> <tr> <td>47,834</td> <td>52,903</td> <td>60,001</td> <td>68,052</td> <td>77,182</td> <td>87,538</td> </tr> </tbody> </table>	2016	2020	2025	2030	2035	2040	47,834	52,903	60,001	68,052	77,182	87,538
2016	2020	2025	2030	2035	2040									
47,834	52,903	60,001	68,052	77,182	87,538									
4.	Neighbourhoods in Uhod (GAM, 2018)	Al-Abdaliya, Zamlet Al Alia, North Khashafiyeh / Addabaybeh, South Khashafiyeh / Ashawabkeh, Manakher, Qa'four, Al Bayda, Rmeidan, Madouneh												

Building on the general administrative setup for Jordan, Table 2 further clarifies the administrative setup for the area in the vicinity of the Ghabawi MSW Landfill as follows:

Table 2: Administrative and Municipal Setup in the Uhod District in Accordance with MoI and GAM Divisions (ECO Consult, 2018)

MOI	Governorate	Amman Governorate
	District	Sahab District
	Localities	Sahab, Al-Abdaliya, Zamlet Al Alia, North Khashafiyeh / Addabaybeh, South Khashafiyeh / Ashawabkeh, Manakher, Qa'four
	Municipalities within Sahab District	Sahab Municipality / Managed by MOMA Uhod Municipality / Managed by GAM / Ghabawi MSW Landfill located in Uhod
GAM	Municipality	Greater Amman Municipality
	GAM District	Uhod Municipality / Ghabawi MSW Landfill located in Uhod
	Uhod Neighbourhoods	Al-Abdaliya, Zamlet Al Alia, North Khashafiyeh / Addabaybeh, South Khashafiyeh / Ashawabkeh, Manakher, Qa'four, Al Bayda, Rmeidan, Madouneh

The Uhod District constitutes an area of around 41% of the total area allocated under the jurisdiction of GAM, has a population of 47,000 in 2017 according to GAM Master Plan records³. The table below indicates the neighbourhoods established by GAM within the Uhod District as well as their population.

Table 3: Population of 2015 in the Uhod District (GAM Master Plan, 2018)

Neighbourhood	الأحياء	Distance From The Site	Total
Al-Abdaliya	العبدلية	More than 10 km southwest	25,276
Zamlet Al Alia	زملة العليا	10 km southwest	173
North Khashafiyeh / Addabaybeh	الخشافية الشمالية / خشافية الدباية	10 km southwest	8,997

³ The Planning and GAM Master Plan Team records indicated that the population of the Uhod District in 2004 was 13,128 and based on the population reached in 2015; this indicates a population growth of 2.55 in this district.

South Khashafiyeh / Ashawabkeh	الخشافية الجنوبية / خشافية الشوابكة	12 km southwest	1,785
Manakher	المناهر	12 km west	2,032
Qa'four	قفور	6.5 km south	1,035
Al Bayda	البيضاء	10 km west	6,566
Rmeidan	رميدان	10 km southwest	415
Madouneh	الماضونة	8 km northwest	357
Total			46,636

The Landfill area is located at a distance from the different communities with the closest community settlement being more than 7 km away and the area in the immediate vicinity around the Landfill is occupied by industrial and commercial activities. Not only is the distance an adequate setback to dissipate landfill emissions and odours away from nearby community settlements, but it was also concluded through the assessment and several consultations that issues related to odour are minimal and only occur for a short period of time during the year. The main nuisance, however, is associated with wastes accidentally dumped on the main road from waste transfer trucks (mainly from Zarqa and Russeifeh Municipalities) and plastic bags blown away from the landfill itself. The Landfill location and the surrounding communities and developments are shown in Figure 2.

The main access to the site is via the external road from Amman, running to the east and turning to the north in its final stretch until reaching the landfill entrance. Another 2-lane road connects the Landfill with Zarqa.

Based on the current records of the Department of Land and Survey (DLS), the area surrounding the Ghabawi Landfill to the east, south, and north is mainly government owned land.

The soils around the Ghabawi Landfill area are considered as poor soils with very low organic content especially in the eastern and southern areas. This has been corroborated by seasonal livestock herders in the area and stakeholders who indicated that they were not successful in any agricultural activities or cultivation in the area to the east of the Landfill. The area to the west of the Landfill on the other hand has a better organic content and potential for irrigated agriculture.

Ghabawi Landfill is solely a MSW management facility and does not accept hazardous wastes or other substances. The waste composition received at the Ghabawi Landfill is mainly 50% organic waste, 16% plastics, 15% paper and cardboard, 8% textiles and napkins, 4% glass and metals, 1% compost material, 1% hazardous waste, and 5% unclassified combustibles. The Ghabawi Landfill team implements waste acceptance criteria which lists accepted and rejected waste at the Landfill.

Under 2003/33/EU rule, Ghabawi landfill is considered a B3 class landfill which means it is considered as a Landfill for non-hazardous waste: Landfill for mixed non-hazardous waste with substantial contents of both organic / biodegradable waste and inorganic waste.

