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Environmental and Social Impact Assessment (Task 2.3 Report)

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This technical assistance operation is financed under the EIB's Economic Resilience Initiative (ERI). The ERI is EIB's response to the European Council's call to intensify its support for the EU's neighbourhood, in pursuit of economic growth and the achievement of the sustainable development goals (SDGs). The objective of this initiative is to rapidly mobilise additional financing in support of sustainable growth, vital infrastructure and social cohesion in Southern neighbourhood and Western Balkans countries. The Economic Resilience Initiative focuses on both the public and the private sectors, in support of EIB activities during different stages of the project cycle. The EIB is contributing to the ERI TA window with an envelope amounting to EUR 90 million from its own budget resources.

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Glossary of Terms and Abbreviations

Abbreviation	Description
AZ	Abu al Zeghan
CAPEX	Capital Expenditure
CPCM	Consultant Procurement and Contract Management
CRVA	Climate Risk Vulnerability Analysis
EIB	European Investment Bank
ERI	Economic Resilience Initiative
ESA	Environmental and Social Assessment
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
EU	European Union
EUFIWACC	European Financing Institutions Working Group on Adaptation to Climate Change
FS	Feasibility Study
GDP	Gross Domestic Product
GGE	Greenhouse Gas Emissions
IFI	International Financing Institution
IPS	Intake Pumping Station
JVA	Jordan Valley Authority
KAC	King Abdullah Canal
KAC-N	King Abdullah Canal North
KAC-S	King Abdullah Canal South
KD	Kafrain Dam
Km	Kilometre
KTD	King Talal Dam
MCM	Million Cubic Meters
MoEnv	Ministry of Environment
MWI	Ministry of Water and Irrigation
NEPCO	National Electric Power Company
O/F	Over Flow
OPEX	Operational Expenditure
PD	Preliminary Design
PJ	Projects Directorate
PS	Pumping Station
SEP	Stakeholders Engagement Plan
TA	Technical Assistance (Referring to the team working on this project as part of a WYG-Led consortium under the ERI-ITA multi-facility contract)
TO	Turnout
ToR	Terms of Reference
USAID	United States Agency for International Development
WAD	Wadi Arab Dam
WAR	Wadi Arab Reservoir
ZCs	Zarqa Conveyor

1. Introduction

The Jordan Valley Water Resources Efficiency Project aims to improve the water supply efficiency in the Jordan Valley. This will be achieved through the construction of a closed water carrier or pipeline to replace a section of the Southern King Abdullah Canal (KAC), the main carrier of irrigation water in the area.

This report represents the Environmental and Social Impact Assessment (ESIA) Study of the project, which has been developed during the feasibility study. The study shall be complemented with further details once the detailed design is ready.

1.1. Purpose and Need for the Project

The project involves the water supply to the existing KAC in the Jordan Valley, more specifically the Southern segment of the Canal, which is currently the source of irrigation to the farms in the Middle Ghor area. The new closed conduit is intended to replace the existing southern part of the open canal to reduce water losses that are estimated to reach up to 38%, including illegal connections, seepage, evaporation, and administrative losses. Therefore, the construction of a closed system is anticipated to reduce these losses and hence, any saving would permit the reallocation of fresh water flowing in the north section of the KAC to domestic water uses in urban centres such as Amman and Irbid. The concept of the project is not to increase the irrigated areas but to free up freshwater resources from the Northern KAC currently used for irrigation whilst maintaining the current level of irrigation water supply.

Figure 1-1 presents the general layout of the project area covering the extent of the Southern KAC downstream from King Talal Dam, the main source of irrigation water in the area. The closed carrier under this study shall, according to the TOR, provide irrigation water supply to the Turnouts located between TO 70 and TO 95.

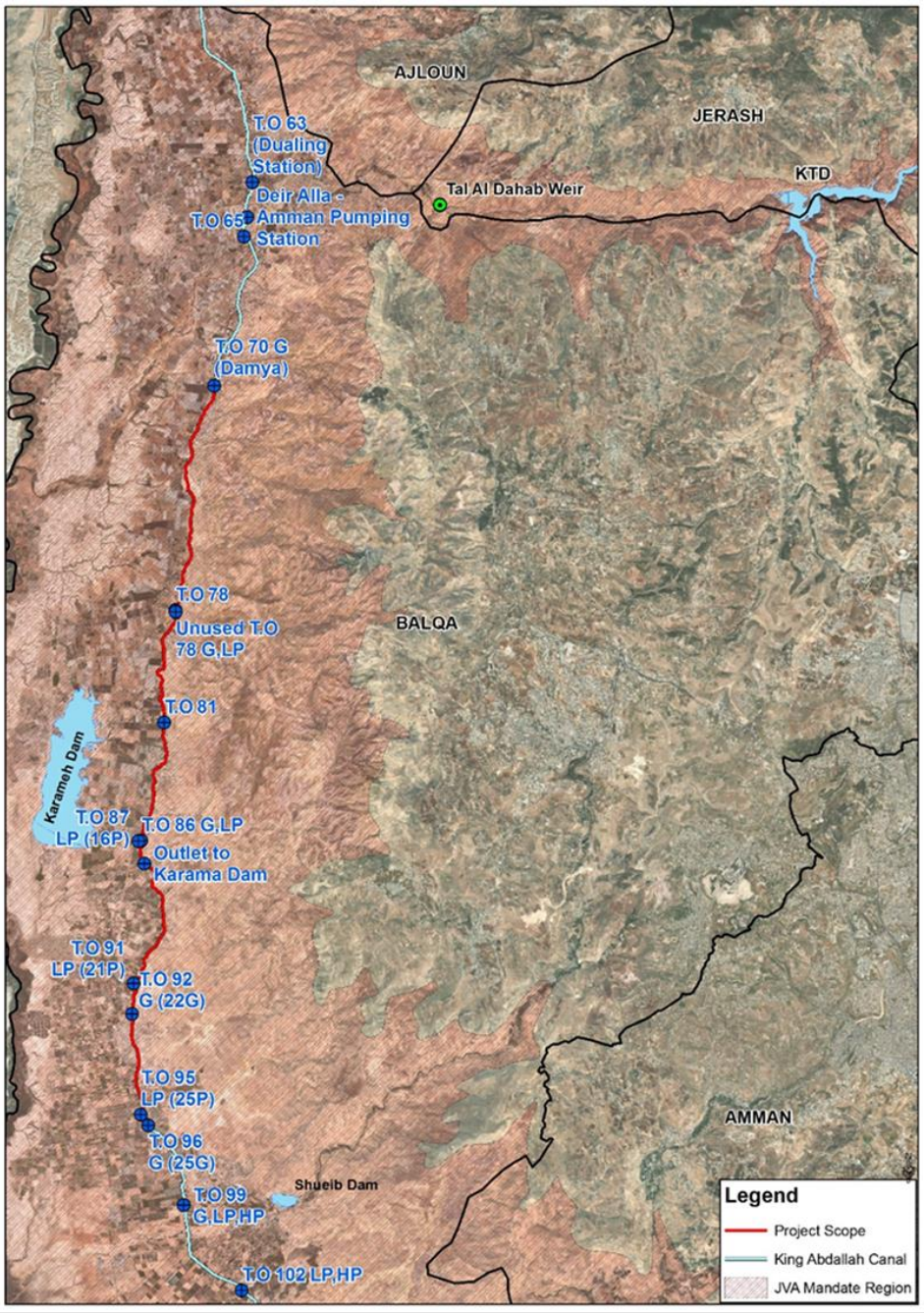


Figure 1-1: General Project Layout

(1): National Master Plan for the Jordan River Valley

1.2. Objectives and Expected Results

The purpose of this Technical Assistance (TA), funded by the European Investment Bank (EIB) is to provide the Project Promoter, the Jordan Valley Authority (JVA), and prospective financiers with:

- Technical and economic feasibility study for the construction of a closed water carrier.
- Assessment of the environmental and social impacts of the project.
- Assessment and addressing the Project's vulnerability to climate change.
- Detailed design and tender documents for the implementation of the Project.
- Options analysis for the reallocation of freshwater resources to be saved by the Project from irrigation to domestic water supply.

1.3. Project Proponents

Different entities are involved in the planning and implementation of the Project. The responsibilities of each key entity that is of relevance to the ESIA are listed in Table 1-1 below, along with an overall description of their roles.

Table 1-1 Project Proponents

Entity	Role
Jordan Valley Authority	Client and owner of the Project
European Investment Bank	Financing entity for the ESIA Study and potentially the Project
Ministry of Environment (MoEnv)	The official governmental entity responsible for the protection of the environment in Jordan. It will be responsible to grant environmental approval for the Project.
TetraTech / Engicon	Designer and ESIA Practitioner for the project

1.4. Purpose and Structure of the Report

This report was prepared in line with EIB and national requirements for ESIA. The structure is presented in Table 1-2.

Table 1-2: ESIA Report Structure

Section	Contents
1. Executive Summary	Presents a non-technical summary of the ESIA report
2. Introduction	Presents the Project's proponent, background as well as ESIA objectives
3. Project Description	Provides a detailed description of the Project and its components
4. Legal and Administrative Framework	Identifies the public entities that will be involved in the various aspects of Project construction and operation and the laws, regulations and standards governing the environmental and social performance of the Project
5. Project Alternatives	Presents the alternatives considered for the project and the various advantages and disadvantages of each leading to selection of the preferred alternative
6. Methods	Defines the project area of influence, presents the methods used to collect data on the physical, biological and socioeconomic conditions within this area and describes the methodology used for impact assessment
7. Environmental and Social Baseline	Presents all relevant information collected on environmental and social conditions within the Project area of influence setting the current baseline
8. Stakeholder Engagement	Describes all stakeholder engagement activities conducted to date regarding the project and the main findings of these activities
9. Impact Assessment and Mitigation	Describes the anticipated positive and negative environmental and social impacts likely to result from the Project and proposed mitigation measures

Section	Contents
10. Management Plans and Institutional Setup	Presents the mitigation and monitoring management plans required to ensure that the project's environmental and social impacts are avoided, minimized or, if necessary, offset. It also presents the required institutional arrangements for implementation of these plans
11. Annexes	All related annexes: Annex 1 - Obstacles Locations Annex 2 - GHG Annex 3 - Overview of Alternatives Annex 4 - Gender analysis Annex 5 - Consultation Session

2. Project Description

This section presents a detailed description of the various Project components for the preferred alternative to convey the irrigation demands of the KAC-S farms via a closed carrier (Figure 2-1). Such a system would replace the current supply via the open canal and would serve to reduce the water losses in the canal. The various alternatives that were studied during this TA can be found in Section 4 of this report.

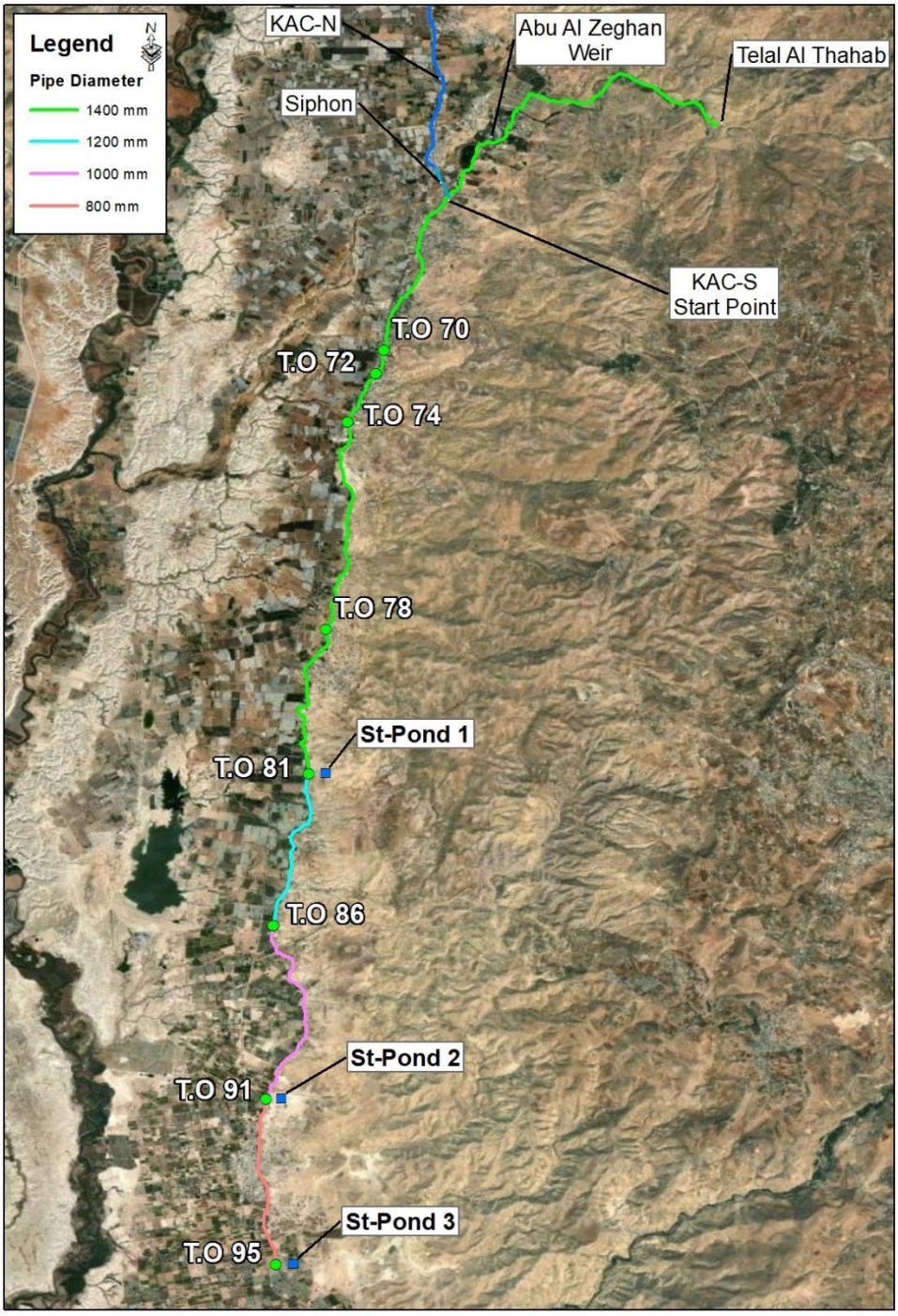


Figure 2-1: Selected Project Alternative

2.1. Intake

A new weir and intake are proposed to be constructed upstream from the Telal Al Thahab (TTH) existing weir. The proposed structure will be located about 150 m to the upstream. The weir will form a new pond upstream, with a crest elevation approximately 3.0 m above the existing water surface. The weir will impound the wadi flow and divert the water to a side intake.

At the intake site, the river flow will be diverted via a side weir to a pipeline, extending along the northern wadi bank for a distance of approximately 190 m until it reaches near the existing intake. At that point, a proposed tunnel, 1.80 m in diameter and 290 m long, will convey the flow to the western side the hill, west of the existing settling basins. The intake system has been designed to control the amount of flow that will be diverted by using adjustable sluice gates.

2.2. Settling Basins

In the settling basins, the flow will be subject to a minimum detention time to allow the large, suspended solids and sediments to settle by gravity (Figure 2-2). The settling basins will receive a flow of about 11,200 m^3/hr to cover the irrigation demand.

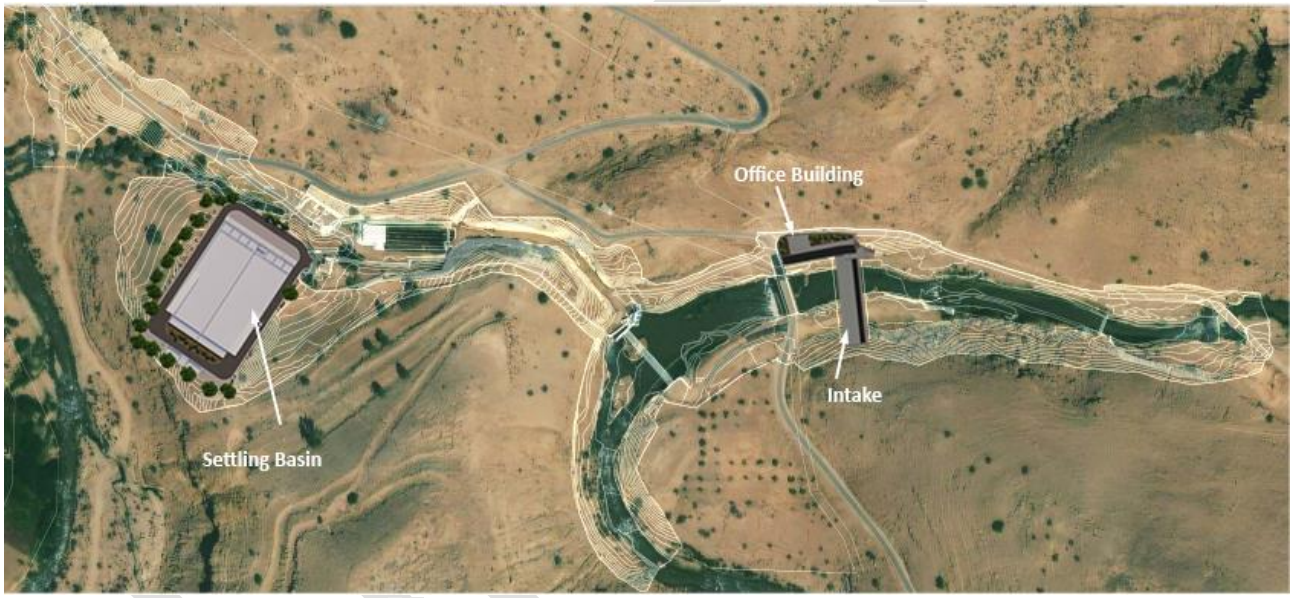


Figure 2-2: Proposed Settling basin location and intake site

The settling basins are sized to remove the gravel and large sized sand particles. Lighter sand particles, silt, clay and colloidal matter are not expected to settle. The settling basins are sized to have a hydraulic retention time of 30 minutes for the settling compartments, in addition to a storage volume at the bottom of the basins to allow for one year of sediment storage.

The sediment storage volume at the bottom of the tanks is sized assuming:

- 10% settling efficiency.
- 30% solids concentration in the storage volume of the tank.

Accordingly, two settling basins are required, with minimum effective dimensions of each as follows:

- Length = 55 meters.
- Width = 17 meters.
- Depth = 4.7 meters.

2.3. Main Conveyor

The new main conveyor will divert the irrigation demands to both pumping-fed and gravity-fed farms of turnouts 81 to 95 from the upstream location in Zarqa River, namely, Telal Al-Thahab. The total peak

demand of these farms is approximately 211,000 m^3/d as shown in Table 2-1. The demands of the gravity-fed farms at Turnout 81, 91 and 95 will be stored in three storage ponds overnight with a total volume of around 77,000 m^3. The storage ponds sizing will be elaborated in the following sub-section.

Table 2-1: Supply Modes and Peak Demands

Turnout	Supply Mode	Irrigated Area (donum)	Gravity Demand (m^3/d)	Pumping Demand (m^3/d)
81	Gravity	6,033	29,441	-
81	Pumping	8,108	-	39,567
86	Pumping	10,522	-	51,347
91	Pumping	4,560	-	22,253
91	Gravity	3,980	19,422	-
95	Gravity	5,634	27,494	-
95	Pumping	4,368	-	21,316
Total		**43,205**	**76,357**	**134,483**
			210,840	

All demands of turnouts 70 to 78 will continue to flow in Wadi Zarqa, Abu Zighan channel and KAC-S, as in the current situation, whereas after turnout 78, the turnouts will be served by the new conveyor pipeline.

The 38 km long main conveyor pipeline extending from Telal Al-Thahab to turnout 95 was sized based on the above irrigation demands starting from a diameter of Ø1400mm for about 25 km until turnout 81, where it starts to feed the turnouts. After Turnout 81, the pipe size becomes Ø1200mm for the next 4 km, Ø1000mm for 5 km and then ends with Ø800mm in the last 4 km of its route as shown in Figure 2-1 above.

Ductile iron material was selected for the conveyor for the advantages of safe and reliable operation, low damage rate, convenience and fast construction and maintenance, in addition to its long-projected service life.

The 1400mm pipeline will be installed in the east roadside from Telal Al-Thahab parallel to the existing ZC pipes for about 4.5 km. It then follows a separate route to Abu Al-Zighan channel starting point for about 2 km and continues on the east side of the 1.8 km long channel. See Figure 6-4 below.

At the end of Abu Al Zeghan channel, where it is connected to the beginning of the southern KAC, the pipe will cross over the canal from the east to the west side of KAC and continues for a total length of about 30 km, with diameters ranging between 1400 to 800mm, until turnout number 95. The crossing over the canal to the west side, as shown in Figure 2-3, avoids the conflict with the siphon connecting the northern and southern King Abdallah Canals.

Figure 2-3: Siphon crossing over KAC-S

The main obstacles along the west service road include culverts, stormwater bridges, underground canal parts below natural ground or roads, riprap, concrete slabs, and tree areas. **Annex 1** to this report includes a table and figure summarizing the obstacle locations and types.

The turnout connections to the new conveyor pipe for the pumping-fed farm from turnout 81 to 95 were sized based on the total irrigation demands for each turnout at a velocity of around 1.5 m/s. As per JVA, the existing turnout connection with the KAC are to be closed and not to be disconnected. Table 2-2 gives the connection pipes diameters of the turnouts for the Project.

Table 2-2: Turnout Connections

Pumping-Fed Turnout No.	T.O. Demand (m^3/d)	Connection Pipe Diameter (mm)
81	39,567	700
86	51,347	700
91	22,253	500
95	21,316	500
Total	**134,483**	

2.4. Storage Ponds

Storage ponds will be used for the gravity connections at Turnouts 81, 91 and 95. The ponds have been sized based on a one-day demand for the gravity turnouts, resulting in 3 ponds with a total volume of about 77,000 cubic meters. The ponds will be filled at a rate of approximately 7,650 m^3/hr over 10 hours from the same conveyor pipe that serves the pumping-fed farms over the first 12 hours of the day.

The locations of the ponds were identified based on the available space near the turnouts on the canal's East-side, where most of the lands East of canal are understood to be owned by JVA. This will avoid or

minimize land acquisition specially farms on the west side of the canal. . See Figure 2-4 for the ponds' approximate locations. The storage ponds' locations are preliminary for the purpose of the Feasibility Study.

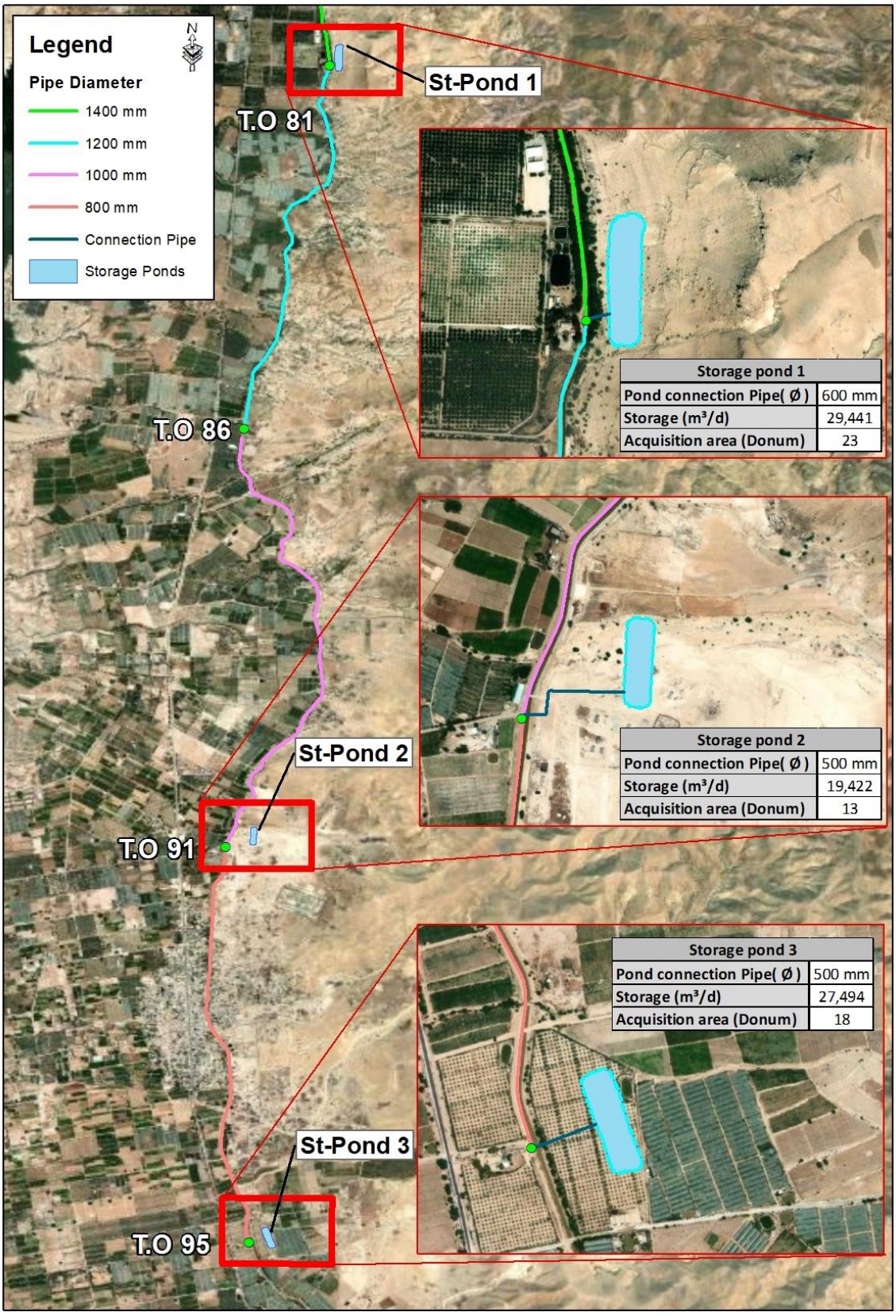


Figure 2-4: Storage Ponds Approximate Locations

The preliminary design criteria of the ponds included the following:

- Depth of ponds is 4.0 meters including free board
- Excavation side slopes 1.5H:1.0V
- Ponds will be surrounded by four-meter-wide service roads
- Ponds will be lined
- Ponds will be surrounded with a fence for safety purposes

The connection pipes from the main conveyor pipe to the ponds were sized based on each gravity turnout's peak demand and a velocity of about 1.50 m/s as shown in the table below.

The connection pipes will be provided with an insolation valve, flow control valve, and a flow meter, each in order to control the flow to the ponds as shown in Table 2-3 and Figure 2-5.

Table 2-3: Storage ponds and connection pipes sizing

Storage Ponds	Turnout No.	Supply Mode	Irrigated Area (donum)	Turnout Demand (m^3/d)	Connection Pipe Diam. (mm)	Approximate Connection pipe length (m)
Pond 1	81	Gravity	6,033	29,441	600	90
Pond 2	91	Gravity	3,980	19,422	500	320
Pond 3	95	Gravity	5,634	27,494	500	180
		Total:	**15,647**	**76,357**		**590**

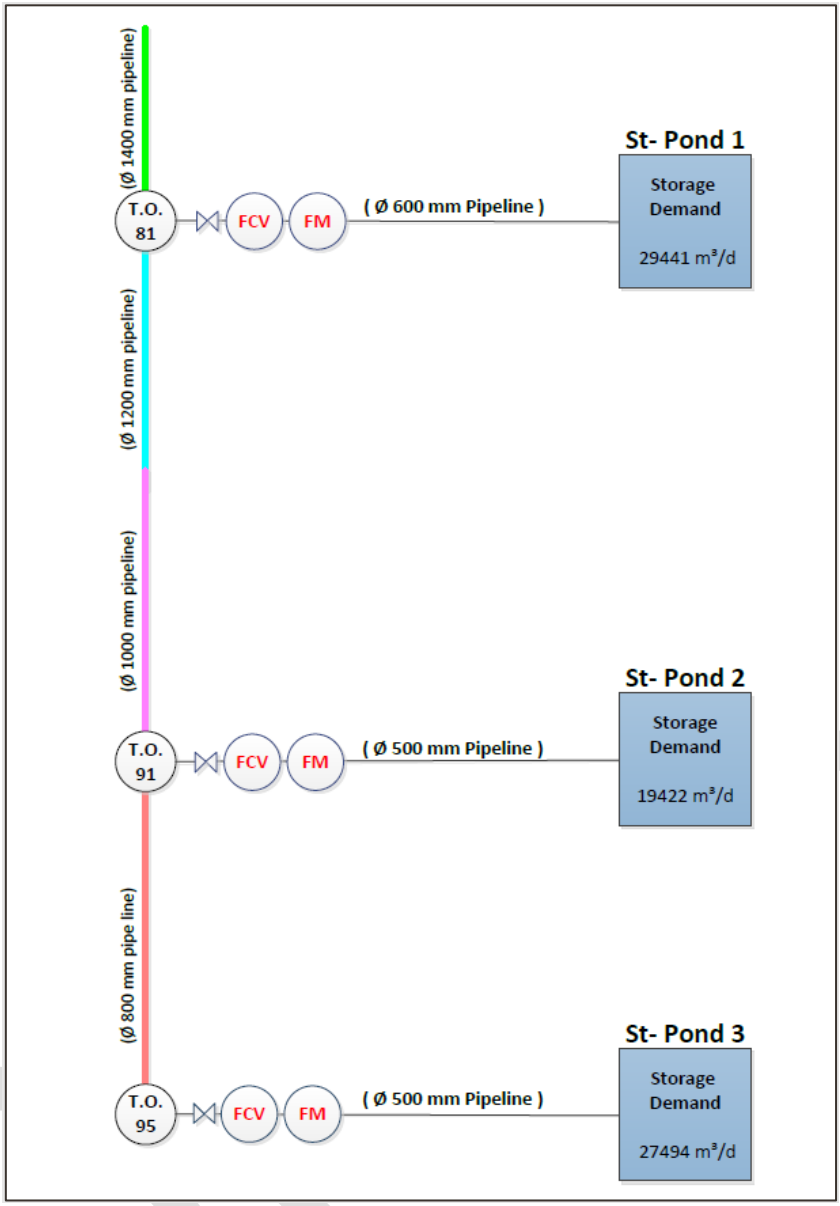


Figure 2-5: Connections to Storage Ponds

2.5. Land Acquisition

Along route of the Zarqa Conveyors, the road's right-of-way (ROW) varies from 14 m to more than 24 m wide, as per the land maps provided by JVA. For approximately the first 2.8 km the road, the right-of-way, starting from Telal Al-Thahab, is 14m wide, and it then changes to 20 m for the next 0.5 km. After that, the ROW becomes 24 m wide for another 600 m, after which is becomes wider than 24 m for the rest of the way. The narrow parts of the roads in addition to the ZC conveyors that occupy most of the roads' ROW resulted in the need for land acquisition along the pipe's path. The following table summarizes the land acquisition required for the conveyor pipeline and the storage ponds.

Table 2-4: Land Acquisition

Uses	Total Acquisition Area (Dounm)
Land Acquisition - Conveyor	6
Land Acquisition -Storage Ponds	30

2.6. Energy Consumption

There are six pumping stations currently on KAC-S located at the turnouts. These pump stations lift the irrigation water supply from the canal and pump it to the farms. Four of these pump stations have recently been reconstructed.

The monthly power consumption of the existing pumping stations was provided by JVA for years 2019 and 2020. The average yearly power consumption for all pumping stations was then estimated based on the power consumption for those years as per Table 2-5.

Table 2-5: Annual Power Consumption of Pumping Stations at T.OFs between 72 - 95

Turn Out #	(2019) kW.h Consumed / year as Received from JV	(2020) kW.h Consumed / Year as Received from JVA	Estimated Average Power Consumption kW.h
72	341,760	405,000	373,380
78	270,720	272,280	271,500
81 & 82	176,160	196,240	186,200
86 & 87	578,320	489,040	533,680
91 & 92	208,400	233,100	220,750
95 & 96	112,800	277,720	195,260
Total	**1,688,160**	**1,873,380**	**1,780,770**

Under this project and based on residual pressures in the proposed conveyor, the pump stations between TO 81 and TO 95 could be by-passed , resulting in a reduction of approximately 60% of current energy consumption of approximately 1,135,000 (kWh/year). Reduction in energy consumption will reduce GHG and decrease JVA overall operational expenses.

For more details on the GHG related to this project, please refer to **Annex 2.**

3. Legal and Administrative Framework

This chapter discusses the legal and administrative framework of environmental and social issues relevant to the Project. The Chapter provides a description of relevant national institutions, legislation, EIB Policy and the EU Environmental and Social Principles and Standards, International Labour Organization (ILO) Standards, mention applicable EU Directives and regional/international agreements signed by Jordan and all relevant policies, strategies, plans and programs.

3.1. Ministries, Authorities and Institutions

Several public institutions will be involved during construction and operation of the Jordan Valley Water Resources Efficiency Project presented in Table 3-1 along with their mandate and relevant responsibilities.

Table 3-1: Relevant Authorities and Institutions

Institution	Main Role	Relevant Mandate
Ministry of Water and Irrigation / Water Authority of Jordan (WAJ)	Overall strategic direction and planning of the water sector in Jordan in coordination with the Water Authority of Jordan (WAJ) and the JVA.	The MWI and the WAJ work collectively in determining the national water policy, monitoring and protecting water against pollution, in addition to studying water, irrigation and sewerage. WAJ is responsible for water and sewage systems, groundwater, aquifer management, and extraction monitoring and licensing.
Jordan Valley Authority	Socioeconomic development of the Jordan Rift Valley, including the development, utilization, protection and conservation of water resources.	Develop water resources in the Jordan Valley, carry out studies for the evaluation of water resources, realize irrigation projects, soil survey and classification and develop and improve the environment and living conditions in the Valley.
Ministry of Environment	Maintaining and improving the quality of the Jordanian environment, conserving Jordan's natural resources and contributing to sustainable development through the development of policies, strategies and legislation and enhancing the integration of environmental concepts into national development plans.	Undertakes monitoring and inspection to ensure that legislation is enforced and information management programs are developed in order to facilitate the decision-making and analysis process of environmental data. All projects that may have detrimental environmental and social impacts must undertake an environmental impact assessment (EIA) that should be approved by the Ministry.
Ministry of Agriculture	Strategic planning for the agricultural sector through promoting self-sufficiency and rural development.	Managing public rangelands and forests, protecting soil resources, pastureland and flora, protecting and managing wildlife.
Ministry of Tourism and Antiquities / Department of Antiquities (DoA)	Conserving, protecting and maintaining Jordanian heritage sites.	Responsible for implementing legislation that ensure that destruction or damage of any heritage site does not occur during project implementation. DoA gives permits for any fieldwork necessary to identify archaeological sites that may be impacted by a development, beginning with the archaeological survey of the project land.

Institution	Main Role	Relevant Mandate
Ministry of Health	Maintaining public health by offering preventive, treatment and health control services, organizing and supervising health services offered by the public and private sectors and providing health insurance for the public within available means.	Monitoring water and food quality to ensure its safety and adequacy for human consumption.
Ministry of Public Works and Housing	Connecting cities, villages, and communities in Jordan through construction, development and maintenance of the public road network.	Maintenance of the road network and ensuring its technical specifications are in line with national standards.
Ministry of Planning and International Cooperation	Formulation and implementation of national social and economic development plans in coordination with other stakeholders.	Enhancing cooperation with international partners including maximizing the benefits from foreign assistance (grants, soft loans, and technical assistance) to finance development programmes and projects.
Ministry of Labor	Administering employment and vocational training matters, labour migration, women affairs and labour affairs.	Safeguarding health and safety of workers and labour and ensuring that working conditions are in line with national legislation.
Public Security Directorate	Seeking criminal, economic, social, political, cultural and environmental security in Jordan.	Supervising and organizing traffic on roads and enforcing emission standards through the environmental police.
Department of Lands and Surveys	Preserving the right of ownership of land and solving conflicts in land and water sources issues.	Overseeing acquisition, compensation payment and ultimate registration land.
Municipalities of Middle Shouneh, Arda and Ma'adi	Strategic planning and providing essential public services such as water distribution, sanitation services, public health issues and solid waste management.	Coordinate with concerned authorities to manage and organize water supply to inhabitants and prevent the pollution of springs, canals, basins and wells, ensure proper solid waste disposal and reference entity for coordination of construction works within municipal boundaries.

3.2. National Legislation

The construction and operation of the Project will require implementation of a variety of activities that need to abide by national legislation that are enforced by various government institutions. These laws are listed in Table 3-2 along with their relevant provisions.

Table 3-2: Legal Framework Related to the Project

Law/Regulation	Relevant Provisions
Laws	
Environmental Protection Law No. 6 of 2017	Defines the role and mandate of MoEnv (Article 3 and 4), creates the legal basis for environmental permitting (Article 5), prohibits haphazard disposal of solid waste (Article 8), prohibits the haphazard discharge of liquid waste (Article 9), prohibits machinery from emitting noise and vibration that exceed the standards (Article 10), requires installation of air pollution control devices on machinery emitting air pollutants exceeding the standards (Article 11), prohibits any activity that may have an adverse impact on terrestrial ecosystems (Article 12), gives mandate to the Minister of Environment in emergency pollution incidents to stop the pollution

Law/Regulation	Relevant Provisions
	and ensure clean up at the expense of the polluter (Article 16), sets the penalties for environmental violations (Articles 17-27).
Agricultural Law No. 13 of 2015 and its amendment (Law No.50 of 2016)	Article 31 protects forest land from damage and pollution and sets penalties for activities that harm forests. Article 33 prohibits cutting, burning or pruning of forest trees, bushes and wild plants without a license issued by the Minister of Agriculture. In Article 38, it is prohibited to infringe on pasture lands, whether by plowing or cultivating them, implement quarries or sandboxes in them, cutting, removing or burning plants, collecting their seeds, assaulting their wells, border signs and fences, or others such as throwing rubble or waste, or Solid, liquid, or radioactive waste, or any materials polluting the environment on it. Article 56 states that instructions shall be issued to regulate the protection, hunting and trafficking of wild birds and wild animals and the trade of ornamental fish according to the international agreements.
Municipalities Law No. 41 of 2015	Article 5 of this law authorizes the municipalities to prepare and implement sustainable development programs with the participation of local communities and the private sector. Furthermore, it authorizes the municipalities to coordinate with the concerned authorities in order to manage and organize water distribution among the population and prevent the pollution of springs, canals, basins and wells.
Social Security Law No. 1 of 2014	Requires the provision of social security and worker insurance for all workers under sixteen with certain exceptions (seafarers, domestic workers, and agricultural workers). It covers occupational injuries and diseases, retirement and disability and death benefits.
Prevention of Human Trafficking Law No.9 of 2009	Prohibits trafficking in persons, creation of offences, prosecution and punishment of offenders, protection of victims of trafficking in persons, and other related matters.
Law on Securing the Right to Information Access No. 47 of 2007	Article 8 requires public access to information and ensures the prompt disclosure thereof in the manner set forth in this Law.
Traffic Law No. 49 of 2008	Article 24 of this Law states that driving vehicles that are spilling or leaking oils or oil derivatives or any dangerous materials on the road or that are emitting smoke or any other polluting materials while in motion, at non permissible rates, shall be impounded. In Article 26, a punishment with imprisonment or a fine is imposed for driving a vehicle carrying dangerous, explosive or flammable materials inside populated places or areas that need a permit, moreover, as per Article 31, imprisonment or a fine are imposed for throwing or pouring vehicle loads such as stones, solid waste, liquid materials or any other materials on the road, and the responsible person shall bear the cost of removing these materials. In addition, Article 35 also impose a fine for driving a vehicle that emits smoke or any other polluting materials.
Public Health Law No. 47 of 2008	Article 4 states that the Ministry of Health is responsible for the protection of public health in the country and for monitoring the water and food quality to ensure its safety and adequacy for human consumption.
Protection of Cultural Heritage and Sites Law No. 5 of 2005	According to Article 11, destruction or damage of any heritage site is strictly forbidden.
Antiquities Law No. 23 of 2004	Article 13 requires that significant archaeological sites should be documented and protected by a buffer zone of 5 m to 25 m.
Civil Defense Law No. 18 of 1999	Article 8 states that in case of emergency and disaster cases, and after an authorization from the Prime Minister, the Minister of Interior may regulate and limit the use of water and electricity

Law/Regulation	Relevant Provisions
	resources, their tools and all their supplies in coordination and cooperation with the authorities responsible for managing and running them.
Labor Law No. 8 of 1996 and its Amendments (latest being Law No. 14 of 2019)	Governs the relationship between employers and employees in Jordan. In Article 73 no juvenile not reaching sixteen might be employed under no circumstances and Article 74 prohibits juvenile not reaching eighteen to be employed in the dangerous or exhausting occupations or those harmful to health. Article 82 states that the employees working in any establishment shall abide by the provisions, instructions and decisions related to the precautions of protection, vocational health and safety, using and maintaining the equipment of vocational health and safety.
Water Authority Law No. 18 of 1988 and its amendments	As per Article 3 of this law, WAJ was established as an autonomous agency linked with the Ministry of Water and Irrigation. WAJ carries full responsibility for the public water supply, wastewater services and related projects as well as for the overall water resources planning and monitoring, construction, operations and maintenance. Article 6 addresses the functions that the Authority shall undertake and that include the regulation of wells construction, setting the requirements in order to preserve the water of basins from pollution, theoretical and applied research and studies regarding water and public sewerage, issue permits for licensed engineers to work in water and sewage installations and the regulation of water uses and consumption.
Jordan Valley Development Law No.19 of 1988 and its amendments by Law 30 of 2001	In Article 21, JVA has the right to carry out expropriation of land in the Jordan Valley or in the basins of the Jordan River Tributaries. The protection of water resources in the Valley against pollution is addressed in Article 38.
Land Acquisition Law, Decree No. 12 of 1987 and its Amendments	Article 3 allows for the appropriation of land for public benefit conditional on fair and just compensation for project affected persons. Article 9 states that direct negotiation between the purchasers or public benefit project and land owners until agreement is reached.
Regulations	
Environmental Classification and Licensing Regulations No. 69 for 2020 and its amended regulation No. 97 for 2020	Article 4 categorizes development projects based on their associated risks (four categories) and level of environmental assessment required. The regulation presents the process for obtaining environmental approval for a project based on the four categories. According to Appendix 1, a facility to transfer 20,000 cubic meters of water is considered High Risk and would require a comprehensive EIA, subject to screening to be done by MoEnv.
Regulation for Obligatory Employment of Jordanian Workforce from Surrounding Communities in Development Projects No. 131 of 2016	Requires the obligatory employment of local communities within development projects to include fresh graduate engineers, technicians, laborers, etc. and specifies requirements for training as well as giving priority to local contractors. The number of job opportunities is specified based on the investment amount of the development project.
Regulation for the Prevention of Health Nuisances within Municipal Areas No.8 of 2014	Prohibits any party from causing any nuisance to anybody or from damaging public health. These nuisances may include bad odours, noise, solid and liquid waste or any other practice deemed harmful to public health or sanity. In addition, it states penalty of violators and waste collection fees.
Regulation for the Classification of Birds and Wild Animals Species	This regulation classifies all bird species that are not allowed to be hunted in Jordan into three appendices based on their conservation status and their number in the country.

Law/Regulation	Relevant Provisions
Forbidden from Hunting No. 43 of 2008	
Regulation on Protecting the Environment from Pollution in Emergency Situations No. 26 of 2005	Article 3 specifies tasks and duties of the Ministry of Environment in cooperation with the concerned authorities in case of Emergency, as follows: (a) laying down plans for the protection of the environment and fighting pollution in case of emergency; (b) managing and following the execution of the Emergency Plans; (c) defining needs of the Emergency Plan; and, (d) taking necessary measures.
Air Protection Regulation No. 28 of 2005	Framework legislation to protect public health and the environment from pollution resulting from human activities by controlling air pollutants emitted from stationary and mobile sources.
Soil Protection Regulation No. 25 of 2005	Article 3e states that: "the MoEnv, in coordination with the Ministry of Agriculture, is responsible for studying the sites of development projects and their impact on land and natural resources."
Standards and Instructions	
Ministry of Labour Instructions on Safety Measures to Prevent the Spread of Coronavirus at construction sites (07/04/2020)	Stipulates measures to be implemented by the contractor for controlling the transmission of Covid-19 during construction.
Noise level control regulation for 2007	Specify the maximum allowable level of noise for the different types of areas, both during the daytime and at night.
Ambient Air Quality Standards (JS 1140/2006)	Provides definitions of ambient air pollutants and the maximum allowable concentration for each of those pollutants. The standards specify the maximum allowable limits of concentration of ambient air pollutants, beyond which, responsible parties should take action.
Maximum allowable limits of air pollutants emitted from the stationary sources (JS 1189:2006)	Specifies the maximum allowable limits of air pollutants emitted from the stationary sources.
MoEnv Instructions for the Management of Solid Waste No. 27 of 2005	Sets for every party that generates and/or manages solid waste general requirements for manpower, equipment, monitoring, container management, separation of hazardous wastes, documentation and final treatment or disposal control.
Ministry of Labor Instructions for the Protection of Workers against the Risks of the Work Environment No. 8 of 1996	Instructions concerning the protection of employees and establishments from dangers in the work environment.

3.3. International Standards and Commitments

3.3.1. EIB Environmental and Social Standards

The promotion of sustainable development underpins the EIB's lending strategy and objectives. The EIB Statement on Environmental and Social Principles and Standards sets the policy context for the protection of the environment and human well-being. In order to achieve sustainability objectives, EIB has adopted 10 environmental and social standards as follows, all of which are applicable to the Project:

PS 1. Assessment and management of environmental and social impacts and risks
PS 2. Pollution prevention and abatement
PS 3. Biodiversity and ecosystems
PS 4. Climate-related standards
PS 5. Cultural heritage
PS 6. Involuntary resettlement
PS 7. Rights and interests of vulnerable groups
PS 8. Labour standards
PS 9. Occupational and public health, safety and security

PS 10. Stakeholder engagement

A brief analysis of the Jordanian Land Acquisition Law No. 12 for 1987 and its amendments and EIB Standard 6: Involuntary Resettlement is included in this section. The main discrepancies between the Jordanian legislation and EIB standard can be summarized as follows:

- EIB considers project affected persons (PAPs) to be all persons impacted by involuntary resettlement including all members of a household, the owner of a business and employees, members of an ethnic minority, land owners and sharecroppers, informal settlers, etc. The Jordanian legislation only recognizes land owners, representative of household or business owner as PAPs.
- EIB states that where land has been taken, persons should be compensated with land of commensurate quality, size and value or better. The promoter is required to offer the choice of in-kind or monetary compensation. EIB also requires that the promoter, at a minimum, restore the living conditions of those affected by the project. However, Jordanian legislation only allows for monetary compensation of lost assets.
- EIB requires that the promoter identify and consult with all persons and communities involved in the resettlement process and given the opportunity to participate in resettlement planning. According to Jordanian legislation, the promoter is only required to announce the works and affected land plots in at least two newspapers 15 days prior to commencement of works. The land owners would then seek compensation from the promoter after completion of installation.

It is also worth mentioning some relevant provisions of the Land Acquisition Law:

- Compensation should be offered to both PAP owners and tenants (Article 10), in case of business, the tenant receives 15% of the compensation while for other uses only 5% is offered. This amount is deducted from the total compensation received by the land owner.
- Trees and annual crops are subject to compensation but there are no specific guidelines except for the mentioning of “equitable compensation”.

3.3.2. Multilateral Environmental Agreements

The international conventions that Jordan is a signatory and to whose provisions may be relevant to the project are represented in table below:

Table 3-3: Relevant International Treaties and Conventions

Convention	Description	Status
Paris Agreement (2015)	Requires all Parties to put forward their best efforts to combat climate change and adapt to its effects through nationally determined contributions (NDCs) and to strengthen these efforts in the years ahead.	Signature 22/04/2016 Ratification 04/11/2016
Convention on Biological Diversity (1992)	The CBD develops strategies in order to conserve biodiversity, ensure the sustainable use of its components and the fair and equitable sharing of benefits arising from genetic resources.	Signature 11/06/1992 Ratification in 12/11/1993
UN Framework Convention on Climate Change (1992)	Aims to "stabilize greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system". In addition, the executive secretary emphasizes the importance of agriculture and land use in the fight against climate change.	Signature 11/06/1992 Ratification in 12/11/1993

Convention	Description	Status
Agreement on the Conservation of African-Eurasian Migratory Waterbirds – 1996	Developed under the framework of the CMS, intergovernmental treaty dedicated to the conservation of migratory waterbirds and their habitats across Africa, Europe, the Middle East, Central Asia, Greenland and the Canadian Archipelago.	Definitive signature Date of Notification/Deposit 12/03/1997 Date of Effect 01/11/1999
Convention Concerning the Protection of the World Cultural and Natural Heritage, (World Heritage Convention, 1972)	This convention encourages the identification, protection and preservation of cultural and natural heritage around the world considered to be of outstanding value to humanity.	Ratification 05/05/1975
Stockholm Protocol on Persistent Organic Pollutants (POPs) – 2001	The Stockholm Convention on Persistent Organic Pollutants aims to protect human health and the environment from the harmful effects of the chemicals that remain intact in the environment for long periods.	Signature 18/01/2002 Ratification 08/11/2004
Basel Convention on the Control of Trans-boundary Movements of Hazardous Wastes and their Disposal (1989) and its Amendment – 1995	This convention aims to reduce the movements of hazardous waste between countries. The Convention is also intended to minimize the amount and toxicity of wastes generated, to ensure their environmentally sound management as closely as possible to the source of generation, and to assist LDCs in environmentally sound management of the hazardous and other wastes they generate.	Signature 22/03/1989 Approval 22/06/1989 and in 06/12/2004
Vienna Convention for the Protection of the Ozone Layer - 1985 and the Montreal Protocol on Substances that deplete the Ozone Layer – 1987	Provided frameworks that aim at the reduction of the production of chlorofluorocarbons internationally as these are contributing to the destruction of the ozone layer.	Accession 31/05/1989
The United Nations Convention to Combat Desertification (UNCCD) – 1994	The UNCCD specifies measures to conserve natural resources through integrated and sustainable management of natural resources, including forests, vegetation cover and wildlife, water resources and biodiversity.	Signature 13/04/1995 Ratification 21/10/1996
Ramsar Convention of Wetlands of International Importance – 1971	The Convention's mission is "the conservation and wise use of all wetlands through local and national actions and international cooperation, as a contribution towards achieving sustainable development throughout the world".	Entry into force 10/05/1977

3.3.3. International Labour Organisation

The International Labour Organisation (ILO) core Labor standards include the following:

- Right to Organise and Collective Bargaining Convention, 1949 (No. 98)
- Forced Labor Convention, 1930 (No. 29)
- Abolition of Forced Labor Convention, 1957 (No. 105)
- Minimum Age Convention, 1973 (No. 138)
- Worst Forms of Child Labor Convention, 1999 (No. 182)
- Equal Remuneration Convention, 1951 (No. 100)
- Discrimination (Employment and Occupation) Convention, 1958 (No. 111)

These Conventions are fundamental and shall be taken under advisement during project implementation, as labor of workers and employees will be hired and have certain rights in accordance with the Conventions.

The Project will provide for measures to prevent accidents and injury to health arising out of, linked with or occurring in the course of work, by minimising, so far as is reasonably practicable, the causes of hazards inherent in the working environment.

3.3.4. EU Directives

The EU Directives applicable to the Project are as follows:

- Water Framework Directive (2000/60/EC – as amended) establishing a framework for Community action in the field of water policy;
- Directive on ambient air quality (2008/50/EC – as amended) defines the criteria and limits values for air quality assessment;
- Directive on EIA Directive (85/337/EEC);
- EU Noise Directive (2002/49/EC);
- Directive on the protection of groundwater against pollution and deterioration (2006/118/EC);
- Waste Framework Directive (2008/98/EC);
- Directive providing for public participation in respect of the drawing up of certain plans and programmes relating to the environment and amending with regard to public participation and access to justice (2003/35/EC);
- Access to Environmental Information Directive (2003/04/EC);
- Directive on the conservation of natural habitats and of wild fauna and flora (92/43/EEC);
- Directive on the conservation of wild birds (2009/147/EC);
- Directive on the assessment of the effects of certain public and private projects on the environment (codification) (2011/92/EU) as amended by Directive 2014/52/EU;
- Equal opportunities Directive (2006/54/EC);
- Informing and consulting employees Directive (2002/14/EC);
- Equal treatment Directive (2000/78/EC);
- OHS- Framework & Directive Directive (89/391/EEC);
- Use of work equipment Directive (2009/104/EC);
- Safety and/or health signs Directive (92/58/EEC);
- Use of personal protective equipment Directive (89/656/EEC);
- Workplace requirements Directive (89/654/EEC);
- Occupational exposure limit values Directive (2009/161/EU);
- Major-accident hazards Directive (2012/18/EU);
- Manual handling of loads Directive (90/269/EC).

3.4. Project Standards

This section presents the environmental standards, limits, measures and instructions that are applicable to the Project.

3.4.1. Ministry of Labour Instructions on Safety Measures to Prevent the Spread of Coronavirus at construction sites (07/04/2020)

These instructions aim to safeguard the safety of contractor staff undertaking construction activities during the COVID-19 pandemic. These instructions require contractors to undertake the following:

- Distribute awareness leaflets to the staff
- Supply personal protective equipment (PPE) including disposal gloves and N95 masks to be changed every two hours for workers exposed to dust
- Ensuring sanitary stations at entrance and exit of the site
- Measure temperature of staff when they enter and exit the construction site
- Ensure social distancing of 1.5 meters
- Supply individual meals for staff
- Sanitize all construction vehicles.

3.4.2. Instructions for Noise Prevention of 2007 and the International Finance Corporation (IFC) Environmental, Health, and Safety (EHS)

Issued by MoEnv, the instructions for Noise Prevention for 2007 specify the maximum allowable level of noise for the different types of areas, both during the daytime and at night. The instructions prohibit construction activities that use noisy equipment like mixers and shakers and any other similar equipment between the hours of 8 pm and 6 am except for the cases approved by the Minister. The applicable area for this project is the "Residential Areas in Villages".

As Directive 2002/49/EC is related to the assessment and management of environmental noise, it is the main EU instrument to identify noise pollution levels and to identify the necessary action both at Member States and at EU level. Since this EU Directive does not specify noise limits, the IFC "Environmental, Health, and Safety (EHS) Guidelines: Environmental – 1.7 Noise Management" are referred to for noise limits specifications. Table 3-4 presents the maximum allowable noise levels according to both the instructions of 2007 and IFC EHS.

Table 3-4: Maximum Allowable Noise Levels in Various Areas according to the Instructions for Noise Prevention for 2007 and IFC EHS

Type of Area	Limit for Equivalent Sound Level (dBA) Column 2		IFC EHS One Hour LAeq (dBA) for 2007	
	Day	Night	Day	Night
Residential areas in cities	60	50	55	45
Residential areas in suburbs	55	45	-	-
Residential areas in villages	**50**	**40**	-	-
Residential areas that have some workshops or simple vocations or business and commercial and administrative areas and downtown	65	55	-	-
Industrial areas (heavy industries)	75	65	70	70

Tuition, worshipping and treatment places and hospitals	45	35	-	-

3.4.3. Jordanian Ambient Air Quality Standards (JS 1140/2006).

JS 1140/2006 provides definitions of ambient air pollutants and the maximum allowable concentration for each of those pollutants. The standards specify the maximum allowable limits of concentration of ambient air pollutants, beyond which, responsible parties should take action (Table 3-5). These standards also describe the methods to be used for measuring these parameters.

Table 3-5: Allowable Emission Limits for Air Pollutants (JS 1140/2006)

Pollutant	Duration	Maximum Allowable Limits	Allowable Number of Times for Exceeding Limits
SO_2	1 hour	0.135 ppm	3 times during a year
	24 hours	0.13 ppm	Once a year
	Annual	0.03 ppm	-
CO	1 hour	26 ppm	3 times a year
	8 hours	9 ppm	3 times a year
NO_2	1 hour	0.21 ppm	3 times a year
	24 hours	0.08 ppm	3 times a year
	Annual	0.05 ppm	-
H_2S	1 hour	0.030 ppm	3 times a year
	24 hours	0.01 ppm	3 times a year
O_3	8 hours	0.08 mg/kg	-
	1 hour	0.12 mg/kg	-
NH_3	24 hours	270 mg/kg	3 times a year
	Annual	8 mg/kg	-
TSP	24 hours	260 mg/m^3	3 times a year
	Annual	75 mg/m^3	-
PM10	24 hours	120 mg/m^3	3 times a year
	Annual	70 mg/m^3	-
PM2.5	24 hours	65 mg/kg	3 times a year
	Annual	15 mg/kg	-
Pb	Seasonal	1 mg/m^3	-
	Annual	0.5 mg/m^3	-
P_2O_5	24 hours	100 mg/kg	3 times a year
	Annual	40 mg/kg	-
Cd	Annual	0.005 mg/kg	-

3.5. Policies, Strategies, Plans and Programs

This section presents the national policies and strategies that are most relevant to this Project.

3.5.1. Water Sector Policy for Drought Management (2018)

The Water Sector Policy for Drought Management of 2018 was developed in response to the weak national capacity in managing drought, minimize its effects and the lack of a drought management policy and response and preparedness procedures. This policy aims at promoting an integrated management approach in order to mitigate the negative impact of drought on society, the economy, social values, the environment and natural resources including water.

3.5.2. Climate Change Policy for a Resilient Water Sector (2016)

The Climate Change Policy for a Resilient Water Sector for the year 2016 aims at responding to the climate change challenges and building resilient actions. It defines the requirements to manage the extreme scarcity of water resources in Jordan in an efficient and sustainable way and to develop resilient solutions based on Integrated Water Resources Management approaches and the SDGs.

3.5.3. Surface Water Utilization Policy (2016)

The Surface Water Utilization Policy of 2016 was developed as most of the surface water in Jordan is used for irrigation purposes while there is a need to fulfill the municipal growing water. The policy presents the different steps to achieve the maximum utilization and optimum use, protection and management of surface water. This will encompass water resources development, treated wastewater as surface water, irrigation, local and regional cooperation, role of society, monitoring, legislation and institutional considerations.

3.5.4. National Water Strategy (2016-2025)

The National Water Strategy (2016-2025) was developed by the Ministry of Water and Irrigation in order to ensure a sustainable future for the water sector in Jordan. For this purpose, the MWI is working on strengthening the planning and management of the integrated water resources with close coordination with the SDGs goals as well on the development of sector policies and legislation. The strategy covers different areas including integrated water resources management; water, sewage and sanitation services; water for irrigation, energy and other uses; institutional reform; and sector information management and monitoring. Moreover, the strategy addresses how the climate change is affecting water resources.

3.5.5. Other Policies, Strategies and Plans

Other national policies, strategies and plans are relevant to the project such as:

- The National Climate Change Adaption Policy of the Hashemite Kingdom of Jordan 2013-2020
- Environmental and Social Policy and Gender Policy (approved in November 2013; revised in 2016) / Climate Change Adaptation Fund
- JVA Strategy Plan for 2003-2008
- National Crisis and Disaster Management Strategy for Agriculture 2016 - 2025.
- Ministry of Environment Strategy 2020 - 2022
- National Strategy for Social Protection 2019 - 2025
- Water Reallocation Strategy between Governorates 2016
- National Strategy for Agricultural Development 2020-2025
- Jordan Valley Authority's Implementation Plan for the years 2018-2020
- Water Sector Capital Investment Plan 2016 – 2025.
- Aligned National Action Plan (NAP) to Combat Desertification in Jordan 2015-2020
- National Biodiversity Strategy and Action Plan 2015 - 2020.
- National Strategy and Action Plan to Combat Desertification. 2015

3.6. National EIA Process

The national EIA process in Jordan is undertaken according to flow chart presented in Figure 3-1. The process is managed by the MoEnv who issue the final environmental approval for a project and are in charge of follow up during implementation of the project to ensure adherence to the approved Environmental Management Plan and other set environmental conditions.

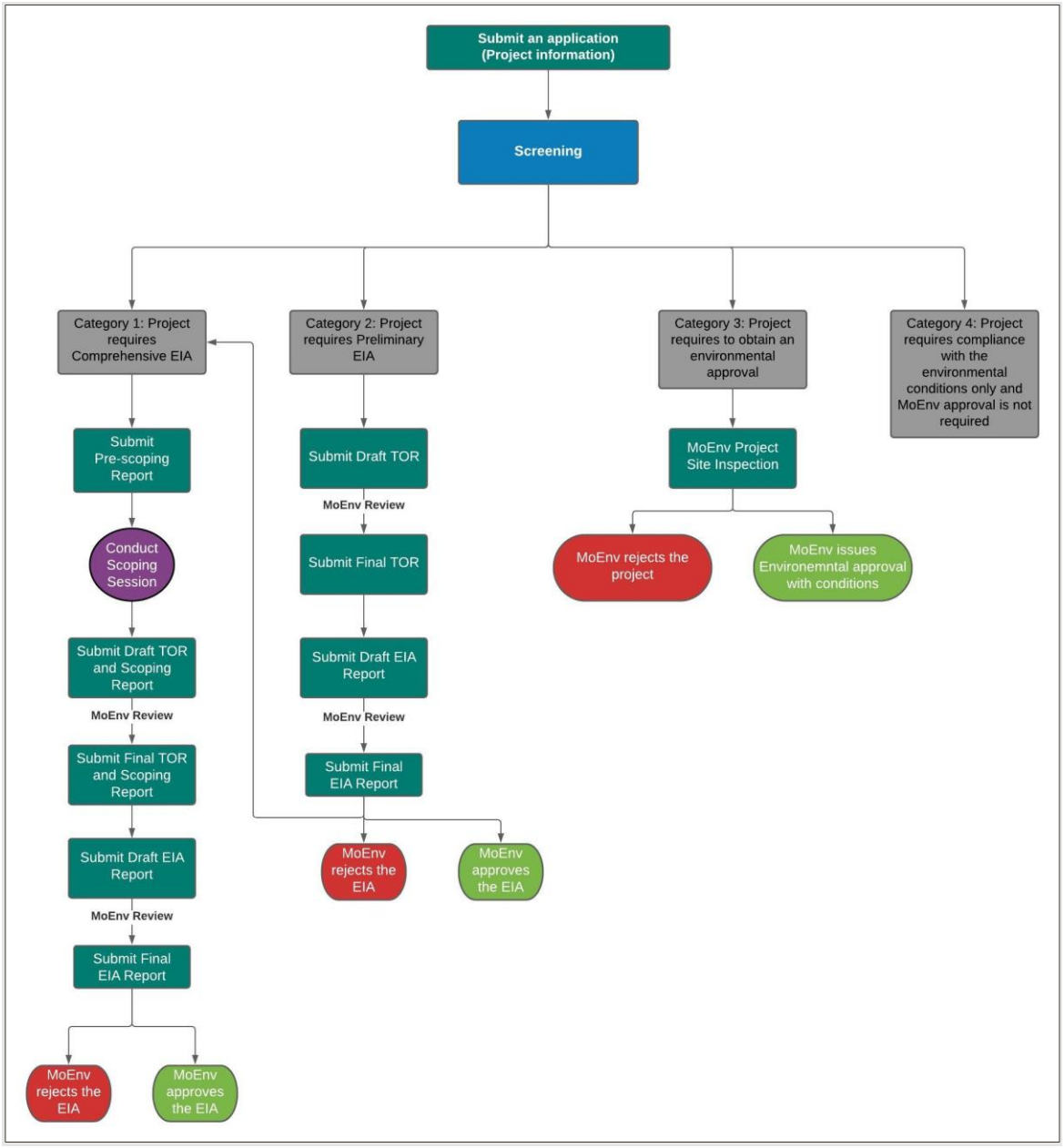


Figure 3-1: EIA Process in Jordan

4. Project Alternatives

The project alternatives to divert water from Zarqa River and convey it to the KAC-S Turnouts have been divided into three groups of alternatives. The alternatives investigated within each group have in common the quantity of water that is to be abstracted from the river and conveyed via the closed conduit. On the other hand, the alternatives investigated within each group differ according to the location of the diversion point and the conveyance scheme considered. The following discussion presents a summary of the three groups of alternatives.

4.1. Group 1 Alternatives

As mentioned earlier in the report, the farm supplied from KAC-S are supplied from the canal either by pumping or by gravity from the canal. The Group 1 alternatives divert from Zarqa River the combined irrigation demands of both the pumping-fed farms and the gravity-fed farms, at a maximum daily diversion rate of approximately 308,000 m^3/d. This volume represents the combined demand of the two types of irrigation farms: pumping-fed and gravity-fed farms. Of this total volume, the pumping-fad farms would have a demand of approximately 168,000 m3, and the gravity-fed farms would require about 140,000 m^3/d.