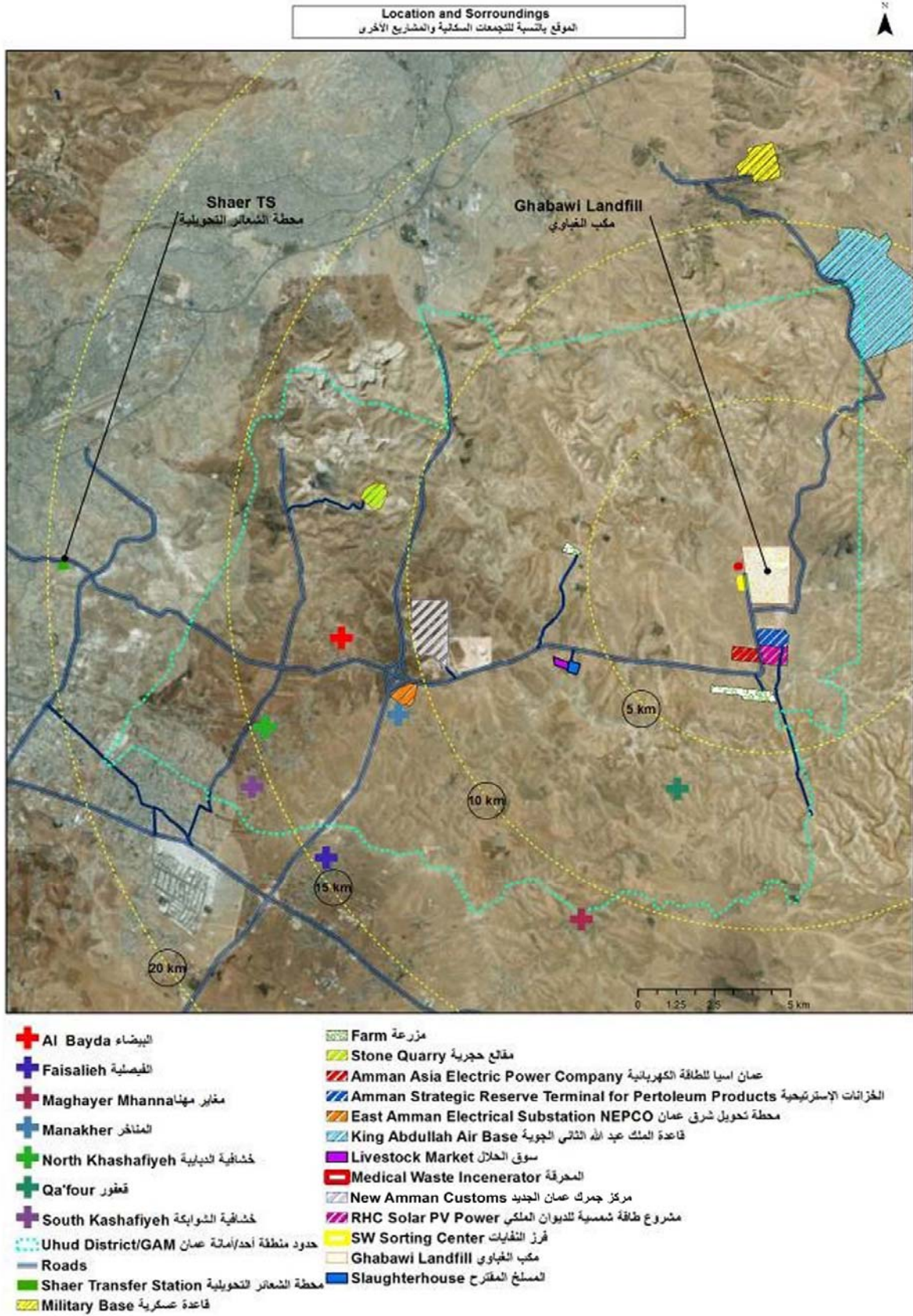


Figure 2: Location and Surrounding Communities and Activities (ECO Consult, 2018)

2.2 Project Alternatives

The ESIA study identified and analysed a number of alternatives including project location, technical alternatives and the “no project” alternative.

- **Site Selection:** Even though the Ghabawi landfill was designed and constructed (2001-2003) before the passage of the EIA regulation (2005), the siting of the facility was examined by a multi-disciplinary government committee formed by the Mayor of Amman with representatives from different government agencies and research institutions. This committee was created in 1998 to study different options for the location of the new landfill site. Based on technical studies and site investigations, the Ghabawi site was selected unanimously by all committee members in 1999. Reasons for this choice included land ownership, limited or absent green cover, distance from the local communities, as well as topography, climatic conditions, hydrogeology, and others. This was followed by a feasibility study and plan for the landfill development. The new location was officially endorsed by the Higher Council for Planning and Zoning and the ownership of the 2,000 dunums⁴ of military land was transferred to GAM without a land acquisition process. At its inception, the nearest local communities were around 9 km to the west with very low population density. Based on discussions with the MoEnv regarding the location of the Ghabawi Landfill and applying the criteria for site selection issued by MoEnv in 2018, it was agreed that the site at its present state still complies with the siting requirements for a municipal waste landfill and no other alternative site is considered for GAM Municipal Solid Waste Landfill.
- As part of the ESIA different technical alternatives were assessed including establishment of new WTS, upstream management (dry waste recycling, Bio-waste collection systems, kerbside containers and recycling centres), and treatment alternatives (Downstream Recycling, Composting, Anaerobic Digestion, Mechanical Biological Treatment and Thermal processes)

Different alternative schemes for the SWM were assessed for GAM as part of the ESIA as shown in table below

Table 4: Different Alternative Schemes for SWM at Al Ghabawi Landfill

No.	Scenario	Description
1	Zero Scenario-No Action	The “no project” alternative assumes that no EBRD investment is made. Should this be the case then the project site area would remain the same- three existing capped cells and one uncapped cell filled beyond its capacity. The leachate will be disposed of in the old lagoons and the support facilities in the landfill will remain static as the new admin building and a new workshop will not be built. There are positive economic and environmental benefits from the project that will not be realised should the project not move forward. This scenario has a number of negative impacts including but not limited to random dumping of waste, nuisance and odour, leachate seepage, no Greenhouse gas reduction, etc.
2	Alternative 1: Disposal in the landfill	This scheme differs from the zero alternatives mainly with regards to the construction of the planned cells and the improvement of support facilities in the landfill. Landfill gas will continue being collected and flared, it will also be used to generate electricity when the engines are installed and will be later connected to the grid. The leachate will be collected in four new leachate lagoons where there is an interconnection between these lagoons making the leachate management system flexible.
3	Alternative 2: Upstream collection/ segregation and sorting / Landfill	This option is based on an upgraded solid waste management, integrating effective upstream separate collection and site improvements. A material recovery facility will be placed on site which will be best operated with the implementation of an upstream separate collection system. After separation takes place the recyclable materials are sent to recycling facilities and residuals are then sent to the landfill.
4	Alternative 3: Upstream Separate collection/ segregation and sorting / Composting/ Landfill	This alternative involves development and establishment of an upstream collection system for recyclables, bio-waste and other mixed solid waste. Recyclables are transported to sorting facility, whereas bio-waste is transported to a composting facility. Other waste is disposed in a landfill. This treatment results in the following outputs: High quality recyclables, and High-quality compost. This alternative conforms to the best international practise and European Union (EU) requirements and achieves high recovery rates due to organised recycling and composting facilities.

⁴ A dunum (دونم), it is equal to one decare (1000 m²), which is 1/10 hectare (1/10 * 10,000 m²)

2.3 Project Concept and Components

The key components of the Project include:

- (3) three capped cells, including the installation of a landfill gas collection network;
- (1) recently closed cell where waste disposal has been stopped and currently planning for capping and landfill gas extraction system being negotiated;
- (1) one recently constructed cell and started receiving waste mid of October 2018;
- (1) one administration building –and a new one under construction-,
- (1) one machinery maintenance and service workshop,
- (1) landfill gas extraction station and its corresponding flare,
- (1) landfill gas power plant -under construction,
- (8) eight leachate lagoons,
- (1) one access control and weighing check point,
- (1) one water well, and
- The site is surrounded by a concrete wall preventing the access of uncontrolled people to the landfill and security for the Landfill is provided by a resident police unit patrolling the site and its perimeter.