Four alternative diversion locations were considered under Group 1. Three of these alternatives are at Telal Al-Thahab site and one at Hwarat site. The daily demand considered under Group 1 would be supplied over a period of 22 hours per day at a rate of approximately 14,000 m^3/hr. The demand of the pumping farms would be supplied during the day, over a period of 12 hours, while the demand of the gravity farms would be supplied during the night, over a 10-hour period. The gravity farms demand would be delivered to proposed storage ponds - located in the vicinity of the turnouts - during the night in order to be released for the farms the following day.

Telal Al-Thahab diversion site is located near the existing weir as shown in the following figure. New settling basins are proposed to provide preliminary treatment diverted flow, and they will be located to the west of JVA offices. The site has been designed to accommodate two settling tanks, approximately 60m long by 20m wide, each, with a depth of approximately 4.7m to allow for a one-year sedimentation volume. As shown in the below figure, two possible locations for the intake arrangement were investigated: first one would be located approximately 120m downstream from the existing weir and the second one would be located approximately 150m upstream from the existing weir. From either of the proposed intake locations, the river flow will be intercepted and conveyed via a tunnel, 1.8m diameter, to the western side of the hill, to the settling basins.

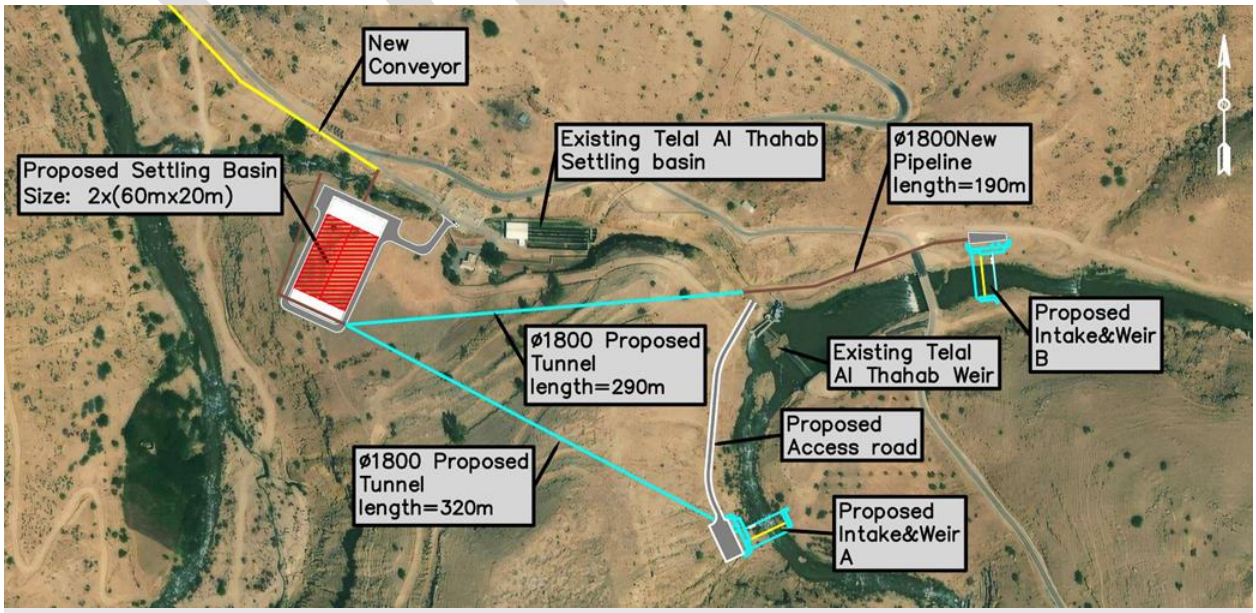


Figure 4-1: Telal Al Thahab Site Plan

The other sites investigated under Group 1 are included, for reference, in **Annex 3**. These sites were assessed in the previous stage but not pursued for the FS.

As mentioned above, the gravity flows would be conveyed during the night, over a period of 10 hours. These flows would be stored in six storage ponds located near the KAC-S turnouts to be delivered to the farms the following day.

4.2. Group 2 Alternatives

The Group 2 alternatives have been developed as alternative solutions to diverting the entire irrigation demands provided by Zarqa River in order to maintain baseflow in the Zarqa River and preserve the rich biodiversity of the River. We understand from JVA that the farms extending on both sides of the river do not use the wadi flows for irrigation, but they get their needs from the ZCs.

The biodiversity study conducted under this project concluded that the reach downstream from Telal Al-Thahab constitute aquatic and riparian habitat which are considered limited habitats in Jordan and are of particular concern. The study noted that diverting the Zarqa River water at Telal Al-Thahab will cause a drastic impact on biodiversity, most importantly in the first few kilometers downstream from Telal Al-Thahab. Accordingly, the biodiversity study recommends limiting the change to the absolute minimum, especially in the reach located around the river bend, downstream from the existing weir, and to maintain/conserve the flow and habitat given its high biodiversity value. The damage arising from a major change to biodiversity will be a grave loss of aquatic and riparian habitat which are of high biodiversity value, and this requires creating an equivalent habitat within a low land near Telal Al Thahab and ensuring sufficient inflow of fresh water, in addition to implementing an effective habitat management program and monitoring at the new site.

Under the current scope, it is not possible to quantify the minimum amount of water that should remain in the wadi to maintain its biodiversity as this requires a detailed habitat investigation including sampling, testing and modelling of habitat change due to proposed action, etc. For this purpose, the irrigation water amounts to be extracted from the River were limited for this group as well as for Group 3, as will be discussed below.

Hence, the Group 2 alternatives have been developed to allow the flow of the gravity-fed farms (approximately 140,000 m^3/d) to continue to flow in Wadi Zarqa, downstream from Telal Al-Thahab diversion points. While the flows designated for the pumping-fed farms (approximately 168,000 m^3/day) would be diverted at Telal Al-Thahab, similar to the Group 1 schemes, and conveyed downstream via a closed carrier.

Irrigation water designated for the gravity-fed farms are maintained in Wadi Zarqa at a rate of 6,000 m^3/hr until it reaches Abu Zeghan, where two alternatives are investigated: (Option A) the flows can either continue down AZ Channel and KAC-S, as the case is now; or (Option B) diverted at Abu Zeghan to be conveyed via a second closed conduit parallel to the one from Telal Al-Thahab. These alternatives are discussed in more detail in **Annex 3**.

Under Option A, the existing Abu Zeghan Channel is proposed to remain the main carrier of the gravity flows to KAC-S that is to be delivered to the gravity-fed farms via the existing turnouts 70-95 on KAC-S. Therefore, the existing AZ Channel and KAC-S will continue to operate under the current mode, but they will be delivering only the gravity flow of 140,000m^3/d to the gravity-fed farms.

4.3. Group 3 Alternatives

The Group 3 alternatives have been developed as alternative solutions to keeping the KAC-S open for conveying the gravity flows as proposed in the Group 2 schemes. Similar to Group 2, the Group 3 schemes would address the biodiversity of the Zarqa River by maintaining baseflow in the Wadi. Meetings with JVA concluded that utilizing KAC-S to convey the irrigation flows of the gravity farms requires continuous operation and maintenance of the 30km open canal, and it will not address the reduction of water losses in the canal according to the objectives of the project. To address these issues and reduce project cost, Group 3 schemes have been developed.

considering that baseflow shall be maintained in Zarqa River at all times, Group 3 has been developed to keep the entire irrigation demand of turnouts 70 to 78, a 12 km stretch, both the pumping and gravity water demands, flowing in the open channel of KAC-S, as per the current operation. The remaining demands of TO 81-95, both the pumping and gravity demands, would be diverted at Telal Al-Thahab similar to the schemes presented for Groups 1 and 2, and they would be conveyed via a closed conduit.

Under this group of alternatives, approximately 134,000 m^3/d would need to be delivered during the day, within a period of 12 hours, resulting in a design flowrate of 11,200 m^3/hr. The gravity flow would be delivered during the night over a period of approximately 7 hours at the same flowrate. The facilities to designed under Group 3 would be similar to those developed under Groups 1 and 2, except that Group 3 would have smaller size elements due to the smaller demands to be supplied by the conveyor. The conveyance scheme from Telal Al-Thahab to the turnouts would be similar in design to that presented earlier, except that the pipeline diameters would be smaller, and there would be no connections to the existing facilities feeding T.O.s 70-78.

Three storage ponds would be required under Group 3 schemes in order to store the flows conveyed during the night. They are proposed to be located on the east side of KAC-S, near T.O.s 81/82, 91/92 and 95/96.

4.4. Comparison of Alternatives

The three groups of alternatives were compared to highlight their merits and limitations such that their advantages and disadvantages are presented in tabular format below.

Group 1 Alternatives

Advantages	Disadvantages
• The irrigation water demand of all the turnouts (70 to 95) is conveyed via a closed conduit, thus maximizing reduction in water losses from the open canal.	• No or minimum baseflow is maintained in Wadi Zarqa, thus severe impact on biodiversity.
• The residual pressure in the conveyor exceeds the pumping head of the pumpstations on KAC-S, thus the pump stations can be bypassed.	• If KAC-S is closed, flood flows from Wadi Zarqa and KAC-N must be diverted to the downstream Zarqa River, ending in Jordan River.
• Canal O&M can be eliminated or reduced to minimum along the 30km KAC-S as flow is diverted away from the Canal.	• Requires six storage ponds along KAC-S to replace the storage capacity that the canal is currently providing, including possible land acquisition.
• Pre-treated irrigation water supplied to all users.	• Highest project cost among the three groups.

Group 2 Alternatives

Advantages	Disadvantages
• Addresses the environmental impact on biodiversity by maintaining a baseflow of about 140,000 m^3/d in the wadi.	• Water losses from the open canal will continue to occur because not all canal water is conveyed by the closed carrier.
• Does not require new storage ponds along KAC-S since the canal will remain open and can be used for storage.	• JVA will continue to incur O&M expenses on the 30 km long canal since it will remain open to convey the gravity flows.
• By keeping the canal open, it can accommodate flood flows from Wadi Zarqa and KAC-N.	• Pre-treated irrigation water to pumping users only
• The residual pressure in the conveyor exceeds the pumping head of the pump stations on KAC-S, thus the pump stations can be bypassed.	

Group 3 Alternatives

Advantages	Disadvantages
• Addresses the environmental impact on biodiversity by maintaining a baseflow of about 97,000 m^3/d in the wadi.	• Water losses from the canal will continue to occur because not all canal water is conveyed by the closed carrier.
• By keeping a segment of the canal open, it can accommodate flood flows from Wadi Zarqa and KAC-N.	• Not all pump stations can take advantage of the residual pressure in the conveyor. Hence, the pump stations between TO 70-78 cannot be bypassed.
• Smaller size project elements due to the reduced design flows, thus lower project cost among the three groups.	• JVA will continue to incur O&M expenses on the part of the canal which will continue to convey water, that is approximately 12km of the canal.
	• Requires three storage ponds along KAC-S reach from TO 81 to 95 to replace the storage capacity that the canal is currently providing, including possible land acquisition.
	• Pre-treated irrigation water to users after TO 78 only.

5. Methods

5.1. Defining the Area of Influence

5.1.1. General Considerations

Reference is made to the definition of the Project Area of Influence (PAI) as provided in the EIB Environmental and Social Standards, Version 10.0 dated October 2018:

'Areas, individuals and communities impacted beyond the footprint of the project or activity by cumulative impacts from further planned development of the project or other sources of similar impacts in the geographical area, any existing project or condition, and other project-related developments that can realistically be expected at the time due diligence is undertaken. In addition to the area of geographical or spatial influence, temporal influence should also be determined.'

Reference is also made to the definition of the 'Study Areas' as provided in the Guidance for Preparing Environmental Impact Assessments issued by the Jordanian Ministry of Environment in October 2014:

'Study areas should encompass the area in which impacts may occur for each technical parameter. The size of the study area may vary depending on the resource area and type of impact (direct, indirect, induced or cumulative), and should include both primary (direct impacts) and secondary (indirect or secondary impacts) study areas when appropriate.'

5.1.2. Project Area of Influence

The Project is expected to have a physical impact directly on those areas that will be used for constructing the various Project components, as described in Chapter 2 of this Report, including the social related impacts. In addition, the Project will have a direct influence on a wider area around these locations as described in the sections below.

More specifically, the Project will influence directly a strip of land adjacent to the conveyance route and associated Project facilities. The socio-economic impacts, both positive and negative, are expected to also reach a wider area beyond the project-specific one.

Physical Environment

The project will influence the physical environment including air, water and soil quality at different areas. As such, the PAI for the physical environment is defined in the following paragraphs.

Regarding air quality and noise, the construction of the conveyance pipe will directly influence adjacent residential areas and sensitive receptors, as well as the ambient air quality along the inlet and settling ponds, main conveyer and storage ponds, where construction activities including excavation and movement of heavy machinery will occur. During operation, sensitive receptors in close proximity to the pumping stations including residential area will be considered as PAI by noise during operation.

The area boundaries that are considered as the PAI relative to soil quality are the strips of lands adjacent to the main conveyor and other project facilities, which will be directly affected by construction activities. The area of the ponds is also identified as a PAI for the assessment of impacts on soil quality during both construction and operation.

During construction, water resources in wadis within the area of the conveyance pipeline may be affected along with the groundwater quality of existing wells adjacent to the entire route of the main conveyor.

Biological Environment

The project will influence the local biodiversity by introducing the following stresses:

- Construction works which are assessed to affect a corridor of about 100m for the canal/pipeline (i.e., 50m from each side of the centreline of the route) along the pipeline route, in addition to the footprint

of the planned/designed AGIs which can be defined as the total area of the land plot where each AGI will be installed.

- Water pumping operations which will result in substantial reduction in water available for the wetland ecosystem within the route between the intake and TTH1 sections. Accordingly, the area of influence will be the wadi/wetland ecosystem along the before mention sections of the project route.

Socioeconomic

Arda, Middle Shouneh and Ma'adi Municipalities in Al Balqa'a Governorate were considered as the affected communities by the Project who will mostly be impacted during construction of the Project. Project operation will also impact communities in Amman and Irbid through increased domestic water supply.

Cultural Heritage

The construction works including excavation and movement of machinery might influence cultural heritage and archaeological sites along the route of the main conveyor, as well as the location of the storage ponds and settling tanks. As such, the PAI is defined as area where excavation works will take place for all these components.

5.2. Establishing Environmental and Social Baseline

This section describes the process followed to establish the environmental and social baseline conditions for the PAI. The description has considered a variety of data and information collected and gathered from various sources, including literature review, stakeholder consultation, and site visits and investigations.

5.2.1. Physical Environment

Establishing the physical environmental baseline for the Project study area has been conducted through a combination of literature review, field investigations, site visits and interviews with relevant stakeholders. The physical baseline conditions cover the following topics:

- Topography
- Geology and Soil
- Water Resources
- Weather Parameters
- Air quality
- Noise

5.2.1.1. Review of Literature and Desktop Research

The Project topographical baseline conditions, it has been established based on available secondary data and the project technical description gathered from the project design team.

The ESIA team relied on available secondary data namely, Handbook of the Geology of Jordan, Burden (1959); Geology of Jordan, Abed (2000); Geology of Jordan, Bender (1974) and the Geology of As Salt area by S. Muneizel and B. Khalil, NRA (1993) to extract information and data for establishing the soil and geology baseline conditions for the water conveyance components.

Baseline conditions in relation to water resources (surface and groundwater) quality and quantity along the route are based on secondary and MWI data.

The ESIA team has established the meteorological data through available literature and using "meteoblue climate diagrams" which is based on 30 years of hourly weather model simulations and complimented by "climate-data organization".

5.2.1.2. Data Obtained from Stakeholders

Air quality data have been collected from MoEnv through a mobile air quality monitoring station which was placed at the municipalities of Dair Alla and at the Middle/South of Al Shuna from 29/06/2020 to 04/07/2020. The collected data includes PM10, PM2.5, NO2, SO2, CO, O3, NH3 and H2S.

5.2.1.3. Site Visits

The ESIA team has conducted several visits to the sites to observe the surrounding environment and identify any additional nearby environmentally sensitive receptors or significant environmental issues. The ESIA team has conducted additional site visits to all Project technical components and documented their observations.

5.2.2. Biological Environment

The methods implemented for the undertaking of biological environment study constituted the following:

1. Review of existing studies related to the Biodiversity in the KAC Project implementation areas. This task was handled by the biodiversity team leader with support from the GIS specialist. The undertaking of this task included:
   a. gathering and desk-top review of all related reports and documents related to KAC project from the client,
   b. preparation of GIS maps to illustrate the project layout and foot print in relation of KBAs and protected areas, and
   c. identification and listing of information gaps thus to guide the preparation of the final scope of work, the methods statement and the scoping report.
2. Evaluation of the project alignment alternatives. This task concerned the evaluation of the identified alternative alignments and options of the proposed project using the information gathered from secondary sources, from a rapid diagnosis visit, and from the GIS maps produced to illustrate the alternatives in relation to existing and proposed protected areas, KBAs (IBAs, IPAs, SCA's etc.).
3. Development of Relevant ESIA Scoping Documentation.
4. Preparation of Baseline Report. This task was handled by the entire team of four biodiversity experts, each focusing on his specific thematic area, and constituted the following activities:
   a. comprehensive review of published literature,
   b. field study based on rapid diagnosis for verification and update of data available from secondary sources to inform the scoping process and the evaluation of alternatives, in addition to detailed field surveys of the selected alignment. The survey was conducted by a team of four experts (Botany, ornithology and zoology). The field rapid diagnosis was in the form of combined drive-through and walk-over survey. The rapid diagnosis drive-through covered the entire alignment on slow-speed while the walk-over / stop-over survey was conducted at pre-selected sites with reported biological importance and/or opportunistic sites based on observation of particular habitat or species during the drive-through survey.
   c. data compilation, analysis and reporting. The compilation of data included all data gathered from primary and secondary sources, and the analysis included preparation of narrative explaining the ecological character of the study area in section-by-section basis, GIS mapping of major findings and finally preparation of terrestrial biodiversity baseline report for the project study areas.
5. Undertaking assessment of the project anticipated impacts on the scoped-in valued ecological components.

5.2.3. Socioeconomic Environment

Information about socioeconomic conditions such as demographics, economic activities, employment and poverty rates and education, health and infrastructure services in the project area were obtained from statistics published by the Department of Statistics as well relevant reports prepared by international organizations. Land use data and maps were established through a published publications by *J. Kool, Sustainable Development in the Jordan Valley, Hexagon Series on Human and Environmental Security and Peace 13,* while actual project site land use have been established through several site visits.

Field work conducted to obtain additional socioeconomic information on the communities within the PA included meetings / focus groups discussions with women and men from the three target communities (Ma'adi, Middle Shouneh and Arda) and Key Informant Interviews (KIIs) with Community Based Organization (CBO) representatives.

Cultural Resources Baseline Conditions

The followed methodology for establishment of baseline conditions related to cultural heritage complies with internationally accepted charters and guidelines such as those adopted by the International Centre for the Study of Preservation and Restoration of Cultural Property, International Council of Monuments and Sites and UNESCO and was undertaken with the following activities:

- Consulting the database of the Department of Antiquities;
- Library research;
- Determining actual and potential locations of relevant cultural heritage sites and determine those that require field verification;
- Field investigations to all relevant sites;
- Documentation and report writing.

a. Literature Review

This includes previously conducted surveys, excavation, limited studies, preliminary reports, old maps or any written document about the PAI subjected to intensive assessment and evaluation. The Archaeology and Cultural Heritage Team completed the research in national and international libraries such as Department of Antiquities of Jordan in the previous JADIS (Jordan Antiquates Database and Information system) or the more recent MEGA-Jordan (a purpose-built geographic information system (GIS) to inventory and manage archaeology sites at a national level), the Library of American School of Oriental Research, the Library of British Council for Research in Levant, the German Institute of the Holy Land and libraires at Jordanian universities.

b. Field Investigations

Based on the inventory of actual and potential sites, a systematic validation investigation conducted in principle covering the entire project area. For the sites known and/or described sufficiently, no additional work was done. For other / new sites, diagnostic cultural remains were investigated such as archaeological remains, pottery shreds, and lithic tools scattered over the surface. The architectural remains were properly evaluated and few samples were checked in field to get more accurate dating.

Main investigated sections include:

- Telal El Thahab.
- Discharge area in the Canal/near Ma'adi.
- Abu Al Zeghan area.

5.3. Evaluation of Impact Significance

This chapter describes the identified potential environmental and social impacts that may result from construction and operation of the proposed project on the physical, biological and socioeconomic environment.

The impact classification and ranking approach will be applied as follows:

1. Identification of project-related activities (during both construction and operation phases) and environmental aspects;
2. Determination of potential impacts on the natural and man-made environment that might arise from these activities;
3. Assessment and evaluation of potential impacts based on the criteria set out in Table 5-1.

Table 5-1: Impact Evaluation Criteria

Nature	B	**Beneficial:** Impacts are considered to improve the baseline condition or introduces a new desirable factor.
	A	**Adverse:** Impacts result in an adverse change of the baseline condition or lead to a new undesirable factor.

Type	D	**Direct:** Resulting impacts from a direct interaction between a project activity and the surrounding environment
	I	**Indirect:** Impacts that are generated as a result of subsequent interactions within the environment
	C	**Cumulative:** Combined impacts that act together with other impacts arising from other projects including future developments, to disturb the same environmental receptor or resource
Magnitude	L	**Low:** • Disruption of degraded areas with little conservation significance. • Simple mitigation measures may reduce the negative impacts to the extent of insignificant effects
	M	**Moderate:** • Destruction or disturbance of areas with some conservation value. • Application of mitigation measures is not simple and may not prevent impact.
	H	**High:** • Disruption of areas with high conservation value (protected area, endangered species, cultural value) or considerable impact on the nearby livelihoods • Mitigation measures are complex and may not reduce impact; compensation may be required.
Extent	L	**Local:** Restricted to the project site and/or area
	R	**Regional:** Impact affecting resources on a regional or national scale and extending beyond the project area
	G	**Global:** Impact affecting resources on a global scale and extending to transboundary settings
Duration	S	**Short-term:** Impacts that are classified by their short duration effect (less than two years)
	M	**Medium-term:** Impacts that are classified by their medium duration effect (2-10 years)
	L	**Long-term:** Impacts that are classified by their long duration effect (over 10 years)
	P	**Persistent:** Impacts that will persist in the foreseeable future
Reversibility	R	**Reversible:** Impacts on the environment may be reversible or able to be rehabilitated upon decommissioning of the proposed project
	I	**Irreversible:** Impacts on the environment may not be reversible or able to be rehabilitated upon the decommissioning of the proposed project
Likelihood	L	**Low:** An impact that is unlikely to occur under normal operating conditions
	M	**Medium:** An impact that might possibly occur
	H	**High:** An impact is likely to occur under normal operating conditions

After evaluating the potential impacts, their significance will be assessed based on the previous criteria. The different criteria in relation to the significance of the studied impact are as shown in Table 5-2.

Table 5-2: Impact Significance Evaluation

Significance	N	**Negligible** • No expected significant impacts
	L	**Low:** • No considerable adverse alteration of the existing environment • Low priority mitigation
	M	**Medium:** • Results in considerable adverse alteration of the existing environment • Impact is a priority for mitigation to minimize or prevent the significance of the impact

	H	**High:** • Results in considerable adverse alteration of the existing environment • Project cannot be safely implemented without mitigation measures; compensation or offsetting may be necessary

Impacts are classified and grouped based on the phase of occurrence, i.e. construction and operation phases and will be evaluated before and after implementation of mitigation measures.

The following is an account of the main activities of each phase that could have an impact on the environmental aspects of the study area:

1. **Construction phase: which is basically the preparations necessary for the commencement of the project which includes:**
    a. Mobilization of machineries, equipment and staff.
    b. Land acquisition.
    c. Construction activities constitutes the following:
        i. Land preparation, excavation, backfilling, reinstating and removal/disposal/management of excavated material, conventional open cut, etc.
        ii. Supply and installation of pipelines and associated fittings
        iii. Materials and stock pilling
    d. Connection to power supply
    e. Control and communications facilities
2. **Operation phase: which is the operation process including the workers' activities, which include:**
    a. Operating and maintenance of two existing pumping stations;
    b. Maintenance cleaning of the intake, conveyance pipeline, settling basins and pond;
    c. Monitoring, patrolling and surveillance.
3. **Decommissioning phase: which is a usually an unlikely scenario for a conveyance project, where a rehabilitation scenario is more likely. In such cases, activities in this phase could be similar to construction phase activities.**

6. Environmental and Social Baseline Conditions

6.1. Physical Environment

6.1.1. Topography

Jordan is bordered by Syria to the north, Iraq to the east, Saudi Arabia to the east and south, and the West Bank and Palestine to the west. The Balqa Governorate (Figure 6-1) where the project will be implemented has an area of 1,120 km^2 occupying 1.3% of the total area of Jordan.

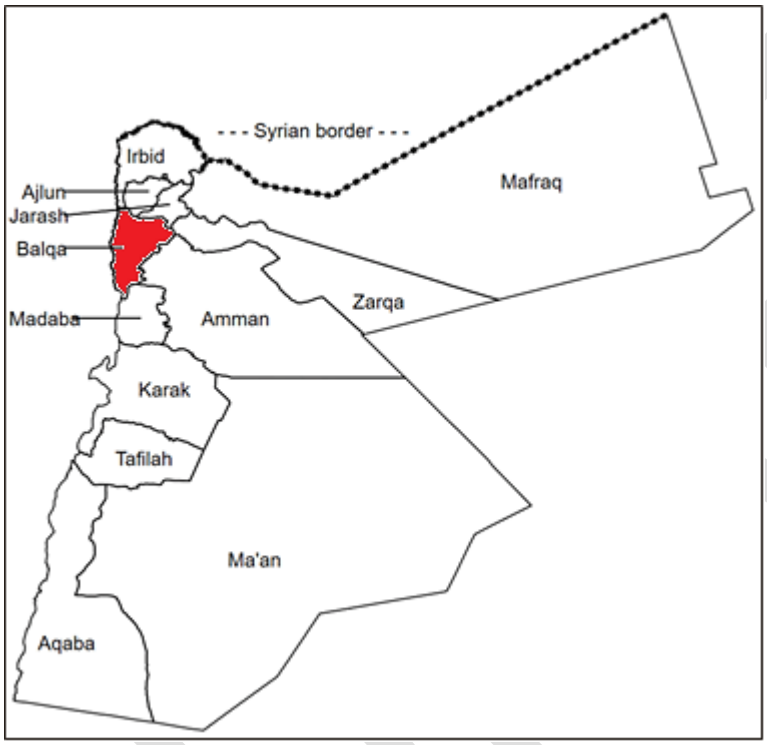


Figure 6-1: Balqa Governorate of Jordan

It includes 5 counties, 3 districts and 9 municipalities. It presents a diversity of terrains where the Ghour region reaches 224 m below sea level, and its highest mountain reaches 1,130 m (Figure 6-2). In addition, the center of this Governorate is 29 km far from the Capital Amman[1].

[1] Ministry of Interior. (2021). Governorates and Sectors. Balqa Governorate. Available at https://moi.gov.jo/EN/ListDetails/Governorates_and_Sectors/57/3 Accessed on 15/07/2021

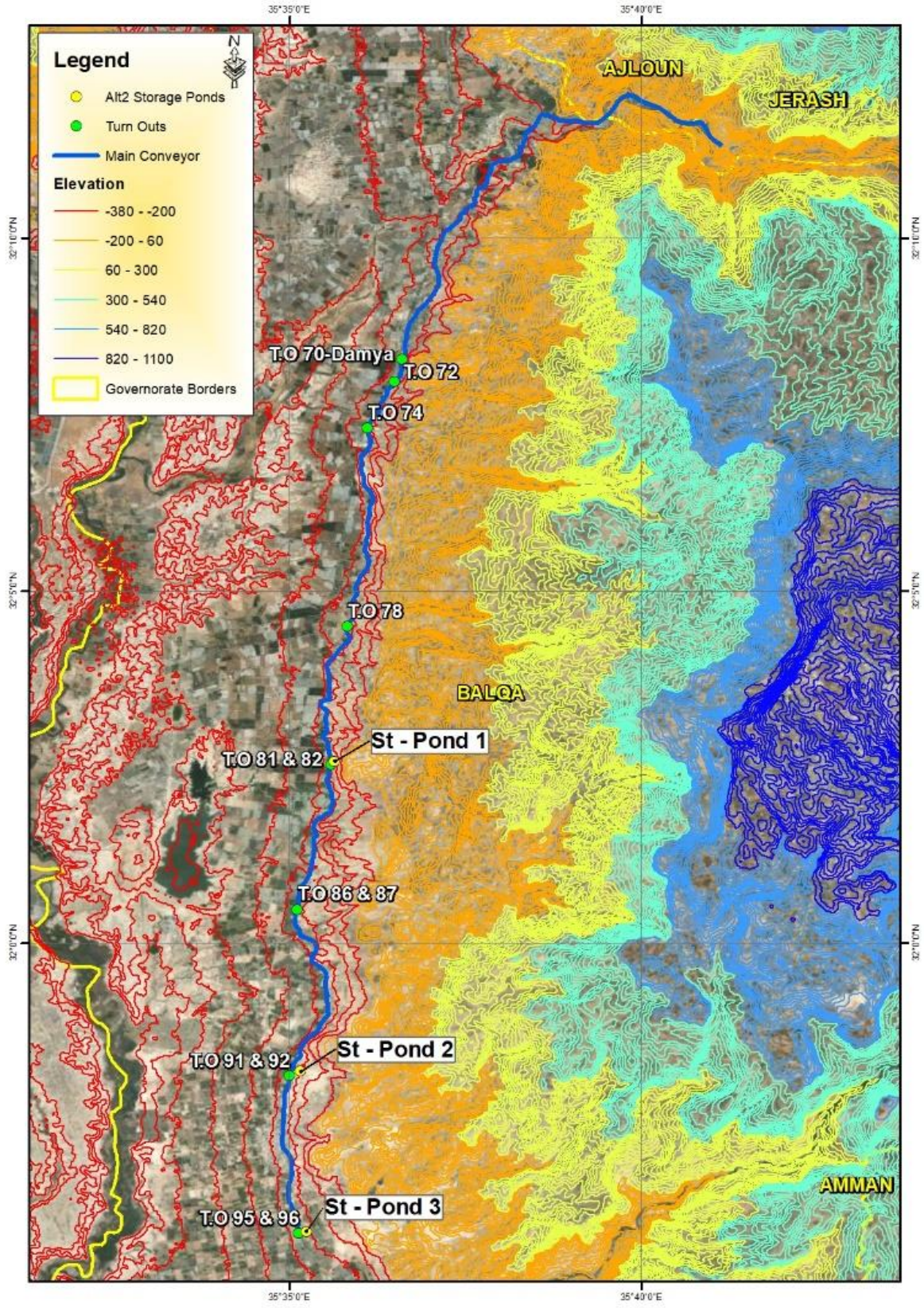


Figure 6-2: Topography of the Project area

6.1.2. Geology and Soil

Three natural regions exist in Jordan which are the Jordan Valley (Al-Ghor); the highlands (borders of the eastern edge of the Jordan Valley); and the plateau of the Syro-Arabian desert (sloping moderately to the south and east). The highlands, divided into three parts, dominate Jordan and the central portion is occupied by the Balqa Heights[2]. The western part of Jordan is where Balqa Governorate is located and bounded by Irbid, Jerash, and Ajloun governorates in the north, the River of Jordan and the Dead Sea to the west, Madaba Governorate and the Dead Sea to the south, and Amman and Zarqa governorates to the east.

The project areas of are situated to the east of the Dead Sea rift. It is dominated by predominantly Jurasic and early Cretaceous sedimentary rocks. Quaternary and Recent deposits are also present in the area. A general geologic map of scale 1:25000 is shown in Figure 6-3.

The study areas consist of the three sites Telal El Thahab, Hwarat and Abu Ez Zeighan. The general geology of the study areas shows that the rock outcrops are of sedimentary origin and consist of carbonates and siliceous rocks which belong to the Kurnub sandstone and Azab Groups of middle Jurasic to Albian Neocomian age. The bedrock is covered by quaternary and Recen deposits.