Future developments are planned in the landfill including the construction, operation, capping and closing of four new additional cells (cells 6-9). The lifetime span for the Ghabawi landfill is 17 years more, until 2035. This estimate is highly dependent on the future waste generation, population growth and waste management policies.

Once the landfill lifetime is finished (by 2035), it is necessary to continue the operation of the landfill gas and leachate management plants, as well as the monitoring activities for a period of time usually not less than 30 years.

This timeframe is considering a present waste disposal of 4,000 t/day of solid waste and to be increased progressively in the coming years.

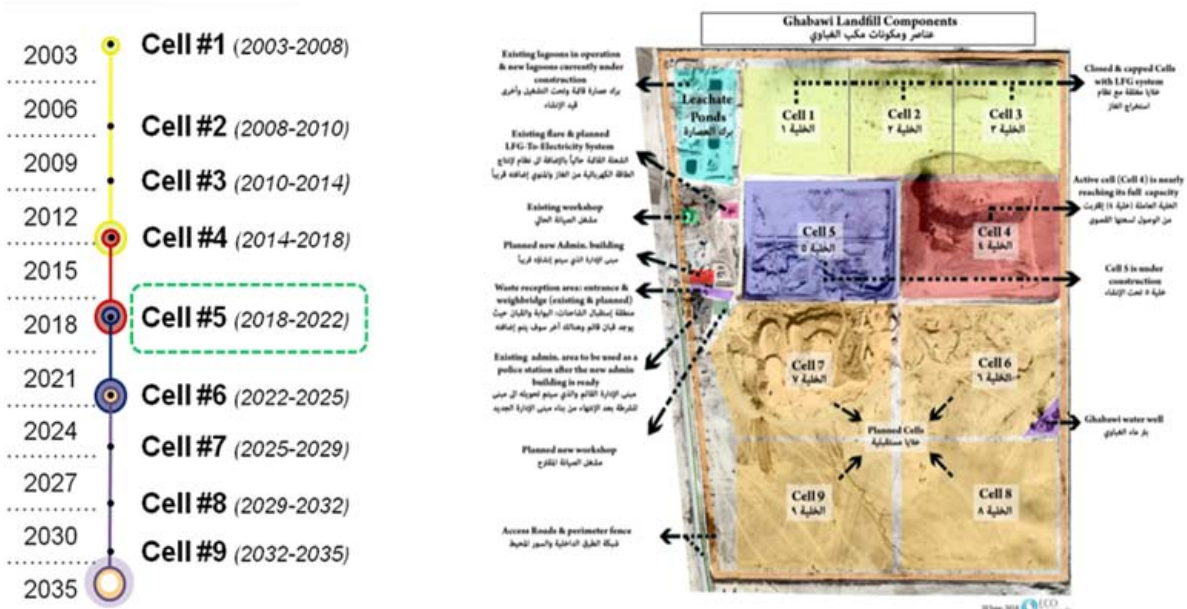


Figure 3: Planning and Operation Schedule for the Ghabawi Landfill (ECO Consult, 2018)

The planned components within the Ghabawi MSW Landfill

In summary, the planned project components in the Landfill include:

- Connection to the grid for power generated from cells 1, 2, and 3;
- Capping and LFG system for Cell 4 and connection to the grid;
- Construction, operation, and capping of Cells 5, 6, 7, 8, & 9;
- New administrative building;
- New leachate lagoons;
- New workshop; and
- LFG and electricity generation with connection to the grid.

These project components are to be implemented by GAM as a number of sub-projects⁵ executed over different phases and timelines as required. The EBRD committed loans and grants covers only part of the components outlined above. These components are to be implemented by GAM and financed by its own financial resources, through the EBRD, or any other IFI.

2.4 Implementation Phases

- **Site Selection and Planning Phase:** All the tasks regarding the selection of the Landfill site took place prior to 2001. As mentioned previously the siting of the facility was examined by a multi-disciplinary government committee. multi-disciplinary government committee
- **Construction Phase:** The Ghabawi Landfill was designed to have 9 engineered cells to be constructed and operated subsequently. The construction of any given cell is only commenced when the previous cell approaches its full capacity to maximise the protection of lining systems in the new cell. As such, construction activities occur intermittently based on the needs and state of the Landfill. This phase is not limited to cell construction and capping but also includes construction of leachate lagoons, buildings and workshop, road networks and building infrastructures.
- **Operation Phase:** Landfills normally require wide and complex activities within different areas and at different times. Those activities can be categorised into: solid waste handling including weighing, waste inspection, spreading, and compaction of waste as well as applying daily cover and dust suppression; landfill gas systems including collection, moisture removal, flaring and monitoring; leachate management; maintenance operations; day-to-day management activities.
- **Decommissioning, Closure, and Aftercare:** Once a landfill is closed, the owner/operator shall maintain the integrity of the landfill cap and make repairs as needed, monitoring waster quality, settlement and methane generation and maintaining gas control, leachate collected and storm water systems.

3. Stakeholder Consultation and Engagement

A number of stakeholder engagement activities were undertaken throughout the study period which included national and governmental organisations, GAM, Non-governmental Organisations (NGOs), and local community representatives. The following table provides in summary the stakeholder consultation and engagement activities which were conducted as part of the ESIA process for the Ghabawi Landfill Project during the year 2018 and provides an overview of the findings.

⁵ The Project- is the Ghabawi Landfill in its entirety. The Sub-projects include the planned components within the Project (Ghabawi MSW Landfill) and these will be implemented at different timelines as required.

Table 5: List of Stakeholder Consultation and Engagement Conducted as part of the ESIA