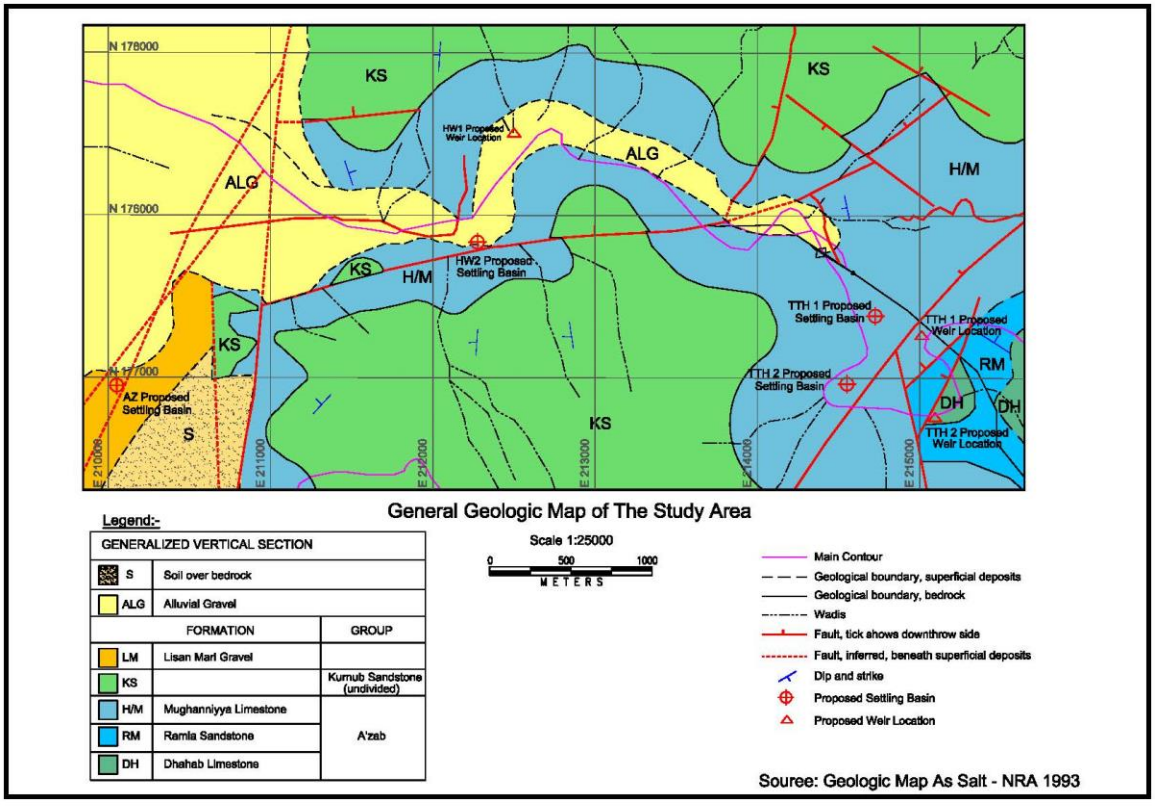


Figure 6-3: General Geologic Map

The soil map of Jordan showing the Project area are represented in Figure 6-4, whereby the main Great Groups of Aridisols Order are Camborthid and Calciorthid and those of the Entisols order are Torriorthent soils. Camborthid and Calciorthid soils are characterized by a dry moisture regime and low development of soil and are rich in calcium carbonate and/or gypsum or other salts. The development of Torriorthent soils is very weak, they are initial soils (mainly A-C horizons or no horizons). They often look like crushed bedrock and are shallow and/or rich in stones or gravel. Entisols and Aridisols dominate the semiarid-arid steppe region and the arid region. Entisols of the semiarid-arid steppe region are shallow soils occupying slopes

[2] Fanack Website. (2020). Chronicle File Jordan. Geography of Jordan. Available at https://fanack.com/jordan/geography-of-jordan/#reserves Accessed on 15/07/2021

great than 10%. Entisols in the arid regions are weakly developed soils and found on steep or eroded slopes or on some sandy areas[3].

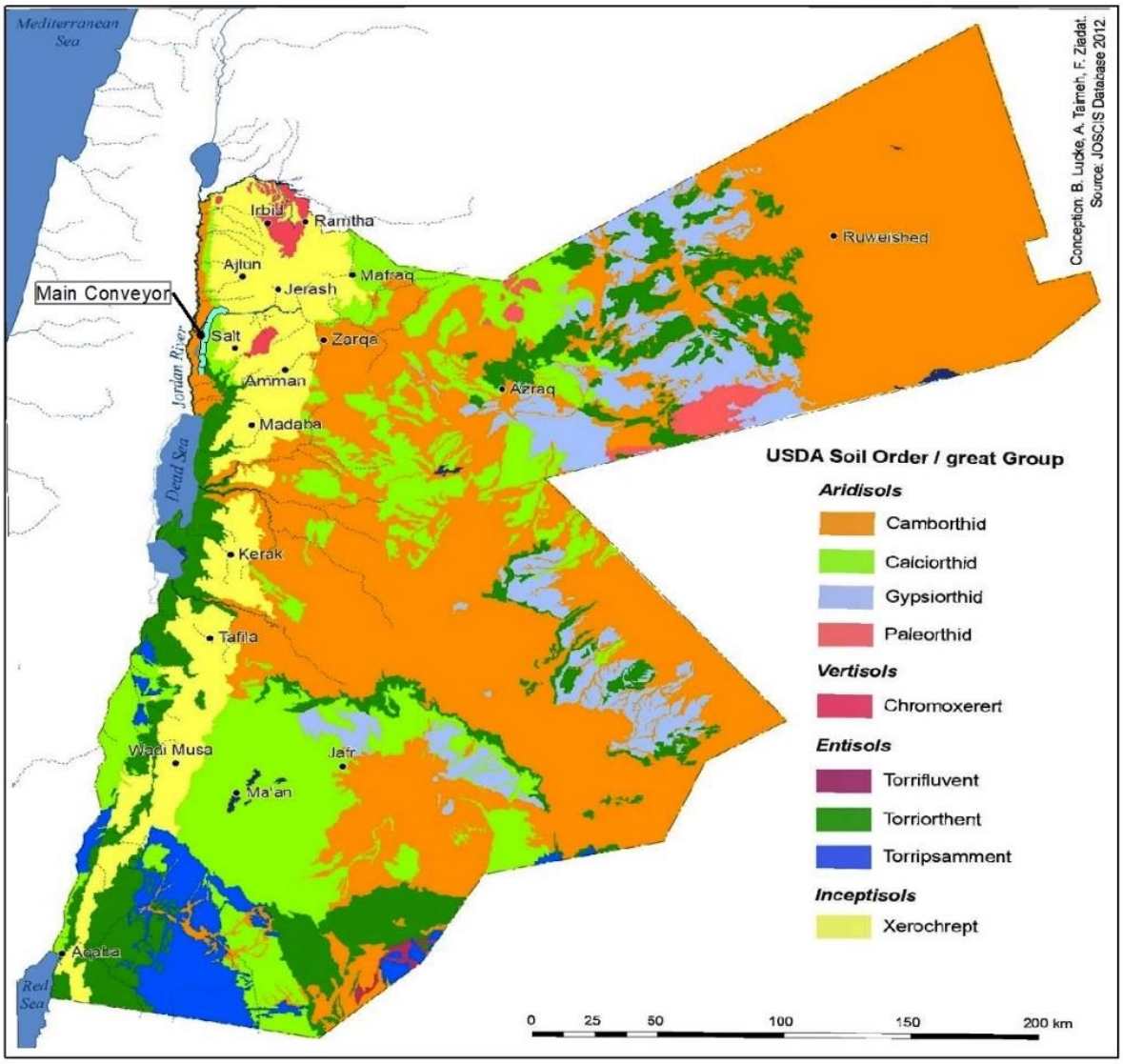


Figure 6-4: Soil Map of Jordan

6.1.3. Water Resources

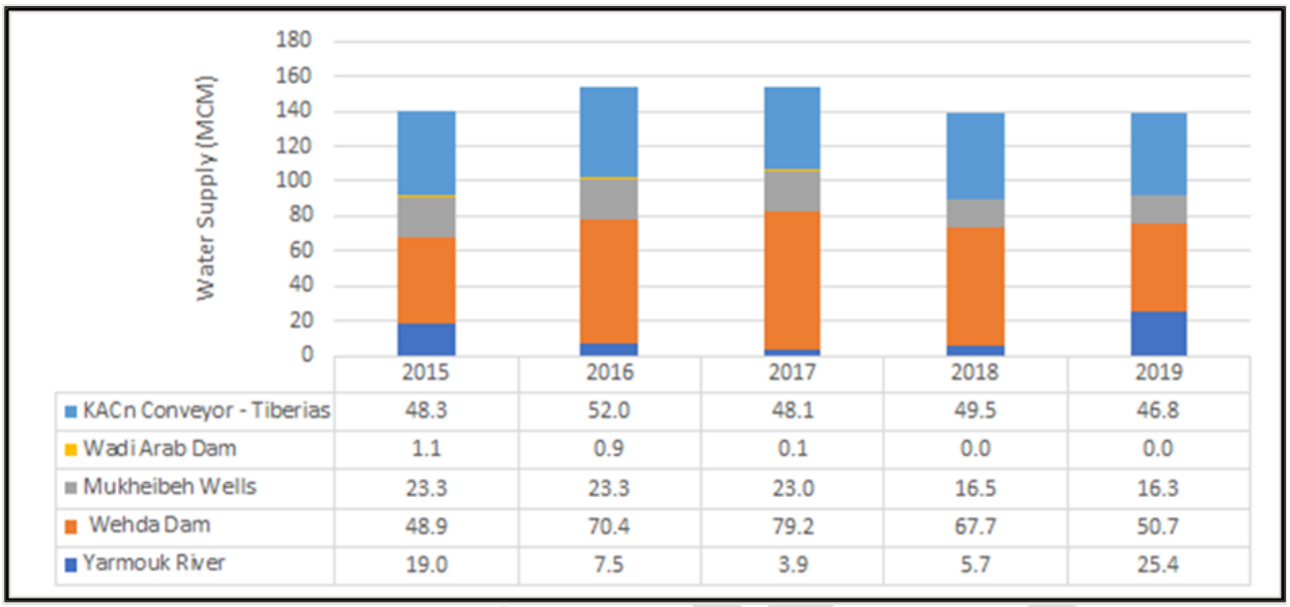
6.1.3.1. KAC Water Resources

The KAC is supplied with fresh water at its northern section (KAC-N) and with mixed water (treated effluent and wadi runoff) from King Talal Dam at its southern section (KAC-S). The annual water supply to KAC over the last five years has averaged approximately 145 MCM/year of fresh water and 68 MCM/year of mixed water.

The three main supply sources of fresh water have been Al-Wehdah Dam, Lake Tiberias and Mukheibeh wells; these sources supplied an average of approximately 63 MCM, 49 MCM and 21 MCM, respectively, over the 5-year period from 2015 to 2019. The supply of the Yarmouk River from its uncontrolled catchment

[3] Ababsa, M. (2013). Atlas of Jordan. History, Territories and Society. The Soils of Jordan. Available at https://books.openedition.org/ifpo/4867?lang=en#authors Accessed on 19/07/2021

varied from a low of 4 MCM to a high of 25 MCM, with an average of approximately 12 MCM per year during the same period. Figure 6-5 below presents the annual inflows to KAC-N during the five-year period from 2015 to 2019. The contribution of the different sources of fresh water is also presented in the graph



	2015	2016	2017	2018	2019
KACn Conveyor - Tiberias	48.3	52.0	48.1	49.5	46.8
Wadi Arab Dam	1.1	0.9	0.1	0.0	0.0
Mukheibeh Wells	23.3	23.3	23.0	16.5	16.3
Wehda Dam	48.9	70.4	79.2	67.7	50.7
Yarmouk River	19.0	7.5	3.9	5.7	25.4

Figure 6-5: Annual Water Supplies to KAC-N (2015-2019)

6.1.3.2. Groundwater

The Project is located within the Jordan Valley Group (Figure 6-6), which thickly fills the rift valley and forms the wide valley floor. This group can be divided into three main units that are from older to younger: consolidated/cemented conglomerate layers of about 100 m in thickness, conglomerates and alternating marl, sand, gravel layers of about 350 m in thickness and alternating marl, clay, chalk, silt and gypsum layer of about 300 m in thickness (Lisan Formation, JV3). The aquifer in the Jordan Valley is formed by the middle unit which is intercalated with sand and gravel layer (Sand/Gravel Aq-uifer). The specific capacity of Sand/Gravel Aquifer in the southern part of the Jordan Valley ranges from 100 to 300 m^2/day on average[4].

[4] Japan International Cooperation Agency (JICA), "The Study on Brackish Groundwater Desalinization in Jordan Valley," Yachiyo Engineering Co., Ltd, and Mitsu Min-eral Development Engineering Co., Ltd., Tokyo, 1965, 318 p

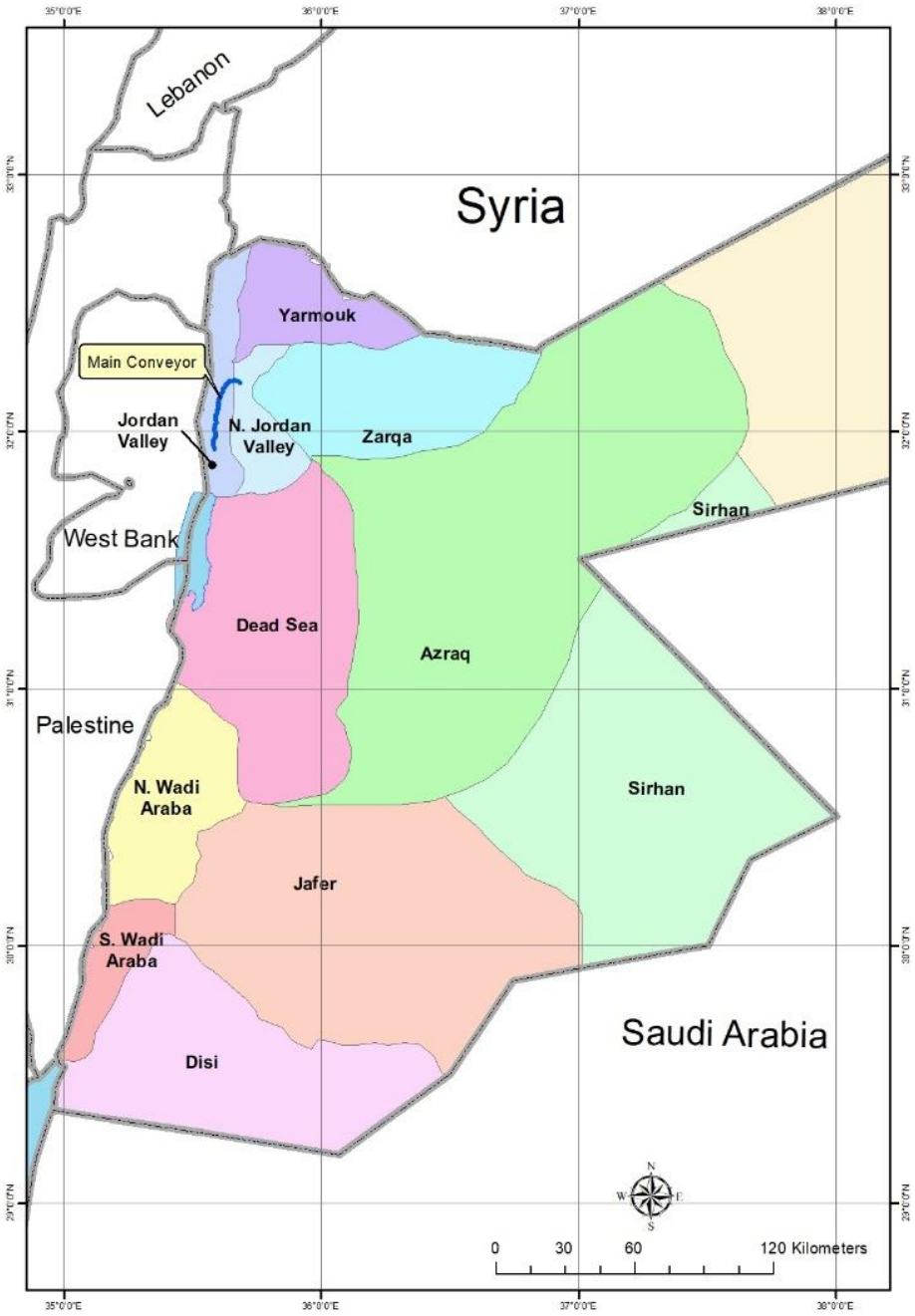


Figure 6-6: Main Groundwater Basins in Jordan

6.1.4. Weather Parameters

Due to its location between the subtropical aridity of the Arabian Desert areas and the subtropical humidity of the eastern Mediterranean area, Jordan presents a hot and dry climate with long, hot, dry summers and short cool winters. Temperature in January the coldest month of the year is from 5°C to 10°C. However, the hottest month of the year is August where temperature fluctuates from 20°C to 35°C and daily temperature can reach 40°C or more especially when the Shirocco winds blow. Precipitation in Jordan varies between season and years. Around 70% average rainfall occur between November and March while no rain falls in June, July and August. In winter, erosion and local flooding are caused by rainfall held in violent storms[5]. The

[5] The WeatherOnline Website. (2021). Jordan. Available at https://www.weatheronline.co.uk/reports/climate/Jordan.htm Accessed on 23/07/2021

historical Average temperature in Jordan is represented in Figure 6-7 and the annual average rainfall in Jordan is represented in Figure 6-8.

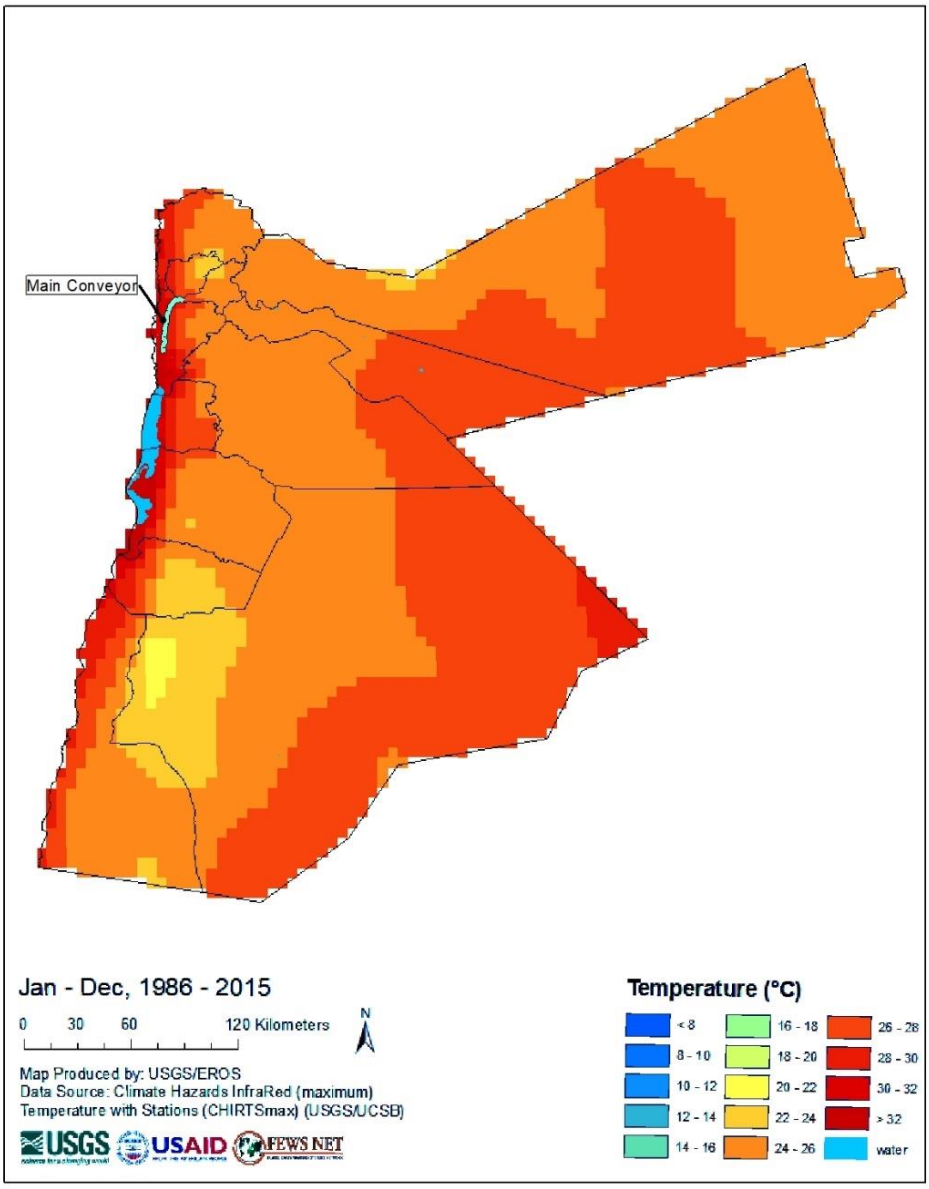


Figure 6-7: Jordan Historical Average Temperature[6]

[6] USGS/USAID. (2015). Jordan. Data Sets. CHIRTS Temperature Annual (Jan - Dec). Available at https://earlywarning.usgs.gov/fews/product/705 Accessed on 26/07/2021

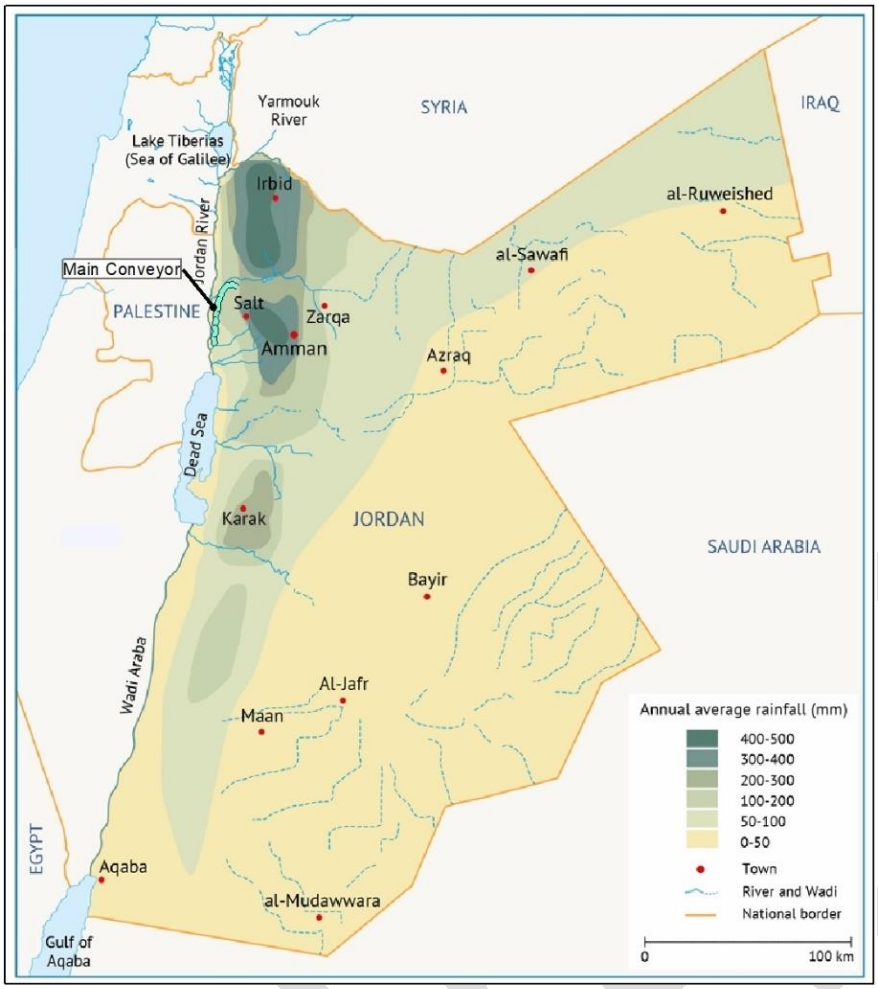


Figure 6-8: Annual Average Precipitation (mm) in Jordan[7]

The Balqa Governorate, where the project is located, presents climate and terrains diversity. The high regions are characterized by a rainy and cold climate in winter and a moderate one in summer[8]. This Governorate falls in the area of semi-arid or the Mediterranean climate with precipitation between 300 mm and 600 mm. Winter is the rainy season and the months from June to September represent the dry season.[9].

Figure 6-9 presents the precipitation and the monthly average of maximum and minimum daily temperatures in Dair Alla town located near the project area. The highest maximum average temperature occurs in July and August with 37°C while the lowest occurs in January with 19°C. Moreover, the highest minimum average temperature occurs in July and August with 23°C while the lowest occur in January and February with 10°C. The annual precipitation is 178 mm.

[7] Fanack Website. (2021). Jordan. Geography, Climate, and Population. Available at https://water.fanack.com/jordan/geography-climate-population/ Accessed on 26/07/2021
[8] Ministry of Interior. (2021). Governorates and Sectors. Balqa Governorate. Available at https://moi.gov.jo/EN/ListDetails/Governorates_and_Sectors/57/3 Accessed on 15/07/2021
[9] JICA. (2014). Preparatory Survey Report On The Project For The Improvement And Expansion Of Water Distribution Network In Balqa In The Hashemite Kingdom Of Jordan. Japan International Cooperation Agency. Available at https://openjicareport.jica.go.jp/pdf/12150447.pdf accessed on 23/07/2021

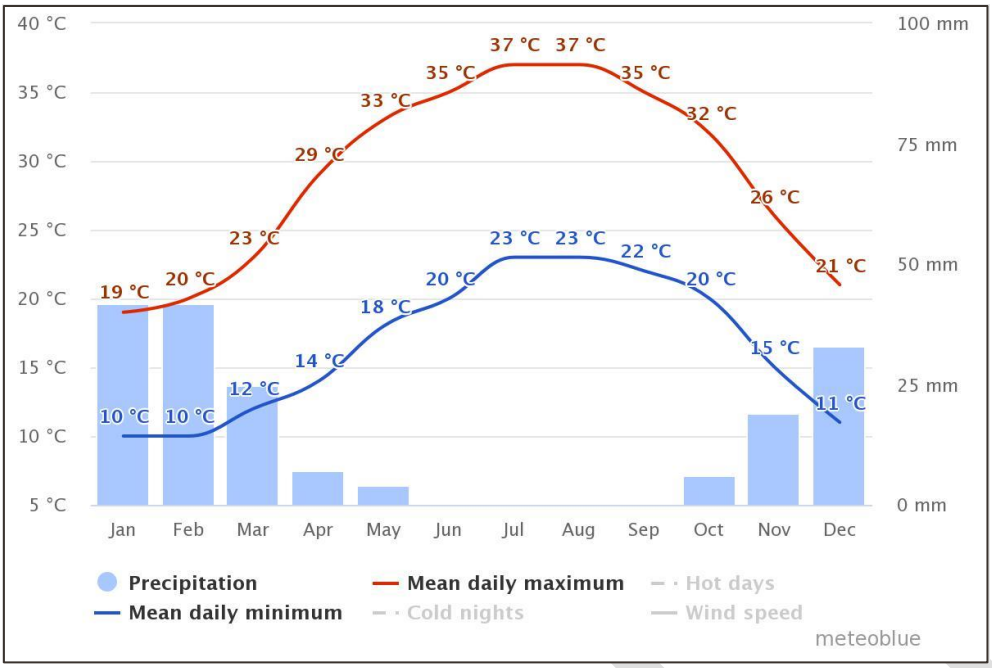


Figure 6-9: Precipitation and Monthly Average of Maximum and Minimum Daily Temperatures in Dair Alla – Balqa Governorate

The wind rose presented in Figure 6-10 shows that wind is predominantly westerly[10].

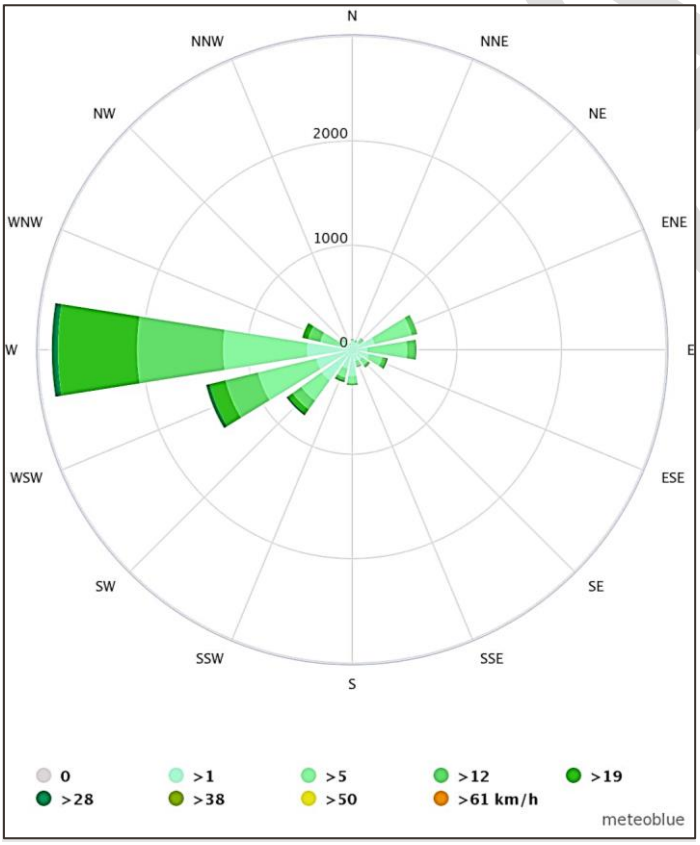


Figure 6-10: Wind Rose of Dair Alla – Balqa Governorate

[10] Meteoblue Website. (2021). Climate Dayr ' Alla. Available at https://www.meteoblue.com/en/weather/historyclimate/climatemodelled/dayr-%e2%80%98all%c4%81_jordan_249693 Accessed on 26/07/2021

6.1.5. Air Quality

The MoEnv is operating a mobile air quality monitoring laboratory to monitor ambient air quality in various locations in Jordan. Air quality data that are relevant to the Project was from the municipalities of Dair Alla and at the Middle/South of Al Shuna. The mobile lab and Project locations are shown in Figure 6-11. The monitored parameters of ambient air in these locations are PM10, PM2.5, NO_2, SO_2, CO, O_3, NH_3 and H_2S.

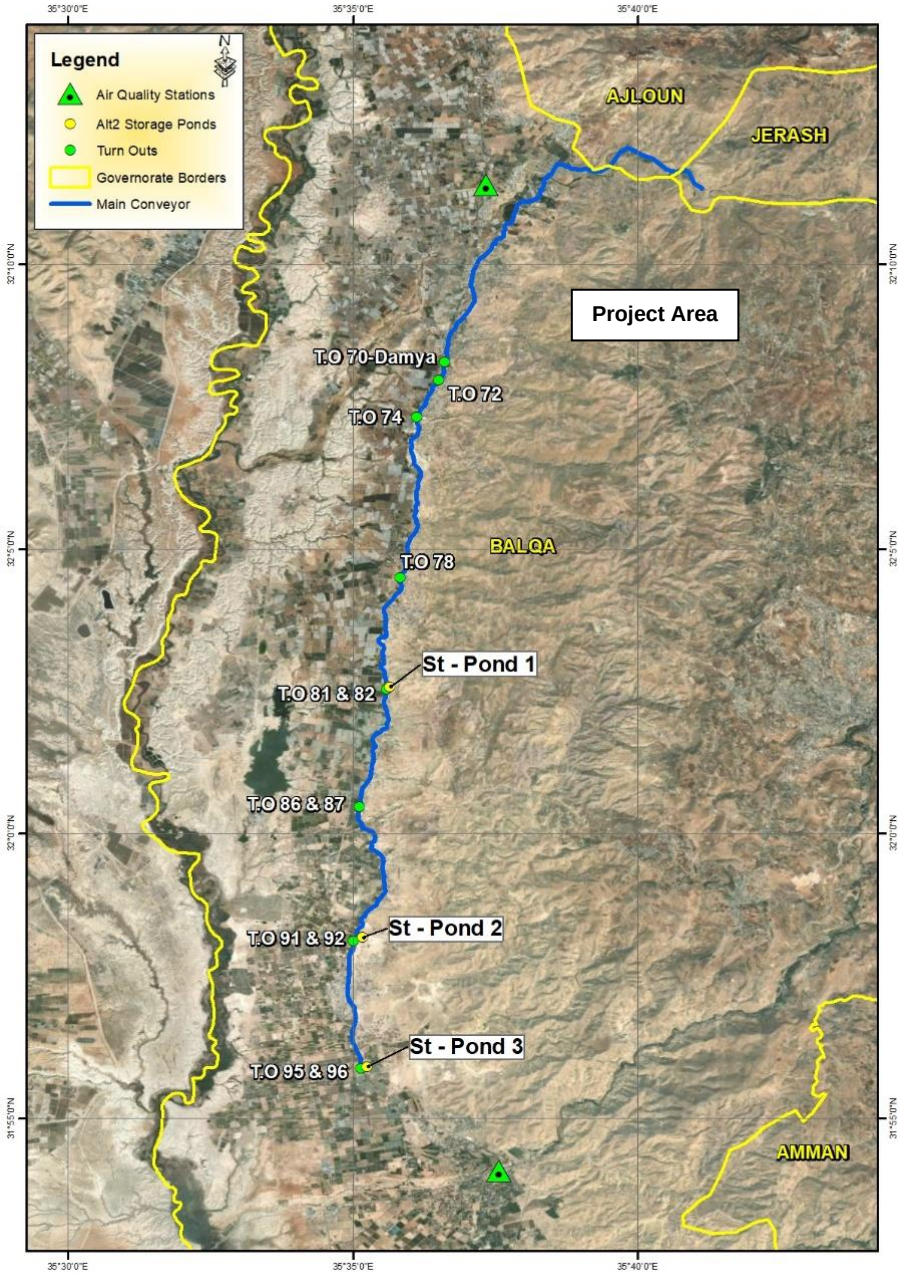


Figure 6-11: Air Quality Monitoring in Dair Alla (North) and El Shuna (South) Municipalities in reference to the Project Location

The ambient air quality at Dair Alla (Coordinates 32.189893, 35.622328) was measured from 29/06/2020 to 04/07/2020. The results are provided in Table 6-1 showing that all the measured parameters were within the maximum allowable emission limits for ambient air pollutants (JS 1140/2006).