Meeting/Consultation	Date	Objective
Scoping Session/public hearing	5 July 2018	<ul style="list-style-type: none"> Held for the purpose of providing consultation with the stakeholders and community representatives on the ESIA being prepared for the Project. It provided individuals, organisations, and agencies the opportunity to raise concerns about the environmental and social effects of the project.
Visit to cow farm	13 Aug 2018	<ul style="list-style-type: none"> The purpose of this visit was to have a general discussion on the ESIA and the feedback regarding the Landfill. During the meeting, the ESIA Team was given a tour around the facility showing the different operations and activities taking place within the boundary of the cow farm.
Several unilateral meetings with community representatives	12 Sep 2018	<ul style="list-style-type: none"> Several individual interviews were conducted with a group of stakeholders including GAM, Al Ghabawi Landfill, Health Centre in Khashafiyeh Ad-Dabaybeh, GAM Library and a number of local community members
	13 Sep 2018	<ul style="list-style-type: none"> Field visits to the area and discussions with different stakeholders on the ground to collect different information and understand the socio-economic background in the project area
	29 Sep 2-18	<ul style="list-style-type: none"> Individual interviews were conducted with local community members to get holistic information on areas around the landfill
	5 Oct 2018	<ul style="list-style-type: none"> Phone interviews with official entities to collect information on health centres and schools Field visits to the area and discussion with different stakeholders on the ground to collect different information and understand the socio-economic background in the project area
	6 Oct 2018	<ul style="list-style-type: none"> Phone interviews were conducted with local community members to get holistic information on areas around the landfill
Meeting with Mohammad Qudah, Health, Safety and Environment (HSE) manager-Amman East Power Plant (AES)	6/9/2018	<ul style="list-style-type: none"> The aim of the meeting was to discuss the role of AES Jordan in community engagement and social responsibility in Al-Manakher village in the past years and the recent involvement of the International Union for Conservation of Nature (IUCN) , and the Corporate Social Responsibility(CSR) Programme AES Jordan has implemented
Data collection session and focus group discussions	15/9/2018	<ul style="list-style-type: none"> The objective was to collect information on the socio-economic situation in areas around Ghabawi Landfill, especially those related to the ESIA study. The session included a brief questionnaire, focus group discussions including filling out detailed questionnaires covering 10 socio-economic sectors, and carrying out open discussion in which, the attendees were given the chance to suggest ways and methods to help enhance the ESIA study
Meeting with livestock herders	25/9/2018	<ul style="list-style-type: none"> Discussion on the area and general social and economic situation, land use, migration pattern, income, child schooling, health services and environmental and economic problems that the areas face
Meeting with local community representatives	15/10/2018	<ul style="list-style-type: none"> The meeting was held with request of some community members to discuss their concerns that are related to Al Ghabawi project and its social and environmental impacts

4. Summary of Environmental and Social Baseline Conditions and Impacts

4.1 Introduction

The ESIA comprised of environmental and social baseline studies and an assessment of impacts. Mitigation measures, which are included in the Environmental and Social Management Plan (ESMP), were identified for potential significant effects and the significance of residual effects determined. The impact assessment followed an assessment methodology developed to reflect current best practice. The key baseline and impact assessment findings are further discussed below.

4.2 Strategic Impacts and Project Importance

Al Ghabawi Landfill stands as an integral pillar of the integrated Municipal Solid Waste Management system in Jordan serving nearly 50% of the population of Jordan and is a strategic response to address current waste management challenges and population influx.

Project Benefits

The key benefits of the Project are:

- Contributing to Jordan’s green developments and act as a very good example for proper landfilling of waste.
- Reduction of greenhouse gas (GHG) emissions from LFG emission from the existing and planned cells within the Landfill. The GHG assessment has estimated that 10,688,009 tonnes CO₂ equivalent of emissions reduction would be produced during the Landfill operation from 2019 up to the closure of the Landfill cells in 2035 in addition to a 14,423,626 tonnes CO₂ equivalent of emissions reduction during the closure of the Landfill and aftercare up to 2075, which results in a total of 25,111,635 tonnes CO₂ equivalent of emissions reduction during the Ghabawi Landfill project lifetime, between 2019 and 2075.
- Improvement in environmental and health management and compliance at the Landfill including possible improvements in the treatment of leachate. Nearly 50% of the population of Jordan will benefit from improved waste management.
- Fulfilment of strategic and operational objectives defined in the waste management strategies and plans at the national and GAM levels.
- There will be a general improvement in environmental, public health, and occupational health and safety management of the area and the Landfill.
- Control of emissions and discharges (odour, dust, leachate infiltration) in landfill areas operated by GAM.

4.3 Environmental and Social Conditions and Impacts

(i) Landscape and Visual

The area around the Ghabawi Landfill is generally flat in the west and north with slight topographic variations and small hills of different elevations can be seen in the east and the south. The facility is low lying, and because of the flat landscape, the site cannot be seen clearly from the approach road or adjacent lands. The area can be characterised as semi-arid desert where the vegetation is sparse, limited, but may thicken up in areas, and is dominated by herbs and shrubs. In the immediate area there are no residential or other sensitive receptor areas (e.g. schools, hospitals, recreational parks, etc.). The closest residential area is more than 7 km to the west and south west of the Ghabawi Landfill.

The key visual impacts from the project development and proper mitigation measures are shown in table below:

Table 6: Summary of Anticipated impacts and related mitigation measures on Landscape and Visual

No.	Description	Phases	Key Mitigation Measures
1	Impact on landscape and visual component from different construction works on the Landfill		
	During construction phase, the visibility of construction activities would mostly be kept low by the topographic setting	Construction	<ul style="list-style-type: none"> ▪ Ensure proper general housekeeping and personnel management measures are implemented as well as committing to the Ghabawi Operation Manual and the Ghabawi HSE Manual
2	Impact on landscape and visual component from the cell closure and capping works on the Landfill		
	The construction activities also include cell capping which is a permanent landform that can be seen from different directions. This landform is taking the shape of a low rising hill, creating a feature that is not largely dissimilar to the surrounding environment.	Construction	<ul style="list-style-type: none"> ▪ Ghabawi Landfill should commit to both the Operation Manual and HSE Manual
3	Impacts on landscape and visual component due to the existing and planned Ghabawi Landfill facilities and operations		
	The setting around of the Landfill is of industrial and investment nature and these facilities are of different sizes. Within the surrounding context and nature of developments in the surrounding area, the existence of the Landfill and all other facilities in a way limited the visual attractiveness of the	Operation	<ul style="list-style-type: none"> ▪ GAM shall provide a timeline when the ‘East Amman and Uhud Development Strategy Area and Direction of Urban Expansion’ concept study shall be completed and announced. ▪ GAM shall review the zoning plan for the land around the landfill to ensure an adequate buffer is established against encroaching development. ▪ GAM shall ensure no residential areas or sensitive receptors are allowed in the area around the Landfill.