Table 6-1: Ambient air Quality monitored at Dair Alla Municipality

Time	PM10 (µg/m³)	PM2.5 (µg/m³)	NO_2 (ppb)	SO_2 (ppb)	CO (ppb)	O_3 (ppb)	H_2S (ppb)	NH_3 (µg/m³)
JS 1140/2006	120	65	80	140	9,000	80	10	270
29/06/2020	60	20	8.6	35.3	1,188	40	0.4	16.5
30/06/2020	54	17	10.1	49.3	1,185	38.3	0.4	13.6
1/07/2020	54	14	8.8	50.8	1,160	38.4	0.4	14.7
2/07/2020	54	17	8.7	50.5	1,197	40.8	0.3	14.2
3/07/2020	57	16	7.6	53.4	1,194	40.2	0.4	16.9
4/07/2020	52	17	10.1	58.6	1,240	36.5	0.4	16.1

The ambient air quality in El Shuna (Coordinates 31.901263; 35.626040) was measured from 22/06/2020 to 27/06/2020. The results are provided in Table 6-2 below and show that all the measured parameters were within the maximum allowable emission limits for air pollutants (JS 1140/2006) except for H_2S.

Table 6-2: Ambient air Quality monitored at El Shuna Municipality

Time	PM10 (µg/m³)	PM2.5 (µg/m³)	NO_2 (ppb)	SO_2 (ppb)	CO (ppb)	O_3 (ppb)	H_2S (ppb)	NH_3 (µg/m³)
JS 1140/2006	120	65	80	140	9,000	80	10	270
22/06/2020	67	18	7.2	21	1,212	40.7	18	8.9
23/06/2020	54	14	6.1	16.3	1,147	39.7	21.1	7.4
24/06/2020	45	10	4.2	14.3	1,133	40.3	21	9.7
25/06/2020	44	10	4	14	1,165	38.2	21.2	8.5
26/06/2020	37	12	3.3	12.8	1,190	39.3	21.2	9.6
27/06/2020	55	18	6.9	14.2	1,227	40.6	21.3	11.8

6.1.6. Noise

Existing pumping stations and current traffic movement at the primary roads in the vicinity of the project area, can be considered as main noise sources. No noise monitoring data is available within the PAI.

6.2. Biological Environment

6.2.1. Biogeography of the Study Site

The north-eastern parts of the project site are within the Mediterranean zone and penetrate around 6 km into the arid Mediterranean overlooking the Jordan Valley. Although it is part of the arid Mediterranean, no natural forests are within the vicinity of the site. The majority of the project is within the Irano-Turanian region and extends along the narrow strip of this zone in the Jordan Valley as shown in Figure 6-12. The Irano-Turanian region is represented by a narrow strip that surrounds the Mediterranean ecozone except in the far north. It

extends to the north-east, joining the Syrian Desert. The vegetation is dominated by *Anabasis articulata, Artemesia herba-alba, Astragulus spinosum, Retama raetam*, *Urginea maritima, Ziziphus lotus,* and *Zygophyllum dumosum.* The altitude ranges from 400 to 700 m a.s.l, with average annual rainfall of 50-100 mm. The surface soil is a very thin layer or absent in some instances and the surface rockiness is very high.

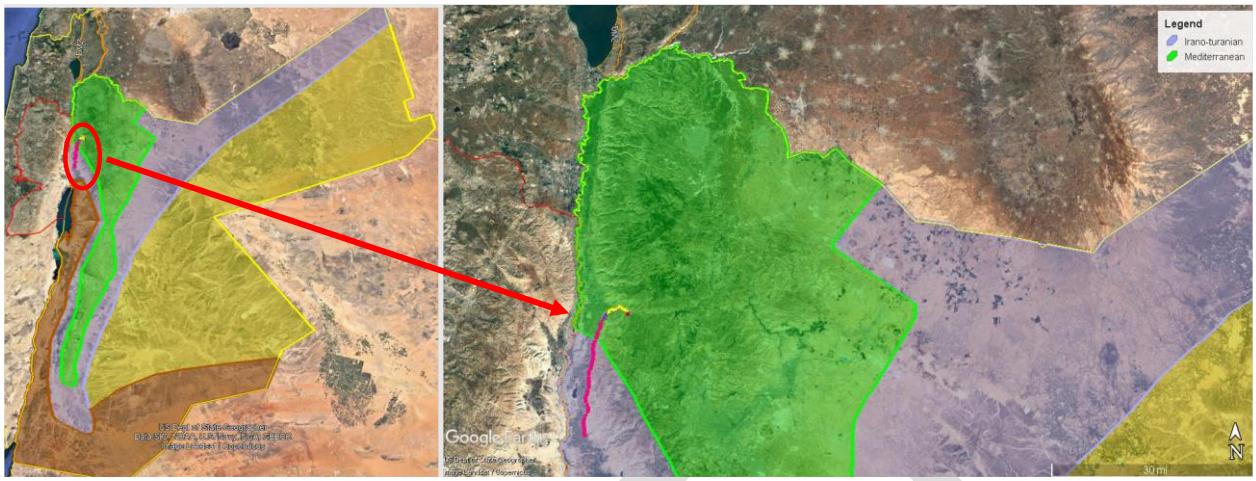


Figure 6-12: Biogeographical Regions within in the Study Site

6.2.2. Vegetation Types

Two types of vegetation communities are present within the study site; one within the Mediterranean zone and dominated by mixed steppe and Saharo-Arabian vegetation, and a second that extends along the Irano-Turanian zone and consists of *Ziziphus spina christi* and *Balanites aegyptiaca* formation (Figure 6-13).

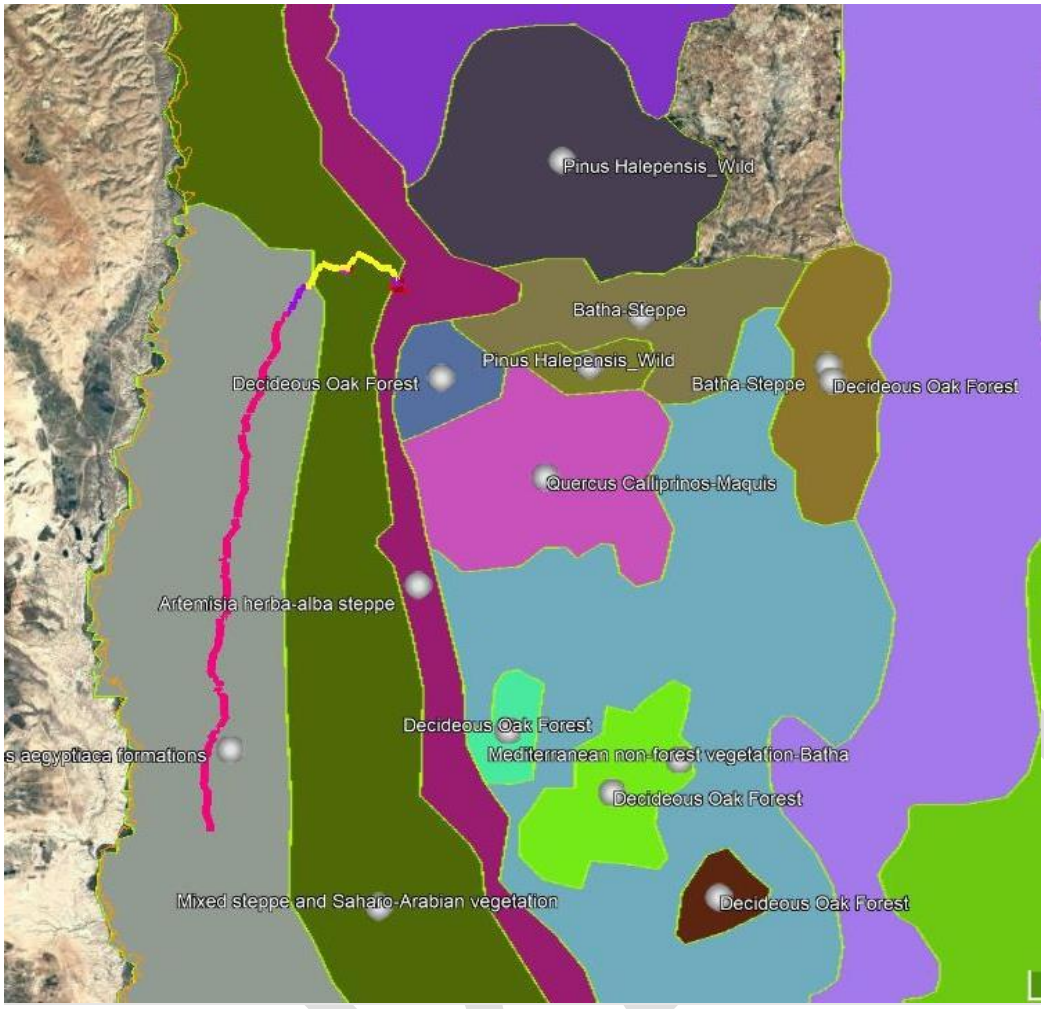


Figure 6-13: Vegetation Types within the Project Area

6.2.3. Mammals

Very little is known about the mammalian fauna of the Project area. However, records from nearby areas may be considered[11] [12] [13]. At least 23 species of mammals belonging to four orders can be found in the study area; including two shrews, two hedgehogs, eight bats, six rodents and five carnivores (Table 6-3). Most of these species are considered of Least Concern both globally and locally. However, the wolf and the striped hyaena are listed as Endangered locally and the striped hyaena as Near Threatened globally. The marbled polecat is considered Vulnerable globally while the Egyptian fruit bat is locally listed as Near Threatened.

Table 6-3: List of Mammals Expected to Occur in the Project Area and their Conservation Status

Order	Scientific Name	Common Name	IUCN Global Status	IUCN Local Status
Eulipotyphla	*Crocidura suaveolens*	The lesser white-toothed shrew	LC	LC
	Erinaceus concolor	Eastern European hedgehog	LC	LC

[11] Jordanian Mammals Acquired by Jordan University Natural History Museum. — Publications of the University of Jordan, Amman
[12] Benda, P., Lučan, R. K., Obuch, J., Reiter, A., Andreas, M., Bačkor, P., Bohnenstengel, T., Eid, E.K., Ševčík, M., Vallo, P. & Amr, Z.S. 2010. Bats (Mammalia: Chiroptera) of the Eastern Mediterranean and Middle East. Part 8. Bats of Jordan: fauna, ecology, echolocation, ectoparasites. Acta Societas Zoologicae Bohemicae, 74:185–353
[13] Eid, E., Abu Baker, M. & Amr, Z. 2020. National Red data book of mammals in Jordan. Amman, Jordan: IUCN Regional Office for West Asia Amman

Order	Scientific Name	Common Name	IUCN Global Status	IUCN Local Status
	Hemiechinus auritus	The long-eared hedgehog	LC	LC
	Suncus etruscus	Pygmy white-toothed shrew	LC	LC
Chiroptera	*Eptesicus bottae*	Botta's serotine	LC	LC
	Pipistrellus kuhli	Kuhl's pipistrelle	LC	LC
	Pipistrellus pipistrellus	Common pipistrelle	LC	LC
	Rhinolophus hipposideros	The lesser horseshoe bat	LC	LC
	Rhinolophus blasii	Blasius's horseshoe bat	LC	LC
	Rhinopoma cystops	Lesser mouse-tailed bat	LC	LC
	Rousettus aegyptiacus	Egyptian fruit bat	LC	NT
	Tadarida teniotis	European free-tailed bat	LC	LC
Rodentia	*Acomys dimidiatus*	The Eastern spiny mouse	LC	LC
	Cricetulus migratorius	Gray hamster	LC	LC
	Dipodillus dasyurus.	Wagner's gerbil	LC	LC
	Hystrix indica.	Indian crested porcupine	LC	VU
	Meriones tristrami	Tristram's jird	LC	LC
	Spalax ehrenbergi	Palestine mole rat	LC	LC
Carnivora	*Vulpes vulpes*	Red Fox	LC	LC
	Canis lupus	Wolf	LC	EN
	Hyaena hyaena	Striped hyaena	NT	EN
	Meles meles	Eurasian badger	LC	VU
	Vormela peregusna	Marbled polecat	VU	LC

LC: Least concern, EN: Endangered, NT: Near threatened, VU: Vulnerable

6.2.4. Reptiles and Amphibians

At least 31 species within 15 families of reptiles are expected to occur in the Project area (Table 6-4). They include one agamid, four geckos, two lizards, five scincids, one chameleon, 16 species of snakes in seven families, and two species of turtles; one freshwater and one terrestrial. The Mediterranean Spur-thighed Tortoise occurs within the Mediterranean section of the study area, while the Western Caspian Turtle may well occur along with the waterbodies extending from King Talal Dam. None of these reptiles is listed under the global and the IUCN Redlists. It worth mentioning in this context that several venomous snakes are known to occur along the Jordan Valley, including the study site. These snakes can inflict fatal bites.

Table 6-4: List of reptiles expected to occur in the study area and their conservation status

Family	Scientific Name	Common Name	IUCN Global Status	IUCN Regional Status
Testudinidae	*Testudo graeca*	Mediterranean Spur-thighed Tortoise	VU	VU
Geoemydidae	*Mauremys rivulata*	Western Caspian turtle	LC	LC
Agamidae	*Stellagama stellio*	Starred agama	LC	LC

Family	Scientific Name	Common Name	IUCN Global Status	IUCN Regional Status
Gekkonidae	*Mediodactylus kotschyi*	Kotschy's gecko	LC	LC
	Hemidactylus dawudazraqi	David's gecko	LC	LC
	Stenodactylus sthenodactylus	Elegant gecko	LC	LC
Phyllodactylidae	*Ptyodactylus puiseuxi*	Northern fan-footed gecko	LC	LC
Lacertidae	*Mesalina guttulata*	The small spotted lizard	LC	LC
	Ophisops elegans	Snake-eyed lizard	LC	LC
Scincidae	*Chalcides güntheri*	Gunther's skink	VU	VU
	Chalcides ocellatus	Ocellated skink	LC	LC
	Eumeces schneideri	Gold skink	LC	LC
	Trachylepis vittata	Bridled skink.	LC	LC
	Ophiomorus latastii	Striped legless skink	DD	VU
Chamaeleonidae	*Chamaeleo chamaeleon*	European chameleon	LC	LC
Typhlopidae	*Rhinotyphlops simoni*	Simon's blind snake	LC	LC
Leptotyphlopidae	*Myriopholis macrorhyncha*	Hook-snouted worm snake	LC	LC
Boidae	*Eryx jaculus*	The Javelin sand-boa	LC	LC
Colubridae	*Dolichophis jugularis*	Syrian blacksnake	LC	LC
	Eirenis rothi	Roth's dwarf snake	LC	LC
	Hemorrhois nummifer	Coin snake	LC	LC
	Malpolon insignitus	Montpellier snake	LC	LC
	Natrix tessellata	Dice snake	LC	LC
	Platyceps collaris	Red whip snake	LC	LC
	Rhynchocalamus melanocephalus	Black-headed dwarf snake	LC	LC
	Telescopus dhara	North-African cat snake	LC	LC
Atractaspididae	*Atractaspis engaddensis*	Palestinian mole viper	LC	LC
	Micrelaps muelleri	Mueller's ground viper	LC	LC
Elapidae	*Walterinnesia aegyptia*	Desert black snake	LC	LC
Viperidae	*Daboia palaestinae*	Palestine viper	LC	LC
	Echis coloratus	Arabian saw-scaled viper	LC	LC

Three species of amphibians are expected to occur along the watercourse from King Talal Dam down to Dair Alla area (Table 6-5). All these species are listed as Least Concern both globally and regionally.

Table 6-5: List of amphibians expected to occur in the study area and their conservation status

Family	Scientific Name	Common Name	IUCN Global Status	IUCN Regional Status
Bufonidae	*Bufotes sitibundus*	Variable toad	LC	LC

Family	Scientific Name	Common Name	IUCN Global Status	IUCN Regional Status
Hylidae	*Hyla felixarabica*	Tree frog	LC	LC
Ranidae	*Pelophylax bedriagae*	Levant water frog	LC	LC

6.2.5. Freshwater Fish

Five species of common freshwater fish are present in the King Talal-Zarqa River drainage system (Table 6-6, Figure 6-14). Further sampling is required to validate the presence of these species and their relative abundance.

Table 6-6: List of Freshwater Fish Expected to Occur in the Project Area

Family	Species	Status
Cyprinidae	*Capoeta damascina*	Common
	Garra rufa	Common
	Barbus canis	Common
	Barbus longiceps	Common
Cichlidae	*Tilapia zillii*	Common

Figure 6-14: Tal Al Thahab Extension to the Jordan Valley

6.2.6. Findings of the Field Activity

An all-day visit was conducted by the biodiversity team along the water course of the Zarqa River to identify the current state of biodiversity and assess potential impacts that construction of the intake and diversion structure, as well as replacement of open running water with closed pipelines may have on the sites. The

team started at the existing Telal Al Thahab system, which currently diverts water from the wadi to an irrigation system in the middle and north Ghors and continued along the existing road and Zarqa River with frequent stops and walkabouts made within the proposed diversion stations (Figure 6-15).

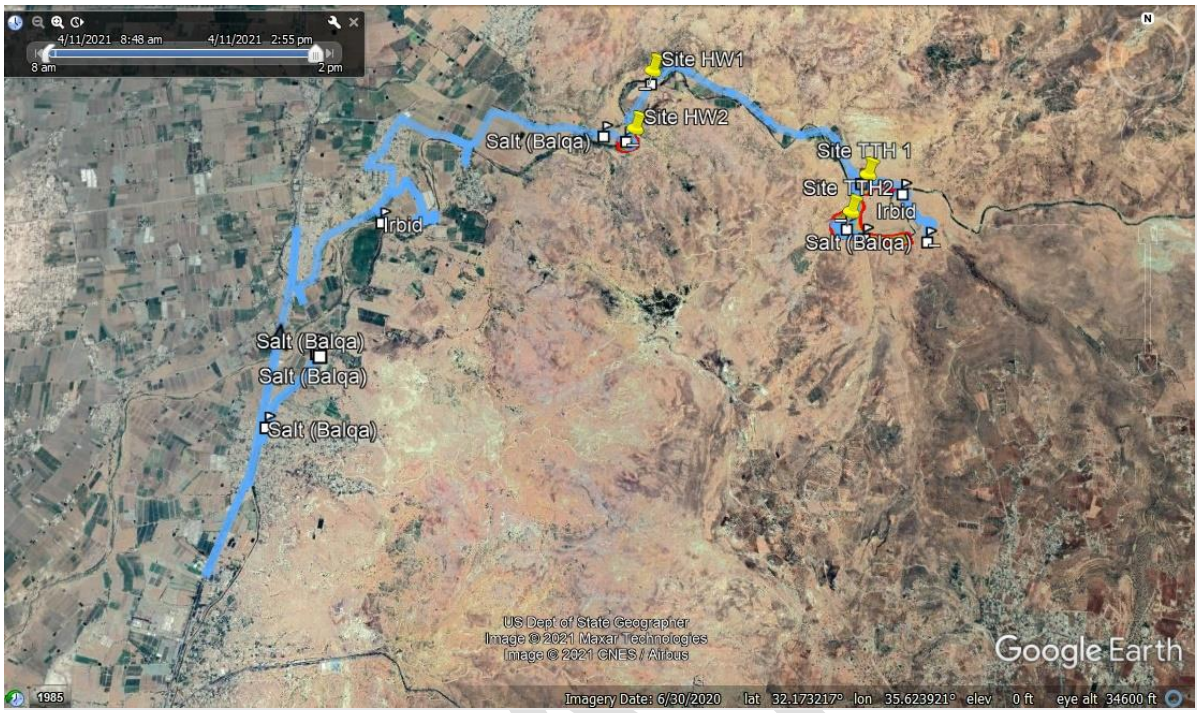


Figure 6-15: The Route and Stops Made by the Biodiversity Team

6.2.6.1. Telal Al Thahab (Site TTH1)

This is a small site near the road. It is the closest to the existing Telal Al Thahab intake and diversion system. It provides a good area for most of the freshwater fauna such as frogs, crabs, and aquatic insects such as dragonflies. The site is close to the road and is frequently used for local tourism and picnicking within its vicinity due to its accessibility.

The site is of low to moderate importance for biodiversity as it is flushed by fast running water that overflows from the existing intake and diversion site, making it unsuitable as a breeding site for frogs and aquatic insects. Its proximity to the road and picnicking by locals already imposes impacts on local biodiversity.

Figure 6-16: Running Water at Telal Al Thahab (TTH1) Site Near the Existing Intake and Diversion System

6.2.6.2. Telal Al Thahab (Site TTH2)

This site has a wide, secluded area, sheltered between the hills. It is the furthest away site from the road and exhibits the least human intervention. The site is a freshwater ecosystem that harbors typical freshwater fauna and provides a natural breeding habitat for the water snake (*Natrix tessellata*), at least two species of frogs (*Hyla felixarabica* and *Pelophylax bedriagae*), several aquatic insects such as dragon flies Odonata, and other freshwater invertebrates. It also provides a hunting ground for several species of insectivorous bats that feed of insects in the area (Figure 6-17).

Figure 6-17: Location and Freshwater Habitat in the Telal Al Thahab TTH2 site.

The site is surrounded by rocky cliffs and slopes that are inhabited by several rodents and small mammals that inhabit non-forest Mediterranean slopes. This includes the spiny mouse (*Acomys dimidiatus*), the mole rat (*Spalax ehrenbergi)*, and other field mice such as *Meriones tristrami*, *Gerbillus dasyurus and Cricetulus*

migratorius. These are typical prey for raptors (long-legged buzzard), owls, and small carnivores (red fox) in the area. The site is also suitable for the largest rodent in Jordan, the porcupine (*Hystrix indica)*.

The site is of high value as it provides the only site in the region where several habitat-restricted species are found. The water-snake (*Natrix tessellate)* is restricted to the limited freshwater habitats in Jordan. Its population in Jordan is decreasing and is threatened by desertification, water extraction, and the drying up of many springs. This is causing the extirpation and eradication of many populations of amphibians and water dwelling reptiles[14] [15]. The site has typical natural and native freshwater vegetation where frogs, snakes, and aquatic insects take shelter.

During the site visit, the team recorded the Levantine freshwater crab (*Potamon potamios)*, which is considered Near Threatened according to the IUCN Red List of threatened species[16]. *Potamon potamios* is a semi-terrestrial crab occurring around the eastern Mediterranean region. Its populations are declining globally due to human impacts and the decrease of freshwater habitats. Generally, the presence of freshwater crustaceans such as crabs may provide a reliable indicator of water quality and suitability of freshwater habitat for aquatic life. Additionally, *Calopteryx syriaca* was also observed in the area. This species is restricted to clear running water and is very sensitive to pollution and manipulation of water courses for irrigation schemes[17]. Figure 6-18 shows photos taken of the species observed at TTH2 site.

[14] Amr Z. S., Mebert K., Hamidan N., Abu Baker M., and Disi A. 2011. Ecology and conservation of the Dice Snake, Natrix tessellata in Jordan. Mertensiella, 18, 393–400.
[15] Disi, A.M., Amr, Z.S. and Hamidan, N. 2014. Diversity, threats, and conservation of the terrestrial and freshwater herpetofauna of Jordan. Russian Journal of Herpetology, 21(3): 221-233.
[16] Cumberlidge, N. 2008. Potamon potamios. The IUCN Red List of Threatened Species 2008: e.T135117A4061032. https://dx.doi.org/10.2305/IUCN.UK.2008.RLTS.T135117A4061032.en
[17] Katbeh-Bader A., Amr, Z.S., Abu Baker, M. & Mahasneh, A. (2004): The dragonflies (Insecta: Odonata) of Jordan. Denisia, 14: 309-317.

Figure 6-18: Species observed at Telal Al Thahab Site (TTH2): Dragonflies Odonata (Calopteryx syriaca and Orthetrum chrysostigma), Freshwater Crabs (Potamon potamios), Frog Larva (Pelophylax bedriagae), and the Dice Snake (Natrix tessellate)

6.2.6.3. Al Hwarat (Site HW1)

Al Hwarat HW1 site is a small area where the road intersects with the water course (Figure 6-19). The water course is narrow, and the water flow is fast which makes this section of the river less important as a breeding site for amphibians and aquatic insects. Its proximity to the road and the impacts from heavy traffic by vehicles and picnicking, makes it less important for wildlife.

Figure 6-19: Location of Al Hwarat HW1 Site

6.2.6.4. Abu Al-Zeghan (Site HW2)

Abu Al-Zeghan HW2 site is a wide area off the road within an abandoned water station (Figure 6-20). The area is heavily disturbed and modified by a large plantation of an introduced tree species (*Prosopis juliflora*). The local fauna and flora are already impacted by the destruction and modification in the area which reaches

the basin of the river. The team did not make any significant observations in the area for unique fauna or flora. In its current state, the area is also not suitable as a breeding ground for amphibians and aquatic insects.

Prosopis juliflora tree is now considered the main invasive alien species in Jordan as it is spreading widely in western Jordan and the Jordan Valley (Ghor and Dead Sea area) and has negative impacts on the local flora, fauna, livestock, soil, and surface water [18]. *Prosopis* has a high ability to establish dense thickets along wadis with year-round water flow that is likely to displace native species of trees and to alter the function of natural ecosystems. [19]

Additionally, the Zarqa River water course beyond this site is very much similar and characterized mainly by thickets of the invasive *Prosopis* and dry, gravely banks of the river.

[18] Al-Assaf, A., Tadros, M.J., Al-Shishany, S., Stewart, S., Majdalawi, M., Tabieh, M. and Othman, Y.A. 2020. Economic Assessment and Community Management of Prosopis juliflora Invasion in Sweimeh Village, Jordan. Sustainability, 12, 8327; doi:10.3390/su12208327
[19] Dufour-Dror, J.M. and Shmida, A. 2017. Invasion of alien Prosopis species in Israel, the West Bank and western Jordan: characteristics, distribution and control perspectives. BioInvasions Records, 6(1): 1–7

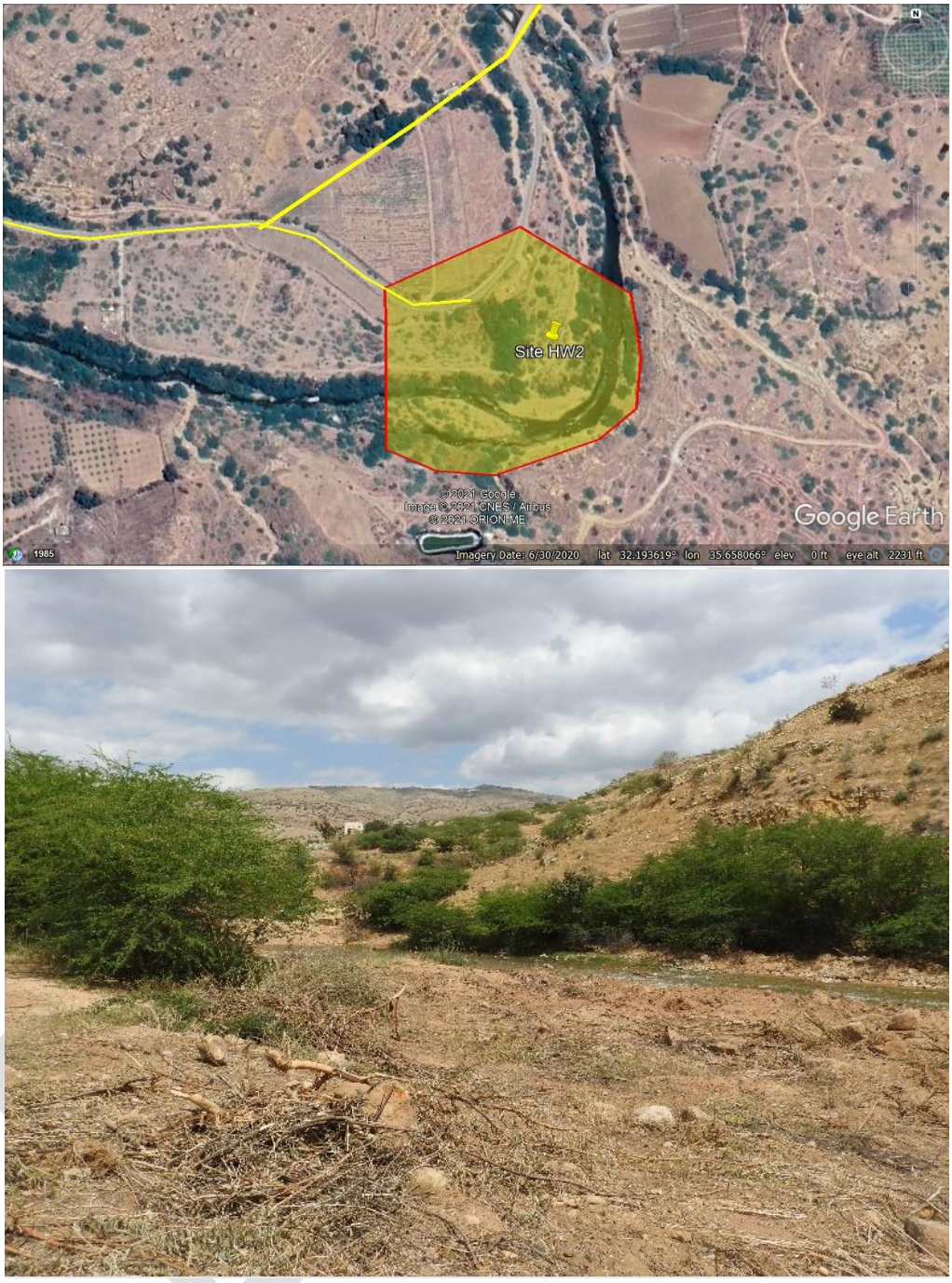


Figure 6-20: Location and habitat within the Abu Al-Zeghan (Site HW2)

6.2.7. Designated and Delineated Biodiversity Areas

The project falls within Zarqa river basin, and its main tributaries rise in the highlands northeast of Amman and drain almost due west into the Jordan Valley. King Talal Dam has been constructed on the Zarqa River about 15 km south-southwest of Ajlun.