	area and caused the area to lose its aesthetic importance.		<ul style="list-style-type: none"> ▪ GAM shall undertake a Strategic Environmental and Social Assessment as part of the 'East Amman and Uhud Development Strategy Area and Direction of Urban Expansion' ▪ GAM shall prepare a Master Plan for the Ghabawi Landfill for the operation and closure and aftercare phases to cover the planned developments and operations within the Ghabawi Landfill as well as a layout for the Landfill and all components. ▪ Ghabawi Landfill should commit to both the Operation Manual and HSE Manual.
4	Impacts from the windblown plastic bags attached to the perimeter concrete wall and its barbed wire fence		
	The western border fence is regularly maintained and attached plastic bags are removed. The remaining parts of the border do not receive the same level and frequency of maintenance	Operation	<ul style="list-style-type: none"> ▪ Ghabawi Landfill should commit to both the Operation Manual and HSE Manual. ▪ All solid waste shall be compacted as soon as practicable after it is unloaded ▪ The working area needs to be kept as small as practicable in order to reduce the potential for blowing debris ▪ Portable fences shall be placed in the vicinity of and downwind from working areas to catch blowing litter ▪ Landfill personnel shall pick up litter that has escaped from the working face on a daily and as-needed basis and inspect the perimeter to remove any attached plastic bags
5	Impacts from the waste and litter disposed on the road leading to Ghabawi Landfill		
	GAM waste transfer vehicles have a proper system in place to prevent waste disposal on the sides of the roads. On the other hand, other municipalities do not which causes waste to be disposed on the sides of the roads.	Operation	<ul style="list-style-type: none"> ▪ Ghabawi Landfill should commit to both the Operation Manual and HSE Manual. ▪ GAM should coordinate with the Ministry of Municipal Affairs (MoMa) and Zarqa and Russeifeh Municipalities in order to apply the required measures to ensure such spillage does not take place. ▪ GAM shall prepare and apply a system for penalties for non-compliance for their own fleet and for other municipalities ▪ GAM shall coordinate with the MoEnv and the Environmental Police to undertake inspections and enforce compliance, as well as Uhud district inspectors ▪ GAM shall continue inspecting and clearing the road on regular basis to ensure nuisance control.
6	Impacts from the windblown plastic bags scattered in the vicinity of the Landfill and in wadis		
	Litter causes a negative visual impact and can cause significant visual impacts and nuisance to the neighbouring facilities and can also lead to harm of wildlife or livestock.	Operation	<ul style="list-style-type: none"> ▪ Mitigation measures for Impact 4 in this table are applicable.
7	Impacts from illegal activities taking place in the general area around the Landfill		
		Operation	<ul style="list-style-type: none"> ▪ GAM shall coordinate with the Local Governor, MoEnv and the Environmental Police to undertake inspections and enforce compliance ▪ Uhud District inspectors shall undertake inspections and enforce compliance

(ii) Biodiversity

The assessment identified several flora and fauna species within the Project site most of which are considered of least concern and common to such area habitats. There are no sensitive habitats recorded within the Project site. Generally, the site is considered of low ecological significance due to its natural setting; characterised by being arid and heavily degraded with few vegetation strips.

Key impacts of the project during construction and operation phase as well as key mitigation measures are shown in table below

Table 7: Summary of Anticipated Impacts on Biodiversity

No.	Description	Phases	Key Mitigation Measures
1	Impacts on biodiversity from different construction activities in the landfill		
	Construction activities would likely result in the alteration of the site's habitat and thus potentially disturb	Construction	<ul style="list-style-type: none"> ▪ Establishing a proper code of conduct and awareness raising / training of personnel and good housekeeping

	existing habitats. Other impacts on the biodiversity of the site could be caused by improper management of the site which could include improper conduct and housekeeping practices by workers.		<ul style="list-style-type: none"> ▪ Prohibit hunting at any time and under any condition by construction workers onsite ▪ Ensure proper storage, collection, and disposal of waste streams ▪ Restrict activities to allocated construction areas only ▪ Avoid unnecessary elevated noise levels at all times and apply adequate noise suppressing measures ▪ Avoid unnecessary removal and relocating of basalt rocks, since they are generally used by several species for resting and as refuge.
2	Impacts on biodiversity during operation phase		
	The only impacts anticipated during the operation phase are related to improper management of the site including improper conduct and housekeeping practices by workers (i.e. hunting of animals, discharge of hazardous waste to land, etc.).	Operation	<ul style="list-style-type: none"> ▪ Ensure that waste is not carried out and/or dropped outside the designated areas of the landfill ▪ All solid waste shall be compacted as soon as practicable after it is unloaded ▪ The working area needs to be kept as small as practicable in order to reduce the potential for blowing debris ▪ Portable fences shall be placed in the vicinity of and downwind from working areas to catch blowing litter ▪ Landfill personnel shall pick up litter that has escaped from the working face on a daily and as-needed basis and inspect the perimeter to remove any attached plastic bags ▪ GAM should coordinate with the MOMA and Zarqa and Russeifeh Municipalities in order to apply the required measures to ensure such spillage does not take place. ▪ GAM shall prepare and apply a system for penalties for non-compliance ▪ GAM shall continue inspecting and clearing the road on regular basis to ensure nuisance control. ▪ Prohibit hunting at any time and under any condition by workers onsite. ▪ Restrict activities to allocated areas only

(iii) Land Use

The Project site location does not conflict with any land use planning as set by the various governmental institutions such as (i) land use planning by MoMA, (ii) Greater Amman Municipality, (iii) planning for areas of critical environmental concern by MoEnv, and (iv) and forest lands and grazing reserves planning by Ministry of Agriculture (MoA).

The ESIA also investigated the actual land use of the Project area which can be summarised as follows:

- Based on the 'Concept for East Amman and Uhud Plan Development Strategy Area and Direction of Urban Expansion' study, the specific area around the Ghabawi Landfill shall be used for strategic national projects and also to become a nucleus for different governmental buildings and services.
- The areas to the west and south west of the Landfill where communities reside are cultivated with fruit trees, vegetables crops, wheat, and Barley through rain-fed and irrigated agriculture. Agricultural activities in the immediate area around the Ghabawi Landfill are quite limited
- The area is not considered a major grazing ground. It is more considered to be wintering grounds for the several tribes in the where livestock is dependent mainly on fodder crops rather than natural vegetation cover. Most livestock owners/herders arrive to the area in September/October and leave to spring season grazing areas in February/March.

Impacts on land use during construction and operation are summarised in table below.

Table 8: Summary of Anticipated Impacts on Land Use

No.	Description	Phases	Key Mitigation Measures
1	Impact on Actual or Customary Land		
	Impacts on local livestock owners and herders, generally, they do not own the land, specifically to the east of the Landfill rather they select a suitable land to temporarily reside in until they	Construction and Operation	<ul style="list-style-type: none"> ▪ Allow all local community members to continue with their wintering activities in the Project area as normal ▪ A detailed grievance mechanism for the local community as well as livestock herders must be prepared and implemented.