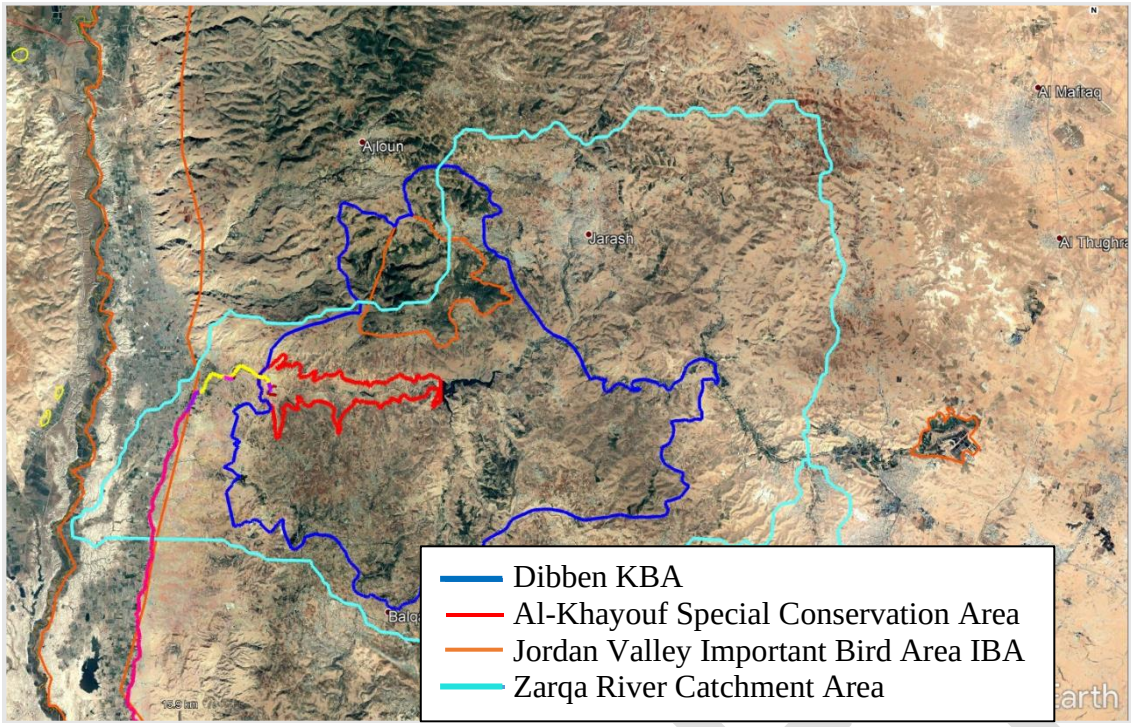


Figure 6-21: Project Location and Areas of Conservation Importance

The northern part of the project area (starting at Telal Al Thahab1 & Telal Al Thahab2) occurs within 2 main areas of conservation importance (Dibben Key Biodiversity Area (KBA) and Al Khayouf Special Conservation Area). The southwestern part of the canal occurs within the Jordan Valley Important Bird Area (IBA) (Table 6-7). The two KBAs of Dibbin Forest and Salt (including Al Khayouf Special Conservation Area) have been merged to form a new KBA Dibbin in 2017.

Table 6-7: Trigger Species Occurring within the Project Area (from King Abdullah Canal to Telal Al Thahab)

Species	IUCN Redlist Category	Status
Black Francoline *Francolinus Francolinus*	Least Concern	Resident
Black Stork *Ciconia nigra*	Least Concern	Migrant
Congregatory migratory Species	n/a	Migrant

King Talal Dam is an important staging and wintering area for a wide variety of migratory waterfowl such as Little Bittern *Ixobrychus minutus*, Cattle Egret *Bubulcus ibis*, Little Egret *Egretta garzetta*, Grey Heron *Ardea cinerea*, White Stork *Ciconia ciconia*, Eurasian Teal *Anas crecca*, Mallard *A. platyrhynchos*, and Coot *Fulica atra*.

Most of these species occur regularly at the northern part of the project (Telal Al Thahab 1 & Telal Al Thahab 2 extending to Hwarat area). While this area is understudied, it has a potential to meet criteria for a freshwater ecosystem. The batches of riparian habitats of this part of the project may support species associated with this micro habitat that cannot be supported by the habitats upstream, hence loss of this ecosystem may have significant changes and loss of associated freshwater ecosystem biodiversity.

The natural wadi of Telal Al Thahab 2 is understood to hold higher biodiversity value compared to the wadi of Telal Al Thahab 1. Both exhibit freshwater habitats, which are considered limited in extent in Jordan, and therefore, maintaining it is of particular representation value.

KAC to the south is part of the Jordan Valley IBA and represents the eastern boundaries of the IBA. The IBA is represented by the agricultural areas to the western part of the canal and has no biodiversity value.

Table 6-8 summarizes the biodiversity value of each site which was used to assess the project anticipated impacts and to develop informed recommendations. As can be noted from the table below, the TTH2 section

is of high biodiversity value, the TTH1 section is considered to be of low to moderate biodiversity value, while the other sections are considered to have low biodiversity value.

Table 6-8: A summary of the biodiversity value of each site

Site	Telal Al Thahab (Site TTH1)	Telal Al Thahab (Site TTH2)	Telal Al Thahab (existing)	Abu Al-Zeghan (Site HW2)	Al Hwarat (Site HW1)
Total number of recorded species	18	34	4	7	7
Percentage of the total number of species (%)	45	85	10	17.5	17.5
number of wild relatives of crops	1	5	0	0	0
number of species of conservation importance	0	4	1	0	0
number of invasive species	0	0	0	1	1

6.3. Socioeconomic Environment

6.3.1. Demographic Conditions

According to the Department of Statistics (DOS), the estimated population of Jordan in 2019 was 10,554,000 with that of Al Balqa Governorate 543,600 representing %5.2 of the total population of the Kingdom[20]. Males constitute 53.7% of the population of Al Balqa'a, compared to a national average of 52.9%. The majority (446,300) of the Governorate's population live in urban areas while 97,300 living in Rural areas. The Governorate has experienced around a 9% increase in population since 2016.

Table 6-9 presents population indicators for Al Balqa Governorate and its eight districts that can be compared with the national estimates. The most populous district in Al Balqa' with over 35% of the population, followed by As-Salt (23%) and Deir Alla (14%). The household size in the governorate is 4.9, comparable to the national average of 4.8. Age group distribution in Al Balqa is also similar to that of the country with around 34% of the population under the age of 15, 62.6% between 15 and 64 and 3.6% over the age of 65.

Table 6-9: Population Indicators (2016)[21]

Administrative Divisions	Total Population	Total Number of Households	Household Size	Age Groups		
				< 15	15-64	> 65
Al Balqa Governorate	491,709	100,126	4.9	33.9%	62.6%	3.6%
As-Salt	105,887	22,701	4.7	31.8%	64.3%	3.9%
Al Ardah	15,644	3,135	5	32.2%	64.1%	3.7%
Zai	19,452	4,139	4.7	34%	62.1%	4%
Eira and Yarga	11,139	2,314	4.8	34.4%	60.9%	4.8%
South Shuneh	52,714	9,819	5.4	36.7%	60.3%	3.1%

[20] DOS (2020). Statistical Yearbook of Jordan 2019.
[21] Ministry of Planning and International Cooperation (2020). Development Plan for Al Balqa'a Governorate 2017-2019.

Administrative Divisions	Total Population	Total Number of Households	Household Size	Age Groups		
				< 15	15-64	> 65
Deir Alla	73,477	13,841	5.3	31.8%	65.2%	2.9%
Ain El Basha	176,726	35,695	5	36.5%	60.2%	3.3%
Mahes & Fuhais	36,670	8,482	4.3	28%	67%	5%
Jordan	9,531,712	1,977,534	4.8	34.3%	61.6%	3.7%

In 2018, the percentage of female headed households (FHH) in the Governorate of Balqa was 12%[22].

As for non-Jordanian residents, in the Jordan Valley area that is located in Al Balqa governorate, the percentage of Egyptians is 6.6% while Palestinians constituted 2.69%[23]. Most Egyptians located in the Jordan Valley work in the agricultural sector.

As for Syrian refugees, according to UNCHR, the total number of Registered Syrian Refugees in Al Balqa Governorate was 18,417 in September 2020 compared, constituting 3.4% of the 533,825 registered Syrian Refugee living outside the camps in the different governorates of Jordan. An estimated 24.2% of the total number of registered Syrian Refugees in Al Balqa are women in the age between 18-59 compared to men in the same age group, who constitute 23.3% of the total[24]. It is important to note that in addition to Registered Syrian Refugees, it is assumed that there is a significant number of Syrians who are not registered with UNHCR living outside the camps in the different governorates.

6.3.2. Economic Activities

The unemployment rate in Jordan for 2019 has increased in recent years. **Table 6-10** shows the economic participation and unemployment rates by gender for Al Balqa'a Governorate and all of Jordan. It shows that while Al Balqa's economic participation rate is slightly lower than the national rate, the female participation rate is slightly higher, at 15.1%, which is still considered very low. As for unemployment, the governorate has a high rate (20.8%), which is above the national average, with high female unemployment (25.6%), compared to a male rate of 19.5%[25].

Table 6-10: Economic Participation and Unemployment Rates in Jordan and Al Balqa by Gender

Indicator	Al Balqa Governorate	Jordan
Economic Participation Rate	32.90%	34.30%
Male Economic Participation Rate	49.50%	54%
Female Economic Participation Rate	15.10%	14%
Unemployment Rate	20.80%	19.10%
Male Unemployment Rate	19.50%	17.00%
Female Unemployment Rate	25.60%	27.00%

The average monthly wage in Jordan in 2018 was 540 JD for men and 484 JD for women, which is a wage gap over 10%. As for non-Jordanian workers, during 2018, 20,422 Syrian males and 644 Syrian females were employed in the public and private sectors compared to 59,385 Egyptian males and 336 Egyptian females[26].

[22] DOS (2019). Household Income and Expenditures Survey 2018.
[23] DOS (2016). Population and Housing Census 2015.
[24] UNHCR: Operational Portal
[25] Ibid.
[26] DOS (2020). Statistical Yearbook of Jordan 2019.

Regarding informal work, the ratio of workers in this sector is 41.4%, most of whom are in the age group 31-50 and working in the services sector. The percentage of women working informally either from home or outside their homes is 9.5%. Unfortunately, it is difficult to obtain accurate data on the informal sector due to the fact that only %21.2 of the informal businesses are registered[27].

6.3.3. Education

Illiteracy rates in Jordan have been on a decreasing trend, reaching, in 2017, 3% for men older than 13 years and 6.9% for women of the same age range[28]. Illiteracy rates among non-Jordanians registered higher at 14.5% in 2015. Regarding school age children (6-15 years), 95% of Jordanian children are in schools while only 70% of Syrian children are. As for the Higher Education, 78% of students in public universities are Jordanian compared to %72 of students in the private universities[29].

In Al Balqa Governorate, the Development Program for Al Balqa Governorate 2017-2019 had shown that the illiteracy rate is 9.6%, which is significantly higher than the national rate. It also found that the success rate in the official secondary school exam “Al Tawjihi” is 31.1%, over 5% lower than the national rate of 36.6%. Al Balqa Governorate also has one of the three highest school dropout rate with a rate of around 0.63% while the national rate is 0.25%.

The number of public schools differs from one district to another in the governorate. For example, in Dair Alla there is 21 school for boys, 2 schools for girls and 41 mixed schools. In South Shouneh, there are 14 school for boys, 3 schools for girls and 32 mixed schools[30].

6.3.4. Land Use

The Jordan Valley forms part of the larger Jordan Rift Valley. The internationally recognized World Heritage values of the Jordan Valley are strongly related to its unique historic, religious, cultural, economic, and environmental values, due to its typical rift valley topography. The Jordan Valley has a total surface area of 2,508 km^2, most of which (61.5%) consists of uncultivated land. A total of 803 km^2 (32%) is used for agriculture and 89.6 km^2 (3.6%) is built-up. Table 6-11, Figure 6-22 and Figure 6-23 provide an overview of land use in the Jordan Valley area[31].

Table 6-11: Land Use in the Jordan Valley

Land use	Surface area in km^2	%
Agriculture	803.1	32
Built area	89.6	3.6
Fish farming	22.6	0.9
Natural/Uncultivated	1,543.50	61.5
Reservoirs	6.4	0.3
Wadi’s	43.2	1.7
Grand total	2,08.40	100

[27] Jordan Strategy Forum Website (2020). Informal Sector in Jordan – Workers and Challenges.
[28] DOS (2018). Jordanian Women Statistical Report 2017
[29] DOS (2016) Population and Housing Census 2015.
[30] DOS (2020). Statistical Yearbook of Jordan 2019.
[31] The Jordan Valley. Available from: https://www.researchgate.net/publication/309173144_The_Jordan_Valley [accessed Aug 29 2021].

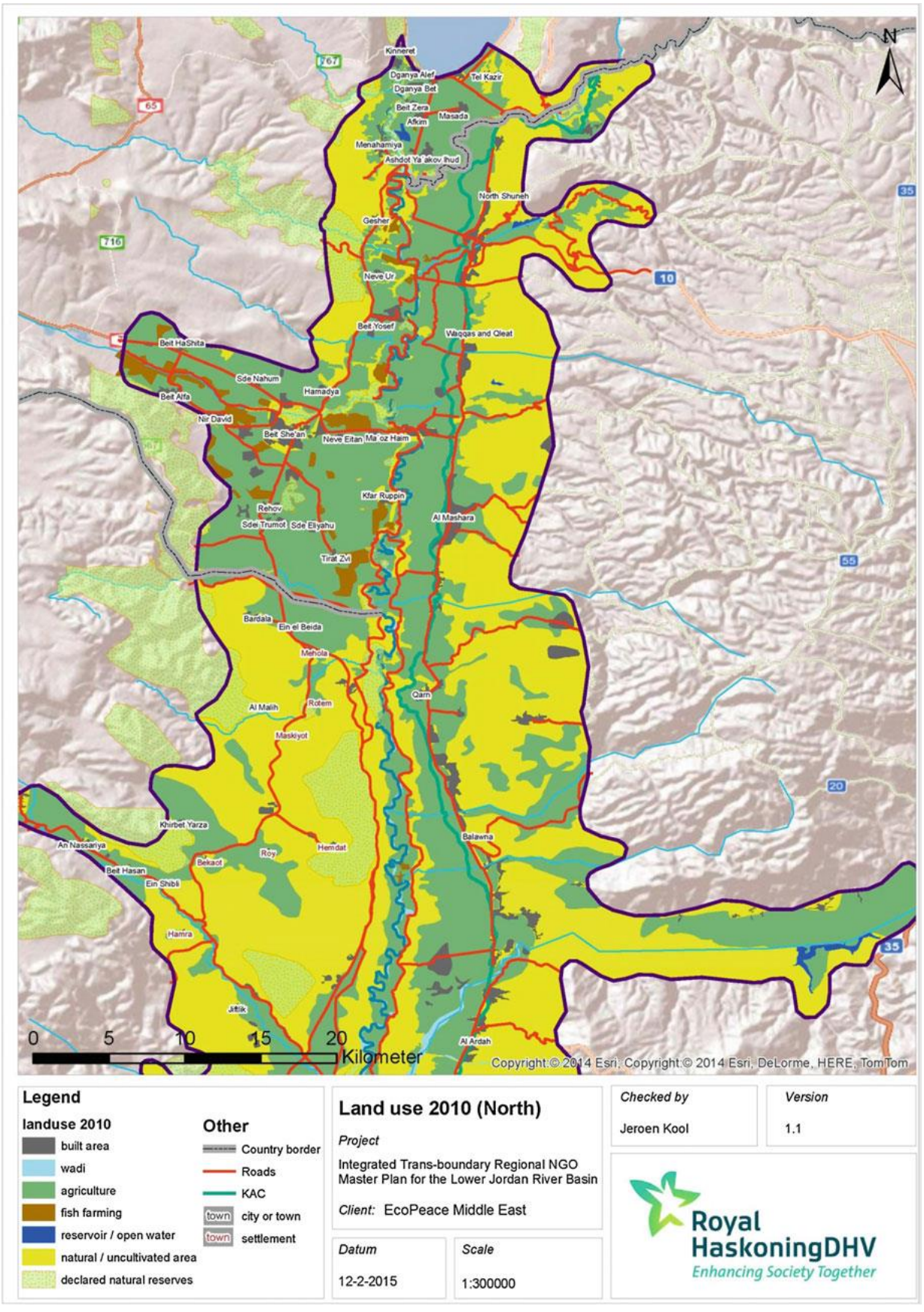


Figure 6-22: Current Land Use of the Northern Part of the Jordan Valley

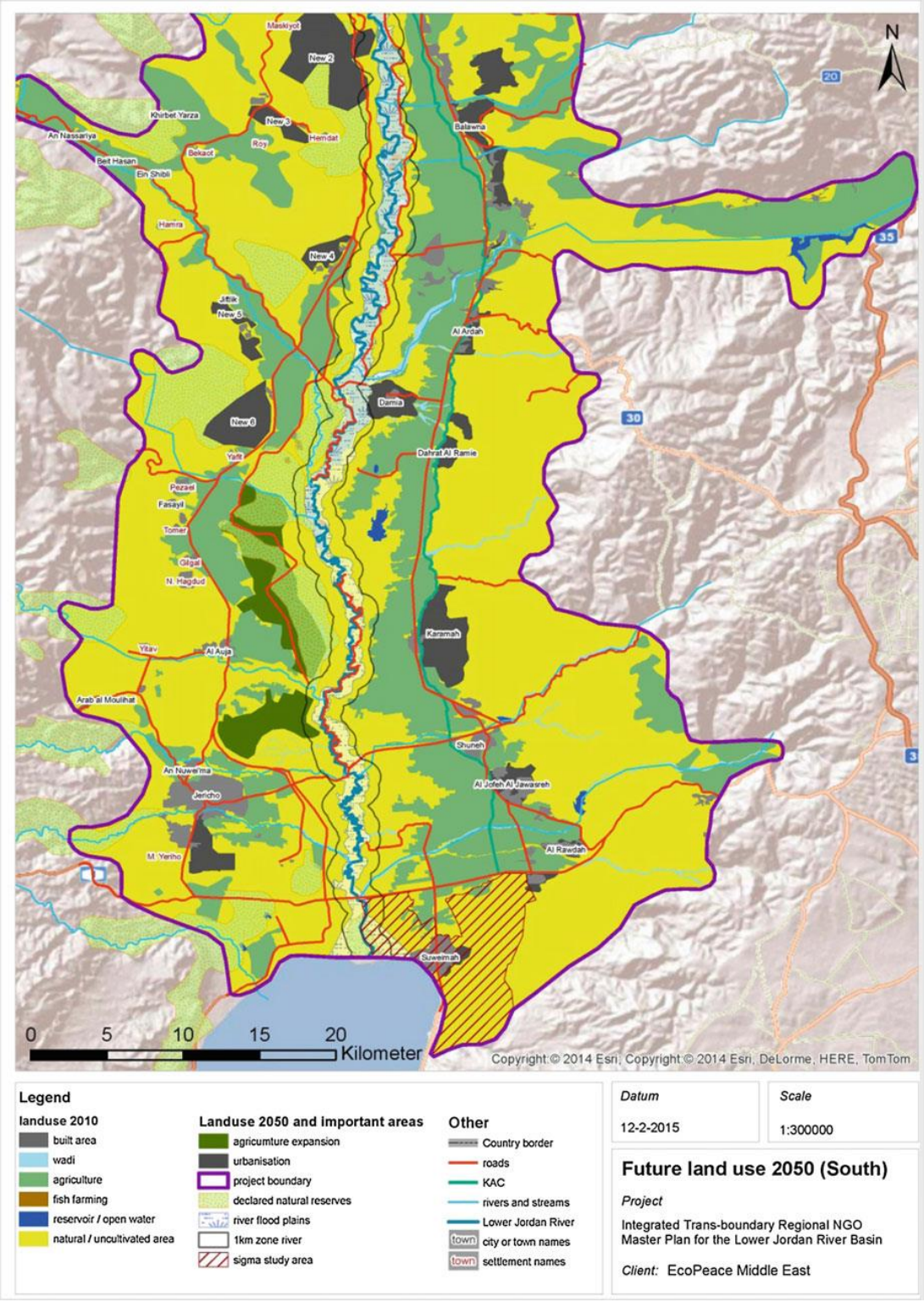


Figure 6-23: Current Land Use of Southern Part of the Jordan Valley South

The proposed new intake and weir will be constructed right before the existing Telal Al Thahab weir which is in a virgin area as shown in Figure 6-24.

Figure 6-24: Telal Al Thahab Existing Weir

As for the proposed settling basin, it will be constructed adjacent to the existing JVA offices on bare land as shown in Figure 6-25.

Figure 6-25: Proposed Site of the New Settling Basin

The site is not occupied and sheep were observed graving in the area as shown in Figure 6-26 during the site visit dated in April 2021.

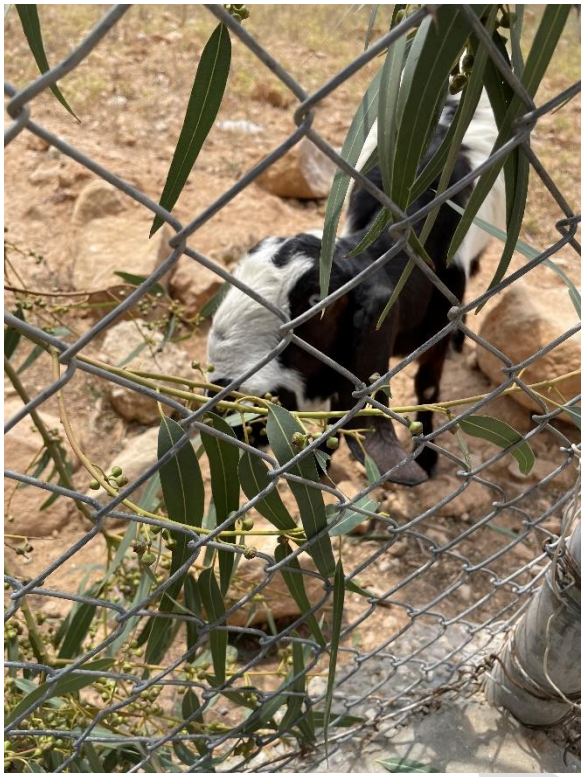


Figure 6-26: Observed Sheep in the Proposed Settling Basin Site

Furthermore, the surrounding areas of the conveyance pipeline, are mostly agricultural areas with different types of crops as shown in Figure 6-27 below.

Figure 6-27: Farms around the Conveyance Pipeline

As for the storage ponds proposed sites, ponds 1 and 2 are proposed to be located on virgin undeveloped lands while pond 3 is currently cultivated (Figure 6-28 and Figure 6-29).

Figure 6-28: Site of Pond No. 3

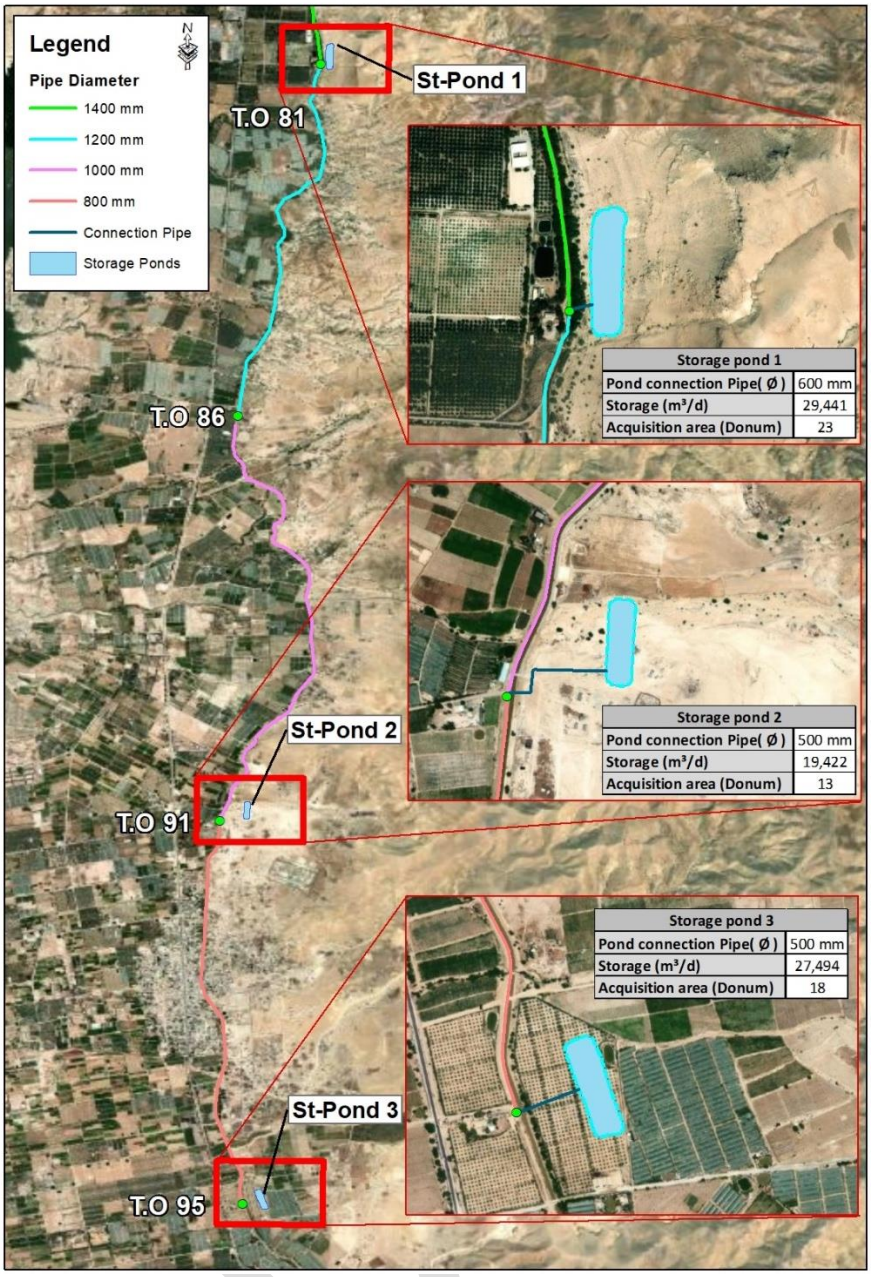
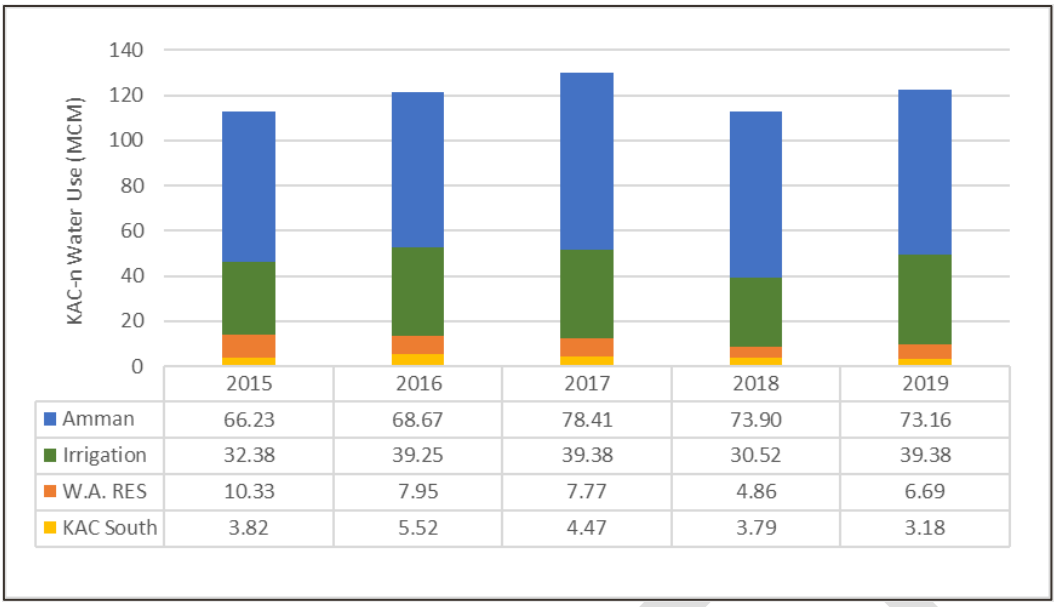


Figure 6-29: Land Use of the Proposed Pond Sites

6.3.5. KAC Water Uses

The King Abdullah Canal water is utilized for irrigation in the Jordan Valley. In addition, KAC supplies fresh water to Zai Water Treatment Plant, which provides domestic water to Amman. KAC-N supplies Wadi Al-Arab Reservoir during the winter months with small amounts, whereas surplus quantities in KAC-N are conveyed to KAC-S, via the KAC Siphon.

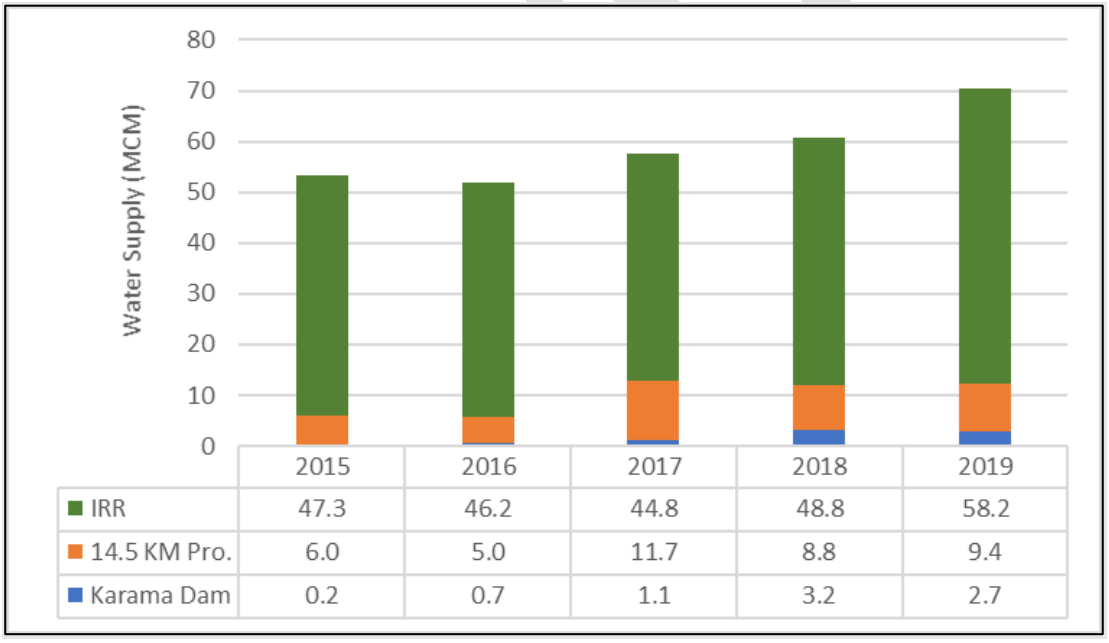
The annual water supplies recorded at KAC-N over the last five years are presented in Figure 6-30, showing that the major uses have been in irrigation and diversions to Amman, which averaged 36 and 72 MCM per year, respectively, over the period between 2015 and 2019.



	2015	2016	2017	2018	2019
Amman	66.23	68.67	78.41	73.90	73.16
Irrigation	32.38	39.25	39.38	30.52	39.38
W.A. RES	10.33	7.95	7.77	4.86	6.69
KAC South	3.82	5.52	4.47	3.79	3.18

Figure 6-30: Annual Water Diversions from KAC-N

The quantities diverted from KAC-S over the last five years averaged approximately 59 MCM per year, primarily for irrigation. This information is presented in Figure 6-31 which shows that irrigation of the Middle Ghor from KAC-S, via turnouts 70 through 96, is the main water use in that section of the canal, averaging about 50 MCM per year.



	2015	2016	2017	2018	2019
IRR	47.3	46.2	44.8	48.8	58.2
14.5 KM Pro.	6.0	5.0	11.7	8.8	9.4
Karama Dam	0.2	0.7	1.1	3.2	2.7

Figure 6-31: Annual Water Diversions from KAC-S

The average annual water supply to KAC during the period from 2015 to 2019 and the average annual water diversions from the Canal over the same period is presented as a schematic diagram in Figure 6-32 below.

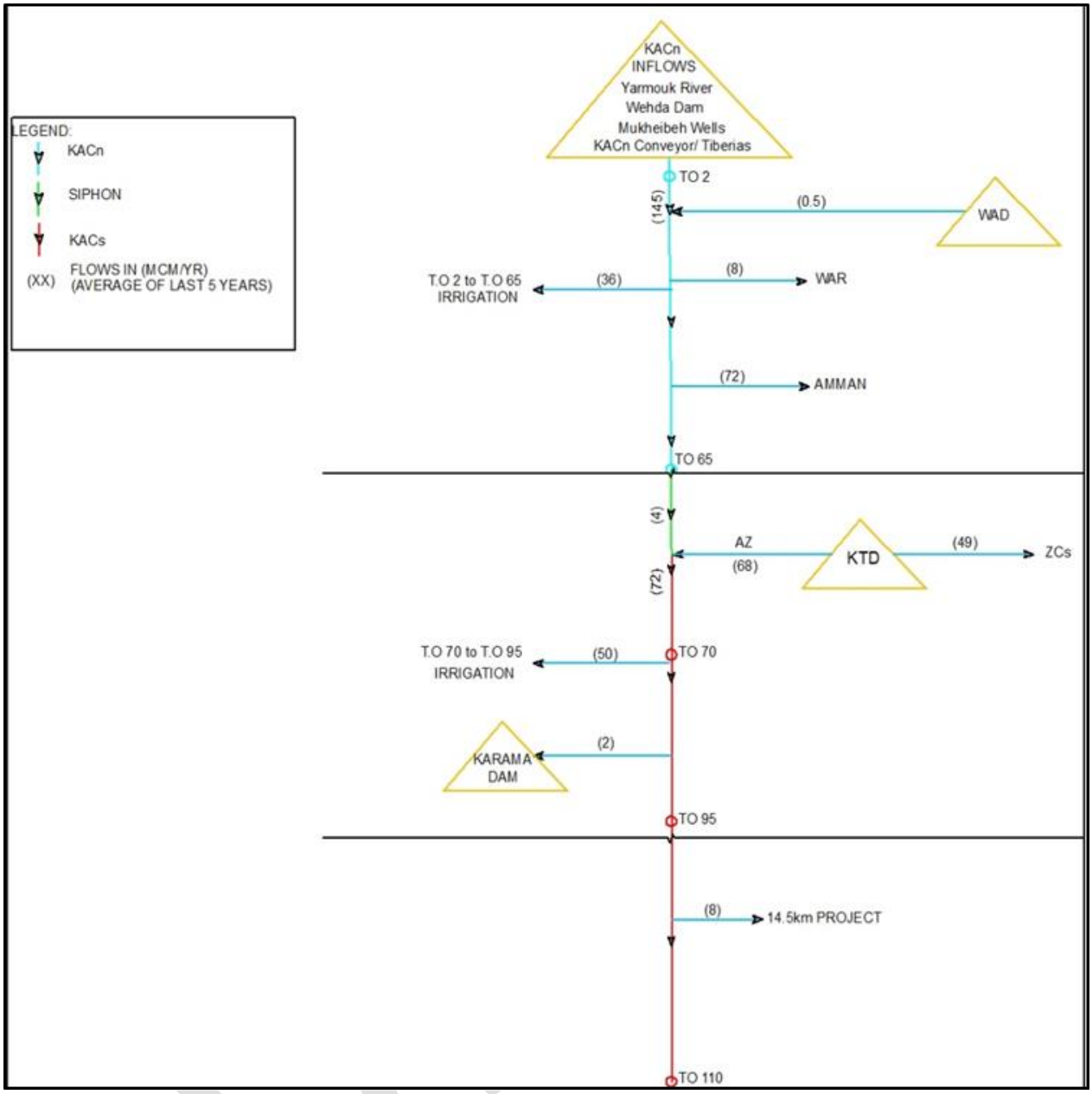


Figure 6-32: KAC Average Annual Water Supply and Water Diversions (2015-2019)

6.3.6. Water Losses

Several studies have discussed water losses in KAC, such as the “Determination of Water Losses in the KAC Conveyance System” under the MWI USAID program that aims to measure the total losses for each reach of the Northern KAC (0-65 km) and Southern KAC (65-96 km) and to determine the relative contribution of evaporation, seepage, and unmetered/illegal use to the total estimated loss.

The total water losses for the Southern KAC as estimated in this study were 38.1% of the maximum flow, allocated between 14.5% being constant/seepage, 23.0% being unmetered/illegal uses, and 0.6% being evaporation.

6.3.7. Transportation

The Dead Sea Highway (Route 65) is the major regional highway in the project area, it crosses the country from the south to the north passing by the Jordan Valley. The road passes through some heavily populated urban areas. The project area includes some other primary roads as shown in Figure 6-33.

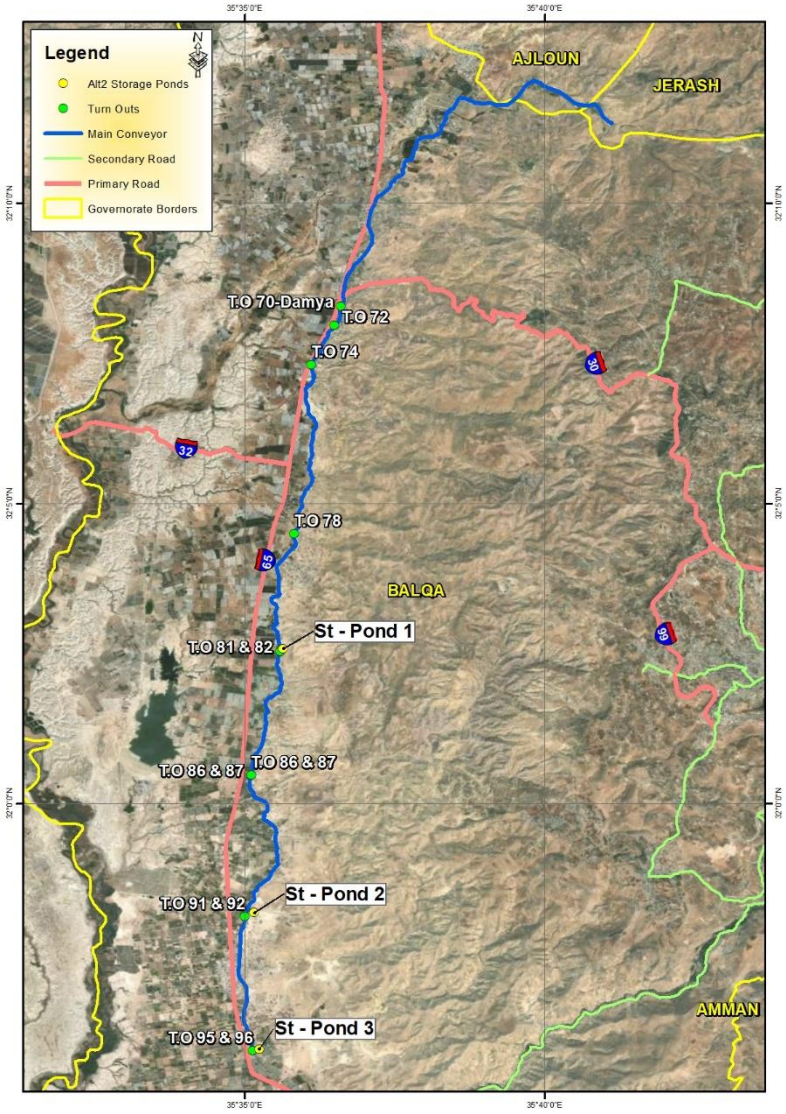


Figure 6-33: Primary and Secondary Roads within the Project area

6.3.8. Solid Waste Management

Solid waste in the area is managed through one controlled dumpsite in Deir Alla and another transfer station in North Shouneh. The waste coming from the southern part of the Jordan Valley is usually disposed at Deir Alla dumpsite. This dumpsite is located 1 km (Figure 6-34) from the Jordan River to the west of Deir Alla.

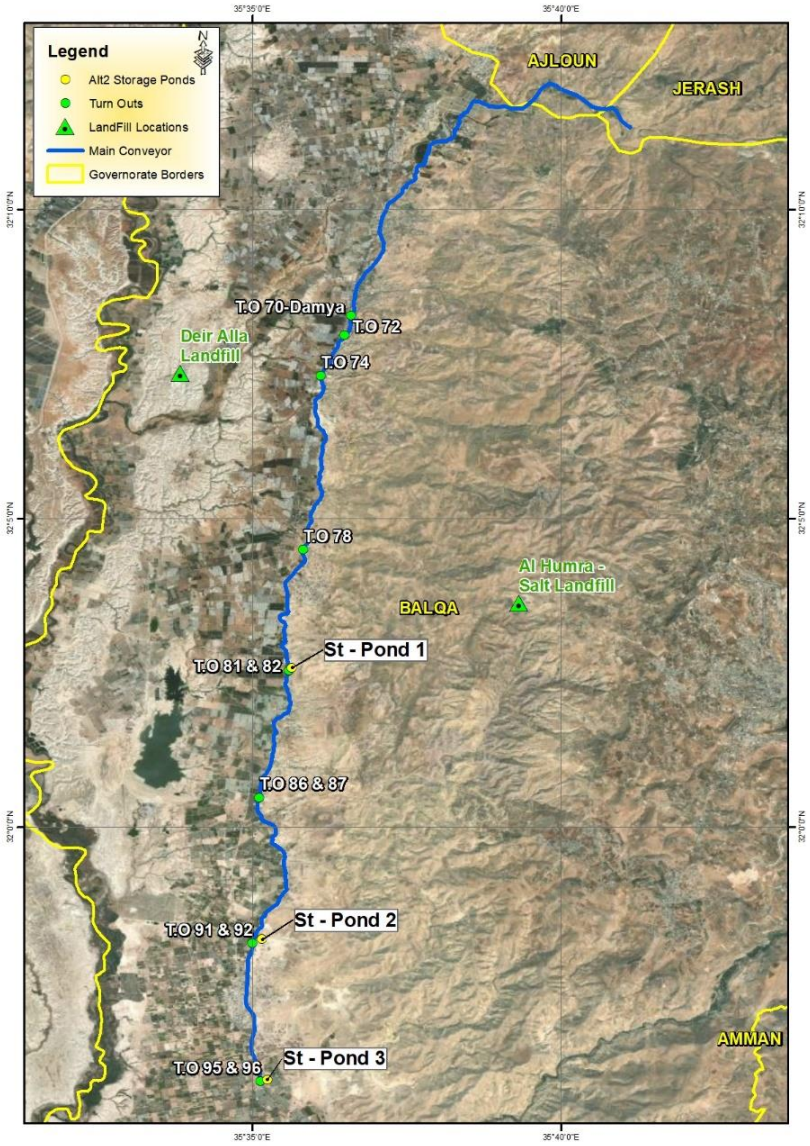


Figure 6-34: Landfills around the Project Area

6.3.9. Public Health and Safety

In terms of health and safety, 2015 records showed that 102 drowning cases occurred in the KAC in the past 11 years[32].

6.3.10. Cultural Resources

6.3.10.1. Revealed Sites Historic Time Sequence (Archaeological Periods)

The review of literature revealed reported sites that belong to different archaeological periods within the project area. An analysis of the sites time sequence and representation of archaeological periods shows that there is a significant shortage of information about the presence of archaeological sites belonging to the periods after the Lower Paleolithic age and till the Neolithic Age, and after Byzantine during Islamic eras. Several reasons

[32]Jordan times. http://www.jordantimes.com/news/local/144-drowning-cases-recorded-northern-ghor-over-past-11-years%E2%80%99. Accessed on 01-09-2021

contribute to this situation; however, the core problem is noted to be the insufficiency of research and field investigation of such resources.

6.3.10.2. Previous Archaeological and Cultural Heritage Research in Project Area

Parts of the Jordan Valley have been surveyed archaeologically and some sites have been excavated, particularly Deir Alla as the most attractive Iron Age site in the Middle Ghor Area. The work has been constrained by three factors:

- Fieldwork from Deir Alla has inevitably been carried out completely independently on the east (Jordan), and no overall understanding of all known sites has ever been produced.
- With certain exceptions, the upper route of the canal has in general been regarded as the lower Wadi Zarqa, but its role as a route - not only north-south but especially east-west - is so far poorly understood.
- Much of the field works is unpublished, and even lists of sites and their coordinates are difficult to access.

Generally, it was noted that archaeological and cultural heritage field excavations and their documentation and reporting are ranged from low to medium. Little is known about the archaeology of Lower Wadi Zarqa and the surrounding zone. According to the search operations, there is limited archaeological field survey and excavations were conducted in this area and mainly headed by foreign missions. Although the published accounts of these surveys are the basic references for the archaeology of the Middle Ghor Area, they provide very little information about the northeast sector of the Lower Wadi Zarqa Area.

In this area, only two archaeological sites were recorded during these early explorations those are Deir Alla & Tlul ed-Dhahab which was considered as the most important historical sites mentioned in the early known archives. Documentation of the area continued & directed by famous archaeologists and heritage experts.

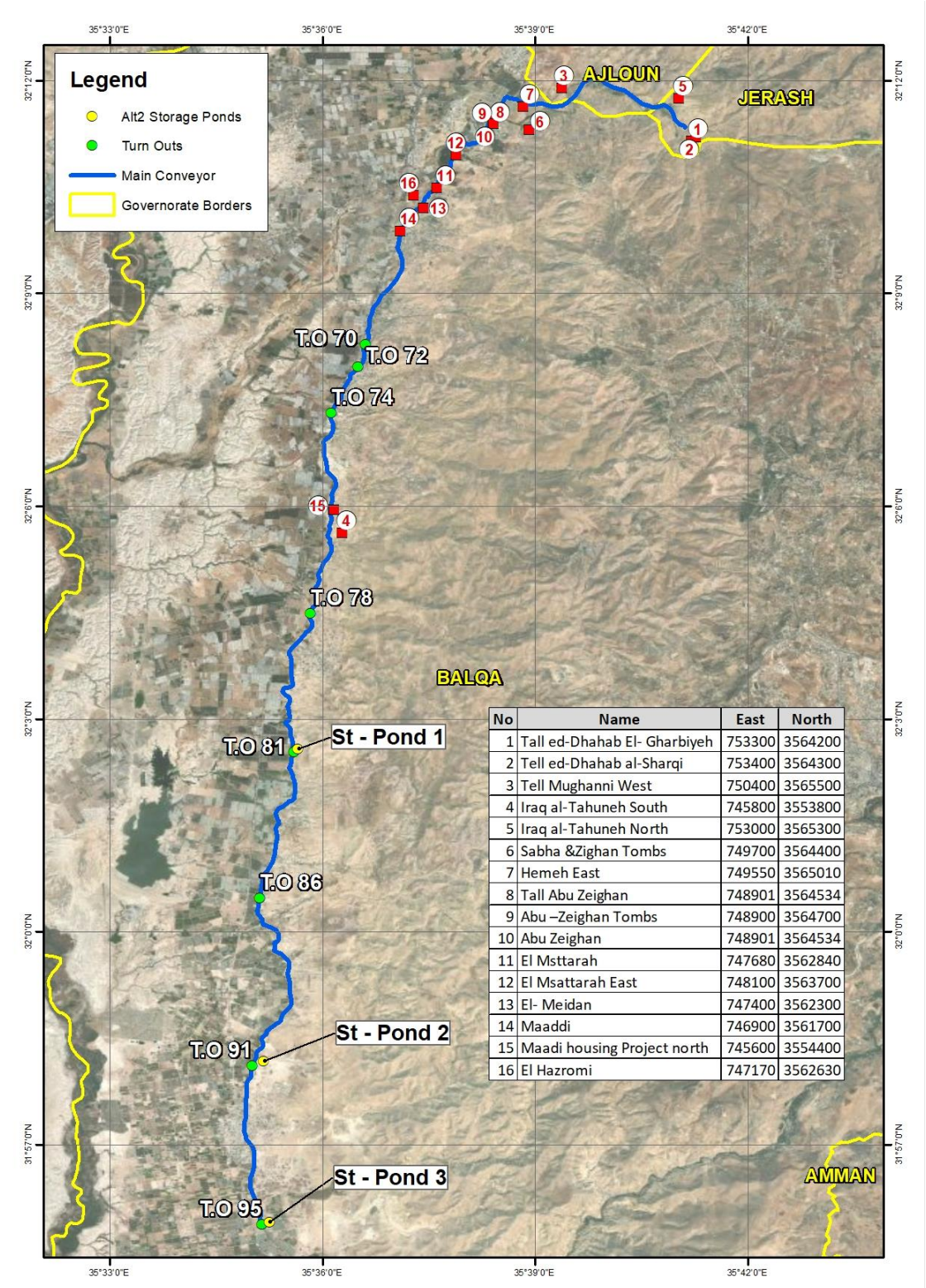
The unpublished reports from these projects make only a limited contribution to the present state of knowledge of the archaeological record for the study area. The only extensive account of the archaeological history of this area is contained within an unpublished report submitted to the Department of Antiquities of Jordan by its representatives in Deir Alla Office.

Field work and investigations of Middle Ghor Area already suggest large parts of the Jordan Valley are immensely rich in archaeological remains and most of those identified are certainly pre-Islamic and probably several thousand years old. Detailed interpretation of one ‘window’ in the middle of Jordan Valley (Deir Alla Complex) forms the basis for illustrating the richness of the heritage and how the land and soil can be harvested to shed important light on the character and development of the human landscape. This research reported the discovery of nearly more than 17 sites as registered by JADIS (Jordan Archaeological Database and Information System)/MEGA program while intensive field survey conducted by several missions in the surrounding zones revealed more than 100 archaeological sites, some of which are major and significant.

The results show clear representation of all periods and many types of sites, ranging from flint and sherd scatters, stone circles and enclosures to towers and agricultural installations, and many cemeteries. Given the hot and difficult landscape it is interesting to note that there are a surprising number of sites, albeit small ones. There are lot of grave sites and cemeteries, but some interesting enclosures were found, some in unlikely places, as well as some small groups of structures, ancient campsites, prehistoric flint sites and water mills.

6.3.10.3. Identified Archaeological Sites related to the Project

A preliminary assessment revealed a total of more than 16 archaeological sites (Figure 6-35 and Table 6-12) known in the area, from previous field explorations related to different periods (Figure 6-36), and more is expected if a systematic survey replaced the random survey system in the Middle Ghor Area. The sections that follow describe all assessed archaeological sites in the project area. It is worth mentioning that all archaeological sites are not intersecting with any of the construction activities of the project.



No	Name	East	North
1	Tall ed-Dhahab El- Gharbiyeh	753300	3564200
2	Tell ed-Dhahab al-Sharqi	753400	3564300
3	Tell Mughanni West	750400	3565500
4	Iraq al-Tahuneh South	745800	3553800
5	Iraq al-Tahuneh North	753000	3565300
6	Sabha &Zighan Tombs	749700	3564400
7	Hemeh East	749550	3565010
8	Tall Abu Zeighan	748901	3564534
9	Abu –Zeighan Tombs	748900	3564700
10	Abu Zeighan	748901	3564534
11	El Msttarah	747680	3562840
12	El Msattarah East	748100	3563700
13	El- Meidan	747400	3562300
14	Maaddi	746900	3561700
15	Maadi housing Project north	745600	3554400
16	El Hazromi	747170	3562630

Figure 6-35: Archaeological Sites within the Project Area

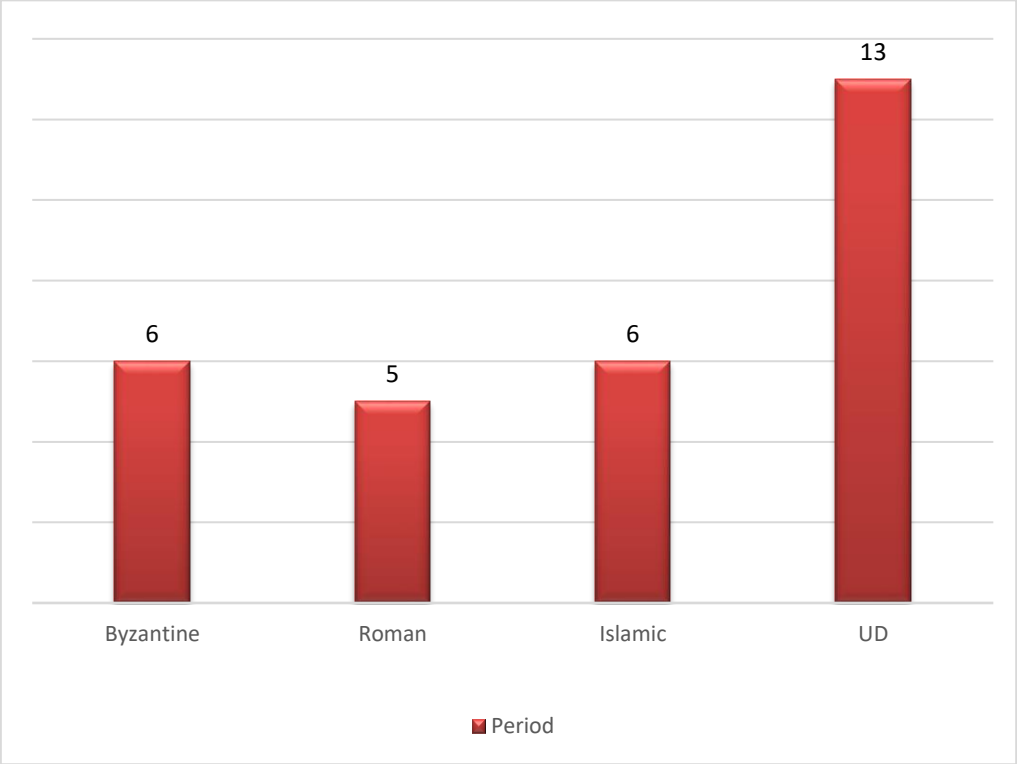


Figure 6-36: Total Number of Identified of Archaeological Sites based on their Period

Table 6-12: List of Archaeological sites within the project area

No.	Site Name	Coordinates		Date	Historical Significance	Protection statues	Excavation statues
1	Tall ed-Dhahab El- Gharbiyeh	E 3675330	N 356420	Middle Paleolithic; PN, Clalcolithic. EB, Iron	High	Unprotected	Partly excavated
2	Tell ed-Dhahab al-Sharqi	E 3675340	N 356430		High	Unprotected	Partly excavated
3	Tell Mughanni West	E 3675040	N 356550	Paleolithic; Iron Age; Roman, Byzantine; Ottoman.	Medium	Unprotected	Not excavated (The site could be considered tow sites with the same utm+date
4	Iraq al-Tahuneh South	E 3674580	N 355380	Byzantine Period.	Low	Unprotected	Demolished
5	Iraq al-Tahuneh North	E 3675300	N 356530	Classical Late Islamic Period	Low	Unprotected	Not excavated
6	Sabha &Zighan Tombs	E 3674970	N 356440	Chalcolithic, EBIII	Low	Unprotected	Not Excavated Demolished
7	Hemeh East	E 36749550	N 356501	EB, Iron Age II, Persian, and Roman	High	Unprotected	Not Excavated
8	Tall Abu Zeighan	E 3608901	N 3564534	EB, Classical	High	Unprotected	Not Excavated
9	Abu –Zeighan Tombs	E 3674890	N 356470	Chalcolithic, EBIII	Low	Unprotected	Not Excavated
10	Abu Zeighan	E	N		Low	Unprotected	Not Excavated

No.	Site Name	Coordinates		Date	Historical Significance	Protection statues	Excavation statues
		3608901	3564534				
11	El Msttarah	E 3674768	N 356284	EBIV, MB	Medium	Unprotected	Not Excavated
12	El Msattarah East	E 3674810	N 356370	EB, Late Byzantine, Unspecified, Ayyubi-Mamluk	Low	Unprotected	Not Excavated
13	El- Meidan	E 3674740	N 356230	Iron Age I, II, III; Roman; Islamic.	Medium	Unprotected	Not Excavated
14	Maaddi	E 3674690	N 356170	Modern, 1915- 1950	Low	Unprotected	Not Excavated
15	Maadi housing Project north	E 367456	N 35544	Islamic Ayyubid-Mameluke.	Low	Unprotected	Not Excavated
16	El Hazromi	E 3674717	N 356263	EB; Iron Age; Roman.	Low	Unprotected	Not Excavated

6.3.10.3.1. Site No. 1: Tall ed-Dhahab El- Gharbiyeh

A major site in the lower Zarqa River area, it consists of a large settlement area, acropolis, and defensive system. The site is surrounded by the river from three sides except the eastern area. The remains were affected by robbery activities and natural factors. The site is currently under excavation. Figure 6-37 below shows Tall ed-Dhahab El- Gharbiyeh site.

Figure 6-37: Tall ed-Dhahab El- Gharbiyeh

6.3.10.3.2. Site No. 2: Tell ed-Dhahab al-Sharqi

Located on the other side of the river directly opposite Tall el-Dhahab ed-Gharbi, the site was subjected to limited excavations on its summit. The site is strongly connected with the Tall ed-Dhahab Al-Gharbi, during the past years. This site is considered to be the most important one and has high historical significant. Figure 6-38 below shows Tell ed-Dahab al-Sharqi site.

Figure 6-38: Tell ed-Dhahab al-Sharqi

6.3.10.3.3. Site No. 3: Tell Mughanni West

Located on a high mountain overlooking the surrounding areas, more than 500 away from the river, field assessment revealed no clear remains or architectural features on the surface, only some flints and few pottery sherds scattered on the slopes of the site. The site possibly represented a watchtower washed away. The nearby Tall Mughani is far away from the project site. Below Figure 6-39 shows Tell Mughanni West area.

Figure 6-39: Tell Mughanni West Area

6.3.10.3.4. Site No. 4: Iraq al-Tahuneh South

The site is located very close to the eastern side of the river where a water mill was historically located. The whole site of the water mill was demolished completely by constructing a new restaurant. Only a few ashlars of the mill are still scattered on the surface of the site without any pottery or flint sherds. Figure 6-40 below shows Iraq al-Tahuneh South site.

Figure 6-40: Iraq al-Tahuneh South

6.3.10.3.5. Sie No. 5: Iraq al-Tahuneh North

A slightly raised ground to the northeast of the river, the site is far away from the project area, and there are no remains on the surface. Some scattered pottery sherds are found but not associated with any structures.

6.3.10.3.6. Site No. 6: Sabha & Zighan Tombs

The area of the site (Figure 6-41) was completely changed during the last 30 years. The area is currently being used for agriculture purposes. In addition, some temporary structures were built there, resulting in demolishing the site and the surrounding environment. Deep investigations revealed very few of pottery sherds scattered here and there.

Figure 6-41: Sabha & Zighan Tombs

6.3.10.3.7. Site No.7: Hemeh East

Remains of a medium site consist of structures of different periods, as well as scattered pottery sherds and flints. The site is also 100 meters away to the east from the river route. Some excavated squares were noticed in the eastern part of the site. Figure 6-42 below shows Hemeh East site.

Figure 6-42: Hemeh East

6.3.10.3.8. Site No. 8: Tall Abu Zeighan

This site constitutes a very large area of approximately 50 dunums overlooking most of the nearby areas occupied by a modern cemetery and an old one. The architectural features visible on the surface dated to different periods. The site (Figure 6-43) severely suffered from destruction caused by local inhabitants and natural factors. The nearby site Handqouq found demolished under new houses.

Figure 6-43: Tall Abu Zeighan

6.3.10.3.9. Site No. 9: Abu –Zeighan Tombs

Located near the Sabha site on the eastern side of the river, field assessment revealed no archaeological remains. The proposed area of the site was completely demolished and replaced with agricultural activities, which included palm tree farming. Few pottery sherds were scattered here and there on the surface. Figure 6-44 below shows Abu-Zeighan Tombs site.

Figure 6-44: Abu –Zeighan Tombs

6.3.10.3.10. Site No. 10: Abu Zeighan

The site (Figure 6-45) is located within a private housing project. The local community turned the site into a cemetery and built a new mosque nearby.

Figure 6-45: Abu Zeighan Site

6.3.10.3.11. Site No. 11: El Msttarah

Located on a sloping area overlooking the plains toward the area-surrounding zone of the canal, a private house was constructed at the site location. The field assessment revealed no archaeological features on the surface of the site. The site was demolished 20 years ago. Few scattered flints were noticed on the surface. Figure 6-46 below shows El Msttarah site.

Figure 6-46: El Msttarah site

6.3.10.3.12. Site No.12: El Msattarah East

The site is a low hilly area with few pottery sherds scattered but without any architectural features on the surface. The location is less than 1 km from the existed canal route. The local community fenced the area and use it for ranching goats and animals, as well as for cultivation of vegetables. Figure 6-47 below shows El Msattarah East.

Figure 6-47: El Msattarah East

6.3.10.3.13. Site No. 13: El- Meidan

The site is a large area without architectural features on the surface, bordered by farms and shallow valley from the west, a small sandy mound situated in the middle of the site contains remains of human bones possibly used as cemetery during the past years. The investigations revealed few pottery sherds on the surface. The site is used for currently cultivating vegetables.

Figure 6-48: El- Meidan

6.3.10.3.14. Site No.14: Maaddi

The site has been demolished completely during construction of the canal and nearby new private houses. Field assessment revealed no remains on the surface. Local inhabitants fenced the area to avoid threats and protect their children from the canal.

Figure 6-49: Maaddi

6.3.10.3.15. Site No.15: Maadi Housing Project North

The site represents pottery scattered only without any architectural remains; no archaeological excavations were conducted in the locality. The scattered pottery date back to the late Islamic period such as Ayyubi-Mamluk and Ottoman. The site was totally bulldozed and removed since building the canal in 1963.

6.3.10.3.16. Site No.16: El Hazromi

The site located between the main asphalt road of DeirAlla and the existed canal. There are no architectural remains on the surface only pottery sherds were noticed; in addition to that, the current cultivation activities demolished most remains of the site and the surrounding zone.

7. Stakeholder Engagement

The following chapter presents the stakeholder engagement conducted during preparation of the ESIA.

7.1. Gender Analysis Focus Groups

A gender analysis and action plan report has been developed based on several conducted focus groups between April 08 and 12, 2021. All related information is presented in **Annex 4** of this report.

7.2. Consultation Session

On September 5, 2021, the ESIA Team, in coordination with JVA, held a consultation session at the JVA offices in Deir Alla and online (in hybrid format) to present the project components of the selected alternative and major environmental and social issues related to the project to the stakeholders and obtain their feedback. Around 58 agencies and institutions were invited to this session such that 27 persons attended. During the session, the project was presented by the design team after which a presentation of major environmental and social issues associated with the project was presented by the ESIA team. The floor was then opened for

feedback and discussion. At the end of the session, all participants (in-person and online) were requested to fill out a questionnaire on environmental and social concerns (which 12 persons completed). This section presents the main issues that were raised during the session. All details pertaining to this session can be found in **Annex 5** including the presentation, letters of invitations, list of participants, agenda, detailed proceedings, questionnaire and results, and photographic documentation.

7.2.1. Discussions

Issues raised by stakeholders during the discussion and were noted by the Study Team are as follows:

- Irrigation areas (gravity vs. pumping), Abu Zighan and downstream area;
- Getting rid of insects;
- Safety of residents from drowning in the ponds;
- Irrigation water standards;
- Cleaning of settling basins;
- Public/farmers acceptance of the project to avoid negative consequences on the project during operation phase;
- Destruction of any of the historical and heritage sites during construction and excavations, a survey of the sites must be conducted before construction phase, and adherence to the national legislation;
- Operating hours of each station;
- Damage of the conveyance pipeline due to floods;
- Eliminate/reduce risk of illegal connections;
- The need for a canal during the winter season;
- Reduce water losses and energy consumption; and
- The canal as a major source of water and national heritage that must be preserved.

7.2.2. Results of the Questionnaires

A questionnaire was distributed to the participants at the end of the session in an effort to give all the attendees the chance to provide feedback on potential environmental and social impacts during both the construction and operation phases of the project. The questionnaire included 19 questions and was available in both Arabic and English languages. The results of the questionnaire are presented below.

7.2.2.1. Environmental and Social Impacts and Issues

7.2.2.1.1. Potential Impacts during Construction

Around 8.3% of the respondents considered that the impact on wadis, surface and ground water contamination from excavation works is of high significance, with 41.7% considered it to be of medium significance. This was also the case regarding the impact of disturbance from generated dust and noise as the percentages of respondents rating this impact as of high significance was 8.3% while 41.7% considered it of medium significance. As for the terrestrial habitat loss or alteration, 16.7% of respondents considered the impacts high and 33.3% considered the impacts medium. These percentages are similar to those percentages of respondents to the significance of disruption/destruction to existing infrastructure due to construction activities. As for impact of construction activities on traffic movement, 8.3% of respondents indicated that it is considered to be of high significance, while the majority was almost divided between medium and low significance. Only 8.3% of the respondents indicated that impacts on workers and public health as of high significance while 33.3% considered it as of medium significance, which means the majority (58.3%) considered it to be low. Most (66.7%) respondents indicated that impacts on cultural heritage are of low significance. The majority (83.3%) of respondents considered impacts due to land acquisition as low significance. None of the respondents indicated the impacts on businesses along the route as having high significance while more than half of the respondents (58.3%) considered it as medium significance. As for the impacts of the disruption of water supply for agricultural units, 8.3% indicated that it is of high significance and more than half (58.3) considered it to be of low significance (Table 7-1).