	leave in March or April. They are not prevented from using the land around the Landfill and thus such continuation of movement patterns is not expected to be affected by the Project development		
2	Impacts due to the presence of noncompliant legal and other illegal industrial activities within industrial areas and outside especially in the Sahab District		
	The Ghabawi Landfill conforms to the land use designated for the area by GAM. The East Amman, Sahab, and Uhud communities are complaining due to the collective impact of all developments and investments taking place in these areas	Operation	<ul style="list-style-type: none"> ▪ GAM shall provide a timeline when the ‘East Amman and Uhud Development Strategy Area and Direction of Urban Expansion’ concept study shall be completed and announced. ▪ GAM shall review the zoning plan for the land around the landfill to ensure an adequate buffer is established against encroaching development. ▪ GAM shall ensure no residential areas or sensitive receptors are allowed in the area around the Landfill. ▪ GAM shall undertake a Strategic Environmental and Social Assessment as part of the ‘East Amman and Uhud Development Strategy Area and Direction of Urban Expansion’ ▪ GAM shall prepare a Master Plan for the Ghabawi Landfill for the operation and closure and aftercare phases to cover the planned developments and operations within the Ghabawi Landfill as well as a layout for the Landfill and all components. ▪ Ghabawi Landfill should commit to both the Operation Manual and HSE Manual

(iv) Geology, Hydrology, and Hydrogeology

The area in general is located at the western parts of the Jordanian Desert plateau which is known for its Chert and limestone with a majority of carbonate rocks belonging to the late cretaceous layers. In terms of hydrology, no surface water resources are available with the exception of limited seasonal wadi floods in the wet season; the area is located at the surface water divide of Amman Zarqa and Azraq basins. In terms of hydrogeology the project site was previously located at the water divide for groundwater basins of Amman-Zarqa and Azraq. However, due to severe pumping on both sides of the divide, the water divided was shifted 3 km to the north therefore locating the landfill in the Azraq groundwater basin.

Impacts on geology, hydrology and hydrogeology are presented in table below

Table 9: Summary of Anticipated Impacts on Geology, Hydrology and Hydrogeology

No.	Description	Phases	Key Mitigation Measures
1	Impact of composition of waste disposed in the Landfill on the leachate quality		<ul style="list-style-type: none"> ▪ GAM to assess and implement waste separation upstream in order to prevent certain waste streams from reaching the Landfill as well as implementing an awareness campaign. ▪ GAM to undertake a waste characterisation study at source, WTS, and Landfill every three (3) years ▪ Application of a waste acceptance procedure is critical to ensure that unacceptable waste types do not enter the site, unexpected chemical reactions are avoided, and worker health and safety are not endangered. ▪ Proper initial operation of active cell to prevent failure of leachate collection system, as well as regular maintenance for leachate collection system ▪ GAM shall assess options for leachate treatment
	Waste disposed in the Landfill mainly includes municipal waste generated from households and different commercial activities. However, no waste separation takes place upstream meaning that the municipal solid waste may include batteries, chemicals, household medical wastes, electronic waste, etc. Any triggered levels of Heavy Metals (HM) in the leachate are due such waste composition which should typically be prevented from source	Operation	
2	Impact of amount of waste disposed in the Landfill on the leachate quantity		
	The increase in waste generated and the absence/poor waste prevention, reduction, segregation, and recycling increased the amounts of waste disposed in the Landfill which resulted in high amounts of generated leachate to be managed at the Landfill.	Operation	
3	Impact of failure of the leachate extraction and drainage system on the mode of operation in the Landfill and causing operational issues and challenges		
	Failure of the leachate extraction and drainage has exacerbated the leachate management problems in the Landfill and caused operational challenges including: GAM having to pump out generated leachate on a daily basis and transport it to leachate lagoons; LFG Operator having to pump out leachate from LFG and	Operation	

	leachate wells; and LFG Operator having to purge LFG wells resulting in spillage of raw leachate		<ul style="list-style-type: none"> ▪ GAM shall undertake regular leachate lagoon maintenance and shall register log of maintenance activities ▪ GAM shall increase amounts of leachate pumped-out of the existing cells and shall undertake proper documentation of the leachate amounts disposed in the leachate lagoons ▪ Undertake continuous visual inspection to prevent over-flow from the cells and the manholes and undertake required action in case of any event ▪ Constructing trenches and rainwater drainage network around the existing and future cells ▪ GAM shall assess options for planting some types of Heavy Metal tolerant plants and consider the use of soil enhancers in different areas around the first three cells. ▪ GAM shall ensure they have all necessary capacity and budget to implement required actions and monitoring plans during the closure and aftercare phase including proper continuous monitoring, maintenance, and control
4	Impact of leachate mode of operation and management at the Landfill on odour in the area		
	In the leachate ammonia, volatile organic compounds, and some dissolved gases (from methane, ammonia-gas, hydrogen sulphide, etc.) are found which causes odours	Operation	
5	Impact of leachate quantity and quality on soil pollution		
	This could be attributed to different reasons including historical issues and also the challenges in the leachate management operations on the Landfill due to the failure in the leachate drainage and extraction networks	Operation	
6	Impact of soil pollution on the surface water and groundwater pollution		
	The leachate discharged outside contained areas of the landfill in previous years and other operational issues may have caused pollution in different areas of the Landfill. Assessment of the potential contamination has been performed which showed that Ghabawi Landfill area is very low vulnerability due to higher protection gained from a confining layer, high depth to water and low recharge rates. The most vulnerable part proved to be the western highlands where groundwater recharge is high and depth to water is relatively lower. The Baseline assessment undertaken has demonstrated that groundwater pollution is of low significance and probability at the Landfill. Surface water courses at the site are unlikely to be affected by the activities at all the stages of the project.	Operation	
7	Impact of Soil Pollution on Occupational Health and Safety for workers and visitors in the Landfill		
		Operation	

(v) Air Quality and Noise

Assessment of the air quality baseline was based on the results of measurements conducted for the landfill and at selected receptor communities around the landfill.

The following table summarises both positive and negative impacts of the project on air quality and noise during construction and operation phase

Table 10: Summary of Anticipated Impacts on Air Quality and Noise

No.	Description	Project	Key Mitigation Measures
1	Impacts from dust emissions due to construction activities		
	Fugitive dust and PM emissions occur as a result of vehicle-entrained dust from unpaved service roads, wind erosion from open areas and dust generation due to landfill equipment operation and construction activity. If dust or pollutant emissions were found to be excessive due to construction activities, the source of such emissions should be identified and adequate control measures must be implemented	Construction	<ul style="list-style-type: none"> ▪ Ensure that for activities associated with high dust and noise levels, workers are equipped with proper Personal Protective Equipment as per local and international requirements ▪ Apply basic dust control and suppression measures ▪ Develop a regular inspection and scheduled maintenance program for vehicles, machinery, and equipment ▪ Apply adequate general noise suppressing measures
2	Impacts from dust emissions due to operation activities		
	The Ghabawi Landfill is located in an open area and susceptible to increased levels in the ambient environment. These cannot be controlled by the Ghabawi Landfill facility. Several SWM operations within the Ghabawi Landfill cause dust emissions and these can be controlled and dust emissions reduced to the extent possible by implementing proper management and operations on the Landfill.	Operation	<ul style="list-style-type: none"> ▪ Mitigation Measures for Impact No.2 in table 5 of this document are applicable ▪ Warranting specific attention to design, management and maintenance of trucks and heavy machinery to reduce emissions ▪ GAM shall commit to the Ghabawi Operation Manual as well as the Ghabawi HSE Manual ▪ Install a weather station onsite to monitor wind direction and temperature and ensure that dust causing activities are

			<p>minimised when the wind is blowing in the direction of the adjacent sensitive receptors.</p> <ul style="list-style-type: none"> ▪ Damping down off-site access roads, using water sprays ▪ Minimising earthwork during windy conditions; immediate covering of excessively dusty or powdery wastes with other waste or daily cover; and reducing vehicle speeds on access roads during dry, windy conditions
3	Impacts from LFG emissions due to SWM operation activities within the active cells		
	<p>Landfill gas is the principal component of emissions to atmosphere in uncapped landfills. It is the by-product of the anaerobic process of biodegradable waste degradation that occurs after being deposited into the landfill body.</p>	Operation	<ul style="list-style-type: none"> ▪ GAM to enhance the design measures applied in the Landfill including proper design considerations for future construction and operation of the Cells and the LFG system to ensure the benefits from these measures are sustainable and continue to maintain the positive impacts ▪ An LFG migration plan to areas outside the Landfill shall be prepared by GAM or any of their consultants to estimate the impact of the migration and identify any required actions of corrective measures ▪ Ghabawi Landfill should commit to both the Operation Manual and HSE Manual
4	Impact of leachate mode of operation and management at the Landfill on odour in the area		
	<p>In the leachate ammonia, volatile organic compounds, and some dissolved gases (from methane, ammonia-gas, hydrogen sulphide, etc.) are found which causes odours</p>	Operation	<ul style="list-style-type: none"> ▪ Mitigation Measures in table 6 are applicable
5	Impact from capping of the closed cells and installation of the LFG system		
	<p>The current system has immense positive impacts on preventing a substantial portion of the LFG from migrating to the atmosphere. measures that are normally implemented in landfills to prevent impact of the GHG emissions are applied at Al Ghabawi landfill</p>	Operation	<ul style="list-style-type: none"> ▪ Positive Impact
6	Impact from flaring of the extracted LFG emissions		
	<p>Enclosed flares burn landfill gas at ground level in a vertical, cylindrical enclosure. This enclosure reduces noise, luminosity, heat radiation and provides wind protection. The enclosure is insulated to reduce heat losses and allow operation at higher temperatures.</p>	Operation	<ul style="list-style-type: none"> ▪ Positive Impact
7	Impact from power generation and combustion of CH₄		
	Direct reduction of GHG	Operation	<ul style="list-style-type: none"> ▪ Positive Impact
8	Displacement of up to 5 MW power generation in the national power grid		
	Indirect reduction of GHG	Operation	<ul style="list-style-type: none"> ▪ Positive Impact
9	Project-Related Potential GHG Reductions		
	<p>The Project-related potential emission reductions have been estimated by comparing the Project estimated GHG emissions with the “do nothing” scenario in which total LFG would be emitted directly to atmosphere (no capping, recovery and utilisation).</p>	Operation	<ul style="list-style-type: none"> ▪ Positive Impact

(vi) Occupational health and safety

During the construction and operation phase there will be generic occupational health and safety risks to workers. The ESIA requires that the Health, Safety and Environment Manual tailored to the Project’s site and activities are applied. The manual includes related Standard Operating Procedures (SOP) which ensures the health and safety of all personnel and visitors. With the implementation of such SOPs the impacts are considered not significant.

Table 11: Summary of Anticipated Impacts on Occupational Health and Safety

No.	Description	Phase	Key Mitigation Measures
1	Impacts on the Workers from Generic Occupational Health and Safety Risks	Construction and Operation	<ul style="list-style-type: none"> ▪ GAM Ghabawi Landfill shall commit to the Ghabawi HSE Manual ▪ LFG Operator shall undertake a site-specific explosion assessment for the current landfill gas extraction collection and flaring system in addition to a site-specific LFG migration study
	Throughout the construction and operation phase there will be generic occupational health and safety risks to workers, as working onsite increases the risk of injury due to accidents. Key risks associated with the nature of development include but are not limited to Slips and falls, working at height, working with powered tools and hand-held tools, heavy lifting, etc.		
2	Impacts on the Workers from Exposure to Odours, Emissions, and Effluents	Construction and Operation	
There is a risk of exposure to toxic substances, including gas, from working with waste and leachate. This applies to GAM workers and the LFG Operator as well as other contractors and subcontractors			
3	Impacts on the Workers from the LFG Explosion Risk Assessment (LFGERA)	Operation	
	Based upon a qualitative assessment matrix and review of the key risk factors, the risk of explosive landfill gas migration occurring and causing an unacceptable human health risk pertaining to explosion is considered low to sensitive developments within the 400m consultation zone		

(vii) Archaeology and Cultural Heritage

There are no archaeological sites within the Ghabawi Landfill. All the sites are located to the east and west of the site. The closest of these sites are Qasr Al Madhuna and Khirbet El Madhuna as presented in table below and which are located around 7-8km from the project site. Therefore, there are no anticipated impacts from the project on surface archaeological remains. However, there is a chance that throughout civil work activities archaeological remains buried in the ground are discovered.

Table 12: Summary of Anticipated Impacts on Archaeology and Cultural Heritage

No.	Description	Project Phase	Key Mitigation Measures
1	Impacts on undiscovered sites	Construction	<ul style="list-style-type: none"> ▪ Appropriate measures for chance find procedures are implemented which are standard requirements by the Department of Antiquities (DoA) as required by the “Antiquities Law No. 21 for 1988 and its amendments No. 23 for 2004”. Those mainly require that construction activities be halted and the area fenced, while immediately notifying the DoA. No additional work will be allowed before the Department assesses the found potential archaeological site and grants a clearance to resume the work
	Improper management (if such sites are discovered) could potentially disturb or damage such sites which could potentially be of importance.		

(viii) Infrastructure and Utilities

In the surrounding area of the project, there are three thermal power plants which generate more than 27% of the main national power in Jordan as well as two solar PV project, one still under construction. There are two transmission networks within the area and two electrical transformers inside the landfill.

The project site is located within the Amman Main Water System which has a total supply of 220 MCM. In addition, there is one operational well in the landfill that supplies the entire water requirements of the project. The well was drilled and licensed by the Water Authority of Jordan (WAJ) in 2000.

With regards to wastewater, the closest Wastewater Treatment Plant (WWTP) to the project site is As Samra WWTP that is located around 24km to the north. There is no wastewater network within the project site, leachate and wastewater is disposed on site and then transported by tankers to the WWTP.

A natural gas pipeline from the south till the north of Jordan and is located around 9km to the west of the Ghabawi Landfill.

Table below presents all impacts related to infrastructure and utilities

Table 13: Summary of Anticipated Impacts on Infrastructure and Utilities

No.	Description	Project Phase	Key Mitigation Measures
1	Potential Impacts on Electricity Networks	Operation	<ul style="list-style-type: none"> ▪ GAM shall undertake a Strategic Environmental and Social Assessment as part of the ‘East Amman and Uhud Development Strategy Area and Direction of Urban Expansion’ that must assess traffic impacts from the development of the project and other development projects within the area.
	GAM has an agreed to connect the energy generated by Cells 1, 2, and 3 to the grid. This will contribute to supplying electricity to the grid for end users and help, to some extent, meet the increasing electricity demands throughout the Kingdom.		
2	Potential Impacts on Traffic and Road Networks	Construction and Operation	<ul style="list-style-type: none"> ▪ GAM shall continue to implement their waste transfer vehicles tracking and control system and strengthen it. ▪ GAM shall commit to both Ghabawi Operation Manual and HSE Manual ▪ GAM should coordinate with the MOMA and Zarqa and Russeifeh Municipalities in order to apply required measures. ▪ GAM shall prepare and apply a system for penalties for non-compliance for their own fleet and for other municipalities ▪ GAM shall coordinate with the MoEnv and the Environmental Police to undertake inspections and enforce compliance
	The key potential impacts on traffic and road networks are related to the GAM waste transfer vehicles. The transportation activities of such transfer vehicles would temporary and intermittently increase traffic volume and movement on the highways and roads and to some extent a reduction of roadway capacities		

4.4 Cumulative Impacts

There are a number of existing and/or planned developments in the area around the Ghabawi landfill which would result in cumulative impacts on the environmental/social receptors investigated as part of the ESIA. These developments include Amman Customs Centre, Amman New Slaughterhouse, Car sales Market for all of Amman, New Land (Onshore) Port and logistics centre, Amman Central Market, as well as other government buildings. Moreover, the East Amman area has a number of licensed and illegal industrial activities; within or outside industrial estates. These may have a potential collective impact on the different stakeholder groups in the area.

The land plots within GAM boundaries around the Ghabawi Landfill extending west to the Amman Development Corridor are outside the urban envelop delineated as part of the Amman Master Plan. GAM prepared a draft concept plan for the area east of the Amman Development Corridor showing the general development trend for the area, urban growth phases, and land classifications. As part of GAM’s efforts to prepare a comprehensive Master Plan for the East Amman Area, it is important to assess the strategic regional level context and highlight the challenges and opportunities in the area in order to establish sustainable action plans for enhancements.

Furthermore, based on the proceedings of this ESIA, it has been realised that certain measures that could be implemented upstream would have important effects on the quality and quantity of emissions within the Landfill. Such measures require strategic-level actions to be implemented by GAM. These strategic level mitigation measures are summarised below:

- GAM shall provide a timeline when the ‘East Amman and Uhud Development Strategy Area and Direction of Urban Expansion’ concept study shall be completed and announced.
- GAM shall review the zoning plan for the land around the landfill to ensure an adequate buffer is established against encroaching development.
- GAM shall ensure no residential areas or sensitive receptors are allowed in the area around the Landfill.
- GAM shall undertake a Strategic Environmental and Social Assessment as part of the ‘East Amman and Uhud Development Strategy Area and Direction of Urban Expansion’, during the preparation of these plans and studies, GAM shall consult with different stakeholder groups in order to take their comments and concerns into account.
- GAM shall prepare a Master Plan for the Ghabawi Landfill for the operation and closure and aftercare phases to cover the planned developments and operations within the Ghabawi Landfill as well as a layout for the Landfill and all components. This shall additionally include maintaining a no development zone around the

facility, maintaining an appropriate buffer zone area and creating a proper management and monitoring system.

- GAM to assess and implement waste separation and segregation upstream in order to prevent certain waste streams from reaching the Landfill.
- GAM shall implement a comprehensive awareness campaign to inform the Amman inhabitants of the importance of waste separation.
- Applying strict waste acceptance procedure.

5. Environmental and Social Management and Monitoring

The ESIA includes an Environmental and Social Management Plan (ESMP) which provides an outline plan for managing and monitoring the environmental and social impacts during construction, operation and decommissioning of the Project. The ESMP identifies the mitigation measures which aim to eliminate and/or reduce the potential impact to acceptable levels and monitoring actions to ensure that the identified mitigation measures are implemented.

During both construction and operation, certain activities, indicators and environmental and social receptors will be monitored. Monitoring may include observation and recording, or may include data gathering and sampling. Monitoring reports will be required from the Contractor and Operator during the construction and operational phases. The monitoring results will be useful for assessing the long-term cumulative effects, if any. If on-going problems occur, adaptive mitigation measures can be developed and implemented.

Moreover, an Environmental, Health, Safety and Social Management System (EHSS-MS) was developed and must be implemented by all relevant parties (i.e. GAM, Contractor(s), LFG Operator) throughout the Project's construction, operation, and closure and aftercare phase. The EHSS-MS includes several components including:

- Health, Safety and Environment Policies;
- Operation Manual: It describes the methods to be used for day-to-day waste management, disposal, and routine operations at the Landfill in accordance with EU Directives and good international practice. The application of all requirements and attached SOPs will ensure the reduction of anticipated impacts;
- HSE Manual: aims to ensure the health and safety of all personnel in order to concur and maintain a smooth and proper progress of work at the site and prevent accidents which may cause injuries or property damage;
- Emergency Response Plan.

In addition, and in accordance with the "EIA Regulation No. (37) of 2005", the Regulator (being MoEnv), will be responsible for undertaking compliance monitoring to ensure that the responsible entity is adhering to the ESMP requirements.

6. Further Information & Contact Details

Full project preparation documents, including the ESIA, NTS, and SEP including the grievance mechanism for affected stakeholders and communities are disclosed on the GAM website (<http://www.ammancity.gov.jo>). Copies of these documents are also available at the GAM Head Office in Amman and the GAM District Office in Uhud District.

GAM commits to the implementation of the ESMP, SEP, and other actions towards community and stakeholder engagement and integration.

Contact details for Project are the 'GAM Environmental Affairs Directorate' who are responsible for the communication with the public as follows:

GAM Head Office:

Environmental Affairs Directorate

Greater Amman Municipality

Omar Matar St., Rass Alain

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