Table 7-1: Summary of questionnaire responses for Construction Activities

Impact	Percentage		
	High	Medium	Low
Wadis, surface and ground water contamination	8.3	41.7	50
Disturbance from generated dust and noise	8.3	41.7	50
Terrestrial habitat loss or alteration	16.7	33.3	50.0
Disruption/destruction to existing infrastructure	16.7	33.3	50.0
Disruption of traffic movement	8.3	50	41.7
Worker and public health and safety risks	8.3	33.3	58.3
Disruption/loss of cultural heritage	16.7	16.7	66.7
Permanent land acquisition	16.7	0	83.3
Disruption to businesses along the route	0	58.3	41.7
Disruption of water supply for agricultural units	8.3	33.3	58.3

7.2.2.1.2. Impacts associated with Operation Activities

Half the respondents (50%) indicated that the impact of keeping part of the canal open is of medium significance and 8.3% indicated that it is of high significance. The majority (58.3%) of respondents considered the impacts on supply hours for agricultural units as of medium significance while 41.7% thought it was of low significance. As for the impacts of disturbance from generated noise of the PSs, 16.7% of the respondents indicated that is of high significance while 41.7% indicated that is of medium significance. Three fourths (75%) of the respondents indicated that the risk of drowning in the new ponds is of low significance as long as health and safety mitigation measures are applied (Table 7-2).

Table 7-2: Summary of Questionnaire Responses for Operation Activities

Impact	Percentage		
	High	Medium	Low
Keeping part of the canal opened	8.3	50	41.7
Supply hours for agricultural units	8.3	58.3	41.7
Disturbance from generated noise of the PSs	16.7	41.7	41.7
Risk of drowning in the new ponds	0	25	75

7.2.2.2. Other Concerns and Suggestions

The questionnaire also presented an opportunity for the respondents to add other issues of concern they may have in narrative format. They were also given the opportunity to propose suggestions in terms of mitigation measures, project component design and location, actions that might enhance the public participation process, or any other suggestion that in their point view might enhance the ESIA and the project. The following provides a summary of the main concerns that were raised by the participants:

- 58.3% of the respondents recommended to close the diverted segment of the canal due to the following:
    - To eliminate/reduce risk of illegal connections
    - To protect water resources
    - To reduce water losses
    - To protect the residents' health and safety
    - To stop drowning cases
- 41.6% of the respondents recommended to keep the canal open due to the following:

- to irrigate the 14.5 area (area beyond TO95)
- the canal can be used in winter and to divert flooding
- it can be a national heritage site that must be preserved and can be used in the future.

8. Impact Assessment and Mitigation Measures

8.1. During Construction

8.1.1. Physical Environment

8.1.1.1. Geology and Soil

Impacts

Soil quality and morphology might be disturbed from construction activities depending on its condition. Potential impacts including soil compaction and natural drainage blockage due to the movement of vehicles and workers on the site, and soil erosion as a result of topsoil layer removal, land preparation and vegetation stripping. This issue is significant especially where the ponds and conveyance pipeline will be installed along the wadis within the project area, which have natural bush vegetation and scattered orchards. Furthermore, improper disposal of solid waste, inappropriate discharge of wastewater and accidental spills (fuel, oil, chemicals) may have a negative impact on soil quality.

Soil could become polluted as a result of improper solid waste and wastewater disposal and accidental oil or chemical spills from the equipment used for the installation of the conveyance pipeline and the ponds.

Mitigation

Soil conservation measures to be adopted by the contractor include:

- Schedule construction activities to reduce the amount and duration of soil exposed to erosion by wind, rain, runoff and vehicle movement
- Preserve existing vegetation to the extent possible and ensure revegetation when possible
- Ensure stabilization of disturbed slopes
- Immediately remediate any localized erosion during excavation and drilling activities
- Prepare and abide by a **Spill Prevention and Management Plan**
- Abide by measures for proper disposal of wastewater
- Prepare and abide by **Waste Management Plan**

Summary of Impacts:

Parameter	Nature	Type	Magnitude	Extent	Duration	Reversibility	Likelihood	Significance
	Soil erosion							
Assessed Impact	A	D	M	L	S	I	M	M
Residual Impact	A	D	M	L	S	I	L	L
	Soil quality deterioration							
Assessed Impact	A	D	M	L	S	I	M	M
Residual Impact	A	D	M	L	S	I	L	L

8.1.1.2. Water Resources (Surface Water and Groundwater)

Impacts

Contamination of surface and groundwater may occur as a result of improper solid waste disposal, inappropriate discharge of wastewater, accidental oil and chemical spillages, and diversion of contaminated rainwater runoff from the project site. The improper management of the generated solid waste and wastewater along with the improper handling and storage of chemicals will likely contribute to surface water pollution. As for groundwater, although the aquifer system on most of the project area site is considered to be confined, thus providing a protective layer to the groundwater, the risk of contamination of groundwater is considered low.

While water is also needed for different processes in the construction activities, such as concrete mixing, cleaning of tools and the used machinery, dust suppression, ground works activities and for potential testing of the newly constructed supplies. The construction phase will also require the consumption of water for domestic usages by the workers. If conservation measures are not in place, water consumption at the construction site may thus be overused causing overexploitation of water resources.

Construction activities within the wadis, if not limited to the dry season, may cause disruption to the natural water flow and on sources of water for local people or livestock.

Mitigation

In an effort to reduce the project's impacts on water quality during construction, the contractor must implement the following mitigation measures:

- Prepare and abide by a **Spill Prevention and Management Plan**
- Abide by measures for proper disposal of wastewater
- Abide by **Waste Management Plan**
- Schedule works during dry season if possible
- Use of barriers or other measures to ensure sediments and other contaminants do not come into contact with or are transported off-site through run-off into nearby water bodies especially near wadis where natural water might flow during the wet season.

Several mitigation measures can be implemented by the contractor to reduce natural resource depletion and consumption. These measures include:

- Reduce water wastage whenever possible
- Whenever possible, use dry-cleaning instead wet cleaning
- Regular site inspection to detect water leakages
- Raise awareness among workers on water conservation measures

Summary of Impacts:

Parameter	Nature	Type	Magnitude	Extent	Duration	Reversibility	Likelihood	Significance
	Surface water quality deterioration							
Assessed Impact	A	D	M	R	S	I	M	M
Residual Impact	A	D	M	L	S	I	L	L
	Groundwater quality deterioration							
Assessed Impact	A	D	M	R	S	I	M	L
Residual Impact	A	D	M	R	S	I	L	N

	Overconsumption of water resources							
Assessed Impact	A	I	M	R	S	I	M	M
Residual Impact	A	I	L	R	S	I	L	L

8.1.1.3. Energy Resources

Impacts

Regarding energy consumption during the construction phase, this will mostly be from generators installed at the construction sites offices for energy supply and construction vehicles including for supply of construction material. Fuel and oils are needed for the generators and for operation and maintenance of machinery engines and vehicles on and off site. If generators and engines are left running without being used in any activity, overconsumption and depletion of fuel is expected. This impact will last for the duration of the construction works.

Mitigation

Several measures can be implemented by the Contractor to reduce energy consumption at the site. These measures include:

- Regularly maintain the generators, vehicles, and construction machinery
- Shut down lighting at site offices during the night
- Switch off machinery and equipment when not in use
- Raise awareness among site staff on energy conservation

Summary of Impacts:

Parameter	Nature	Type	Magnitude	Extent	Duration	Reversibility	Likelihood	Significance
	Overconsumption of energy resources							
Assessed Impact	A	I	M	L	S	I	M	M
Residual Impact	A	D	L	L	S	I	L	L

8.1.1.4. Air Quality

Impacts

The machinery and vehicles used during the construction phase will produce exhaust emissions and gases that can temporarily affect local air quality. Exhaust gas emissions will also result from the power generators that will be utilized during the construction phase. In general, these exhaust gases contain particulate matter, Benzene, Toluene, Xylenes, Ozone, Nitrogen Oxides, and Sulfur Oxides, Carbon Dioxide and Carbon Monoxide. In addition, VOC might be released from storage of fuel and other chemicals.

Excavation activities, site preparation, trenching, and other earthwork activities along with the movement and transportation of heavy machinery on the site, generate particulate emissions such as dust that can affect local air quality. The significance of dust emissions is highly dependent on the wind conditions during the construction phase. Open burning of solid waste or other material on site, if allowed, could release emissions accompanied by toxins.

The improper storage and disposal of solid waste along with the improper discharge of wastewater will lead to odour emissions.

In terms of GHG emissions, a separate report has been prepared and includes the GHGs calculations for the project, as well as recommendations for their reduction (**Annex 2**).

Mitigation

To minimize impact on air quality during construction, the Contractor should undertake the following activities:

- Implement the **dust suppression measures**.
- Regularly maintain all vehicles and construction machinery
- Prepare and abide by **Spill Prevention and Management Plan**
- Abide by measures for proper disposal of wastewater
- Abide by **Waste Management Plan**

Summary of Impacts:

Parameter	Nature	Type	Magnitude	Extent	Duration	Reversibility	Likelihood	Significance
	Air quality degradation							
Assessed Impact	A	D	M	L	S	I	M	M
Residual Impact	A	D	L	L	S	I	L	L

8.1.2. Biological Environment

Construction works of the intake, the settling tanks and the water conveyor are expected to be limited to the construction zone/corridor along the selected route and will likely have a construction corridor not exceeding 100 m. These activities are associated with the following impact categories that are described in the following subsections:

- Impact on local morphology and surface hydrology. This impact category is likely to include:
  - Habitat loss and fragmentation
  - Impact to natural water flow in the intermittent wadies and streams
- Pollution
- Disturbance – noise, vibration, lighting which may cause behavioural responses
- Hunting and active taking of wildlife pressure

8.1.2.1. Impact on Local Morphology and Surface Hydrology

During the construction phase, vegetation is expected to be cleared in a strip of 20 to 50 m along the conveyance route and to an area equivalent to the total area of the settling tanks and the ponds, while the construction corridor is expected to extend to about 100 m or less to accommodate the movement and operation of the construction machineries and workers along the route, and also expected to extend to up to few hundred square meters in the locations of the intake, settling tanks, above ground installations, and the construction camps.

Land works within the construction strip described above are anticipated to cause temporary, on some occasions prolonged, changes in local geo-morphological settings. These land works include cut, fill, accumulated piles of construction materials and waste, construction camps and storage areas, and many others.

Once construction of the conveyance is completed, permanent facilities (e.g., intake, settling tanks) and the ponds will be visible along the whole route. These installations and facilities are permanent features of the conveyance component, and will include several water dikes, ditches and culverts as needed to avoid obstructing natural stormwater / wadis intermittent floods from continuing its natural flow during the rainy season.

The clearance of vegetation and the above-mentioned land works are expected to disturb the surface hydrology. As mentioned earlier, the expected disturbance will be manifested in accelerated soil erosion especially at the depleted areas and changing the flow of surface runoff. Additionally, moving vehicles and equipment needed for construction will accentuated the abrupt of the surface hydrology.

Construction activities will result in permanent removal of vegetation and deleterious changes in the biological habitats within the construction zone, more specifically within the proposed plots for the settling tanks, the intake and the ponds. Temporary removal of habitat and vegetation covers is expected within the construction corridor, where machineries will use spaces for movement and parking, and where campsites and temporary service facilities will be established.

The magnitude of this impact is anticipated to be severe within sensitive habitats located along the route. TTH2 is the most important section, followed by TTH1 and also the main wadis along the pipeline route. Species like carnivores and other endangered species will be affected.

The removal of vegetation will be temporary throughout the route, except at the locations of the permanent facilities where the impact will be in the form of permanent habitat loss. More specifically:

- Accumulation of excavated material and litter will result in removal of native vegetation (temporary, until completion and restoration).
- Alteration of surface morphology and drainage paths (especially within the TTH2 and TTH1 sections) will result in temporary loss of habitat at the construction sites, and temporary degradation of habitat downstream the construction areas.
- Ground clearance resulting in the removal of native vegetation and tree stands most importantly in the before mentioned TTH2 and TTH1.

Upon completion of the construction activities, habitat alteration or loss of habitat for native species can be caused in the following cases as residual impacts:

- If the construction sites and natural water flow are not effectively restored to its natural or near natural condition, then the above impacts will turn into permanent impacts. This particularly concerns the habitat and wetland wadi systems, drainage paths and biological habitat within the TTH2 and TTH1, and the agricultural habitat along the rest of the route.
- Upon completion, prominent features (i.e., Settling tanks, intake, ponds and abandoned piles of construction waste and materials) could preclude linkages and movement corridors
- Alteration of surface morphology and drainage paths will result in temporary loss of habitat at the construction sites (or permanent if not restored after completion of the construction activities, especially for the section which will witness substantial reduction in natural water flow cause by project operations), and temporary degradation of habitat downstream the construction areas (also can be permeant if natural water flow is not restored).

The wadis along the being assessed conveyance are fragile ecosystems. The biotic components of these wadies are dependent on the running floodwater after rainfall events. Therefore, disturbance of the natural flow of floodwater and surface runoff are expected to cause drastic effects on the flora and fauna in these wadies. The potential impacts include:

- Loss of biodiversity.
- Disruption of the natural flow of the floods in the wadis.
- Soil erosion.
- Disruption of farming along the route and in the wadis.

The magnitude of such impacts is assessed to be high at TTH2, Moderate at TTH1, and Low to Moderate along the remaining sections of the route. The likelihood is assessed to be high before the implementation of adequate mitigation measures. Accordingly, the overall intensity of the above listed impacts is assessed to be high and it is likely to extend, mostly due to possible miss management or none-compliance with best practices, beyond 100 meters radius (local extent).

Regarding the duration of impacts, it is understood that the proposed facilities will be permeant, and therefore, the impacts will be permeant within the construction footprint (i.e., constructed facilities, and ponds and along the wadies which will witness reduction in natural water flow at TTH1 and TTH2). Hence, the

duration will be short term for the rest of the construction zone, and these sites will be rehabilitated after the completion of the construction activities. Accordingly, the overall impacts significance before the application of any mitigation measures is assessed to be high and will be confined to the site.

Mitigation

Through the following mitigation measures, it is expected that the intensity of the above listed impacts will be confined and prevented from extending beyond the construction footprint. Therefore, the significance of the residual impact terrestrial biodiversity is expected to be avoided or at least minimized to acceptable low levels. The proposed mitigation measures include:

- **Conserving natural landscape and natural resources.** During the construction phase, the contractor should apply maximum care not to conduct unnecessary damage to the local landscape and natural resources beyond the determined construction footprint (i.e., the route of the pipeline, the planned facilities and above ground installations). Only, where the clearing is required for permanent works, for approved construction activities and for excavation operations, local geomorphology, natural drainage systems and natural vegetation must be conserved and protected from the damage that might result from the construction activities. Changing the morphology, the local drainage systems, in addition to flora demolition should be prohibited outside the proposed project construction zones and corridor. Furthermore, dumping solid wastes in the wadi crosses should be prohibited.

  Reduction measures are also proposed to control and confine the anticipated impacts from the project on the natural landscape, geomorphology and natural resources. This particularly concern minimizing land levelling and destruction of existing habitat by identifying early machinery movement routs and excavated material accumulation areas.

  As for **rehabilitation measures**, and after work completion, all work areas should be rehabilitated, smoothed and graded in a manner to confirm the natural appearance of the surrounding landscape. The restoration option is upon incidence of impact and mainly directed to:

  - Restore as possible changing surface morphology to maintain natural water flow and to avoid soil erosion.
  - All work stations and workers camps should be rehabilitated to its original condition, and that the contractor should be responsible on achieving this issue.
  - Ensure use of local natural vegetation and avoid the introduction of exotic and/or invasive species in the landscaping of the site.
- **Installing and operating appropriate wastewater collection and management system**
- **Implement spill prevention and management plan**
- Develop and implement a **Solid Waste Management Plan**
- **Noise Control**. In order to control the expected high noise levels during the construction phase, working night shifts should be prohibited or at least reduced as much as possible.
- Restoration of the areas used as temporary storage grounds should be applied immediately after the completion of the construction activities.

Summary of Impacts:

Parameter	Nature	Type	Magnitude	Extent	Duration	Reversibility	Likelihood	Significance
	Impact on local morphology and surface hydrology							
Assessed Impact	A	D	H	L	P	R	H	H
Residual Impact	A	D	M	S	P	R	M	M

8.1.2.2. Pollution

The pollution sources during the construction phase include, but not necessarily limited to, leaks from construction machineries, stock and materials storage, wastewater generated by the work force, liquid waste generated from the routine and emergency maintenance and serving of construction machineries, and other fluid materials used during the construction phase.

Leakages of fluid waste and accumulation of solid waste will cause water and soil pollution. Consequently, this will affect the flora and fauna. During the construction and operation phases emissions and air pollutants are expected to be generated by the construction machineries. The major direct pollutant species present in emissions are:

- Carbon monoxide (CO): a product of incomplete burning of fuel.
- Hydrocarbons (HC): incomplete burning or evaporated fuel or solvents, produced by mobile sources.
- Nitrogen oxides (NOx): products of high-compression internal combustion engines.
- Sulfur oxides (SOx): product of the burning of sulfur- rich fossil fuel, particularly coal with minor emissions from motor vehicles.
- Particulates: mostly carbon particles much like soot.
- Lead: the result of burning leaded gasoline.

The occurrence of pollution and its magnitude depends on the management performance, commitment and implementation of effective mitigation measures and as will the quality of the used machineries. The magnitude of this impact has also much to do with the site of occurrence, for instance if close to flood area during the flood season.

Another possible source of pollution is the accumulation and improper management of waste from work force and camps. These stressors are likely to cause contamination to the biological habitat at the construction sites and would consequently cause deleterious impact on wildlife (habitat, flora and fauna).

The magnitude of such impacts is anticipated to be moderate to high, and controllable. The likelihood of occurrence is directly related to contractor management performance and compliance with the best practices and the set mitigation measures. It is assessed herewith following conservative approach as high potential. Accordingly, the overall intensity of the above listed impacts is assessed to be high and it is likely to extend, mostly due to possible miss management or none-compliance with best practices, beyond 100 meters radius (local extent).

Regarding the duration of impacts, it is assessed to be short term, and these sites will be rehabilitated after the completion of the construction activities. Accordingly, the overall impacts significance before the application of any mitigation measures is assessed to be low, and will be confined to the site.

Nevertheless, through the proposed mitigation measures, it is expected that the intensity of the above listed impacts will be confined and prevented from extending beyond the construction footprint. Therefore, the significance of the residual impact terrestrial biodiversity is expected to be avoided or at least minimized to acceptable low levels.

Mitigation

The mitigation measures discussed in above section to mitigate identified possible impacts to the local morphology and landscape also applies for pollution impacts. Most importantly those designed to address:

- Applying appropriate solid waste collection and management system
- **Installing and operating appropriate wastewater collection and management system**
- **Implement spill prevention and management plan**

Parameter	Nature	Type	Magnitude	Extent	Duration	Reversibility	Likelihood	Significance
	Pollution							

Assessed Impact	A	D	H	L	S	R	H	H
Residual Impact	A	D	L	S	S	R	M	L

8.1.2.3. Disturbance – Noise, Vibration, Lighting

Ambient noise is the total noise composed of all natural and human –made noise sources considered as part of the acoustical environment of the general area. It is expected that the construction of the conveyance system and as its operation will generate noise, vibration and lighting.

Noise, especially during the breeding season of animals and birds, will cause disturbance to breeding species. In some cases, it might force abandoning nests or offspring. The sections most affected by this impact are expected to be TTH2 and TTH1.

Vibration caused by the movement of heavy machinery is expected and will frighten birds and animals in the area, thus they will escape to other areas. The magnitude of this impact can be more serious during the breeding seasons.

Lighting is expected if construction activities proceed during the night. Lighting might force nocturnal species to escape; however it is expected to attract night migrant birds during the migration periods.

The magnitude of such impacts is anticipated to be high, and controllable. Lighting at night should be avoided. The probability of occurrence is directly related to contractor management performance and compliance with the best practices and the set mitigation measures. It is assessed herewith following conservative approach as high potential. Accordingly, the overall intensity of the above listed impacts is assessed to be high.

Regarding the duration of impacts, it is assessed to be short term. With regard to extent, it is likely to extend, mostly due to possible miss management or none-compliance with best practices, beyond 100 meters radius and less than 5 kms radius (local extent) beyond which the impacts are negligible. Accordingly, the overall impacts significance before the application of any mitigation measures is assessed to be low and will be confined to the site.

The significance of the residual impact on terrestrial biodiversity is expected to be avoided for lighting impacts and minimized to acceptable moderate or low levels for the noise impacts.

Mitigation

The mitigation measures include:

- Avoid night shifts and avoid unnecessary lights at the construction camps
- Use construction machineries with lowest possible noise generation, at least at the specified biodiversity sensitive habitats at TTH2 and TTH1.

Summary of Impacts:

Parameter	Nature	Type	Magnitude	Extent	Duration	Reversibility	Likelihood	Significance
	Disturbance and Noise							
Assessed Impact	A	D	H	L	S	R	H	H
Residual Impact	A	D	M	L	S	R	H	L
	Lighting							
Assessed Impact	A	D	M	L	S	R	M	M
Residual Impact	A	D	L	L	S	R	L	N

8.1.2.4. Hunting and Active Taking of Wildlife

Legal and illegal collection of woods and hunting of birds and animals can be noted in many areas in Jordan. Legal hunting is being practiced by licensed hunters in pre-defined hunting seasons and with well-established bag limits in many locations west of the existing Hijaz Railway; nevertheless, hunting is not legal east of Hijaz Railway. Illegal hunting occurs east of the Hijaz Railway, or west of the railway out of the permitted seasons. Exceeding bag limits is also illegal. Hunting is not allowed in any sort in protected areas in the country. Most if not all protected areas in the country, were known to be very popular sites for hunting before being declared as protected areas.

Law enforcement and monitoring of hunting and active taking of animals is conducted year-round by the Royal Rangers (Administration for Environment Protection) and the rangers of the Royal Society for the Conservation of Nature. Caught violations to the hunting law and related regulations are subject to legal actions as governed by related hunting legislation.

Presence of venomous snakes and scorpions may cause stings and bite accidents among workers during construction phases. The workers are expected to indiscriminately kill any observed snake or scorpion at sight to avoid possible stings and health risks. This is most anticipated at the construction camps.

It is anticipated to have incidents of active taking of live animals and birds and shooting of wildlife, in particular near water bodies and in vegetated habitats, which will be a violation of the hunting regulations. It is also anticipated that collection of wood will take place by the construction workers. This impact is expected to occur during the construction and operation phases.

The magnitude of this impact is dependent on the contractor's compliance with the best practices and ESIA mitigation measures, and the enforcement of strict mitigation measure like strict prohibition off-road divining, strict prohibition of shooting and active taking of animals and birds, active enforcement of relevant hunting regulations in addition to other measures. The assessment of the magnitude following conservative approaches assumes the magnitude to be high, and the probability to be moderate. The duration is assumed to be short term and the extent to be local.

Mitigation

In addition to what stated above as mitigation measures, the following actions should be strictly adhered to in order to mitigate the project anticipated impacts on the biological environment:

- Avoid and strictly prohibit wildlife persecution, hunting, and all forms of animal and plant collection and active taking.
- Strictly prohibit tree cutting by the project staff and workers and apply fines and charges on none-compliance by the staff.
- Design and implement an extensive terrestrial biodiversity monitoring program as part of project requirements to assess environmental conditions before, during, and after the completion of the construction works so that the 'new' baseline conditions before operation commences are determined. Please refer to above sections on the monitoring program for other impacts which shall be the same for this impact as will.

Summary of Impacts:

Parameter	Nature	Type	Magnitude	Extent	Duration	Reversibility	Likelihood	Significance
	Hunting							
Assessed Impact	A	D	H	L	S	I	M	M
Residual Impact	A	D	L	L	S	I	L	L

8.1.3. Socio-economic Environment

8.1.3.1. Economic Activities

Impacts

Construction of the conveyance pipeline and the ponds are considered an economic opportunity for the selected contractor and their subcontractors. Local businesses may also benefit from construction activities through selling raw materials, equipment, machinery and goods. In addition, the project will create jobs for the local community with varying skill requirements. The presence of workers within the communities could increase local business opportunities. This impact is, however, temporary and jobs will be discontinued as soon as construction works are complete.

In addition, as a result of the excavation works in the towns, surrounding businesses and visitors using common roads may be disrupted.

Mitigation

The Contractor should implement the following:

- Transparent recruitment procedure
- Local hiring and skills development strategy to encourage local employment and manage expectations

As a mentioned earlier, surrounding businesses and visitors using common roads may be disrupted during construction phase. As such the Contractor must ensure that excavation works in the concerned towns are not blocking access to local businesses by owners and visitors. This can be done by:

- Install temporary structures from the road where pipe laying is being done to local businesses
- Inform local businesses owner about construction activities and schedule
- Proper communication and coordination with affected owners

Summary of Impacts:

Parameter	Nature	Type	Magnitude	Extent	Duration	Reversibility	Likelihood	Significance
	Creation of job opportunities and increase local business							
Assessed Impact	B	D	M	L	S	R	M	M
	Disruption to surrounding local businesses							
Assessed Impact	A	I	M	L	S	R	M	M
Residual Impact	A	I	L	L	S	R	L	L

8.1.3.2. Social Tension

Impacts

Social tensions may arise, if a significant portion of job opportunities are offered to foreign workers recruited for the Project, as Jordanian workers may perceive that such job opportunities could have been filled by them. Social tensions between national and foreign workers may also arise if they are not equally compensated as per the scale of market price rates. Moreover, social interactions between workers living in camps and the surrounding communities can cause culturally insensitive behaviour, relationships and incidents.

Potential recruitment of minors in hazardous tasks might also occur during the construction phase, as well as discrimination between genders during recruitment procedure.

Mitigation

The following mitigation measures should be implemented in an effort to reduce and eliminate social tension between workers and local community to the extent possible:

- Draft a Code of Conduct for workers

- Ensure that workers sign Codes of Conduct
- Respond to culturally insensitive behaviors and incidents as a matter of priority

Summary of Impacts:

Parameter	Nature	Type	Magnitude	Extent	Duration	Reversibility	Likelihood	Significance
	Social tensions							
Assessed Impact	A	I	M	L	S	I	M	M
Residual Impact	A	I	L	L	S	I	L	L

8.1.3.3. Land Use/Land Cover and Aesthetics

Impacts

Construction of the ponds will change the land use of the existing sites especially for Pond 3 since it is currently cultivated while the installation of the conveyance pipeline may cross different types of lands such as empty virgin lands, rocky lands, or agricultural lands that may experience a change in land use. Some of the land where the conveyance and the ponds will be located are private land that are used for agricultural or grazing activities. These activities are considered as a source of income for the landowners. As such, land acquisition will economically affect the landowners. In addition, visual intrusion due to the presence of construction activities is expected especially near residential areas and those using the area for recreational activities.

Mitigation

All lands in the project area of the PSs shall be acquired and compensated according to the Jordanian Land Acquisition Law No. 12 for 1987 and its amendments and EIB Standard 6 for Involuntary Resettlement. Furthermore, the following must be implemented to mitigate the impacts of visual intrusion due to the presence of construction activities on site, especially near residential areas:

- Install adequate fencing around construction sites
- Organize stock piling scheduling works to minimize the construction area

Summary of Impacts:

Parameter	Nature	Type	Magnitude	Extent	Duration	Reversibility	Likelihood	Significance
	Land acquisition impact on owners							
Assessed Impact	A	D	M	L	P	I	H	M
Residual Impact	A	D	L	L	P	I	H	L
	Negative aesthetics at active construction sites							
Assessed Impact	A	I	M	L	S	R	M	M
Residual Impact	A	I	L	L	S	R	L	L

8.1.3.4. Infrastructure and Public Services

Impacts

As part of the conveyance pipeline crosses residential areas, temporary disruption or disturbance to local road networks and services provided within the vicinity of the sites such as the electricity network, water supplies and telecommunication services might occur as a result of the excavation works.

During construction, the use of public utilities such as water supply and waste disposal for construction activities and by workers is likely to be limited but is still expected to result in minor and temporary pressures on these systems.

Mitigation

During construction, the contractor should plan and coordinate with local authorities including the relevant municipalities, Balqa Governorate, and local police to avoid disruption to utilities and underground infrastructure. In addition, a detailed investigation of existing and planned underground pipes and cables should be undertaken prior to construction commencing through a cooperation with utility and telecommunications companies.

A work procedure should be developed including detailed method statements from the contractor prior to site activities taking place. Moreover, this issue must be considered within the emergency preparedness and response plan to describe measures to be taken if unforeseen disruptions occur such as damage to water pipes or electricity lines.

Summary of Impacts:

Parameter	Nature	Type	Magnitude	Extent	Duration	Reversibility	Likelihood	Significance
	Disturbance of public infrastructure services							
Assessed Impact	A	D	M	L	S	R	M	M
Residual Impact	A	D	L	L	S	R	L	L
	Use of public utilities							
Assessed Impact	A	D	M	L	S	R	M	M
Residual Impact	A	D	L	L	S	R	M	L

8.1.3.5. Traffic

Impacts

A short-term increase in the amount of traffic is expected to occur within the project area. In fact, the construction activities require the transportation of materials and equipment carried by trucks and large vehicles thus leading to traffic congestion. In addition, the closure of certain roads/lanes may also lead to traffic congestion. Furthermore, there is a risk of materials falling from vehicles during transportation potentially causing accidents and leading to disruption in traffic.

Mitigation

The contractor should develop and abide by a **Traffic and Transport Management Plan** that would ensure smooth traffic along the local road network especially in residential areas. In addition to proper warning signs, a worker should be positioned on the road near an active construction area to warn the passing cars and ensure the traffic is not blocked. If blocking a road is necessary, an alternative route should be clearly marked. The contractor should also ensure that any material transported by trucks is well covered along transportation.

Summary of Impacts:

Parameter	Nature	Type	Magnitude	Extent	Duration	Reversibility	Likelihood	Significance
	Traffic congestion							
Assessed Impact	A	D	M	L	S	R	M	M
Residual Impact	A	D	L	L	S	R	L	L

8.1.3.6. Health and Safety

Impacts

During the construction phase, the local community may be exposed to several health and safety risks due to excavation works and the presence of heavy machineries onsite, especially near residential and recreational areas. Construction activities generate high levels of dust and noise causing nuisance and health problems to the residents that are in close proximity to the construction sites. Moreover, in the area where the conveyance pipeline will be installed along existing roads, activities associated with the installations might lead to road closure or narrowing the original width of the road, thus increasing traffic volumes to and from nearby towns. Increased traffic volumes can result in traffic accidents and injuries to the local community that use these roads.

Accidents and injuries to workers may be caused from several construction activities including site preparation and excavation works. This might lead to transportation accidents, falls, electric shock, mishandling of machinery and other construction related accidents. For example, the high noise generated from the machinery could damage the hearing of the workers and dust generation from the different construction activities. Movement and transportation may cause respiratory problems for workers on site if appropriate personal protection equipment is not being used. In addition, natural environmental challenges such as extreme cold conditions, heat stroke or snake bites might cause health problems to onsite workers.

There are also risks of injuries to workers from accidents with public and private vehicles which are driving near construction sites. Without effective barriers and safety signs in place, there are risks of vehicles driving into construction areas such as into excavated trenches. Furthermore, there is a risk of spreading diseases between workers on site or at worker camps such as transmission of COVID-19.

Mitigation

The contractor shall be responsible for the protection of public health from any danger associated with construction activities, the safe and easy passage of pedestrians and traffic management within project area. Therefore, a **Health and Safety** plan should be developed and implemented, in addition to a **Site Security Management Plan**

To protect the rights of workers, the contractor should adopt human resource policies and procedures that are in accordance with national laws and the International Labour Organisation's Core Labour Standards to which Jordan is a signatory. The contractor should ensure the workers' health and safety against possible accidents and injuries as a result of different construction activities. As such the following mitigation measures should be incorporated into the Health and Safety Plan and implemented:

- Workers should wear personal protective equipment (PPE) including hard hats, safety glasses, slip resistant boots, and masks;
- First aid kit should be available at each working site;
- At least one onsite worker trained in basic first aid should be present onsite. If number of workers in one site exceeds 100, appoint a full-time nurse;
- Chemicals stored onsite should be labelled and handled properly;
- All electrical tools and equipment should be maintained and checked regularly for any defect;
- The contractor shall conduct training and awareness meetings including safety toolbox talks, correct use of PPE, health and safety procedures, and handling hazardous material containers and related wastes.

Regarding preventing the spread of Covid-19 among construction workers, the contractor should adopt the following measures (if still applicable), as per the guideline published by Ministry of Labour of Jordan regarding prevention procedures during construction projects:

- Raising awareness of the recommended measures to prevent the spread of Covid-19 by providing easily available educational materials;

- Cleaning and sterilising work sites, housing, bathrooms, kitchens, buses, and others frequently used locations daily;
- Distributing masks to all employees/ workers; and
- Temperature tests for all workers before site entrance, during work and upon leaving.

Summary of Impacts:

Parameter	Nature	Type	Magnitude	Extent	Duration	Reversibility	Likelihood	Significance
	Health risks from the generated dust and noise							
Assessed Impact	A	D	M	L	S	I	M	M
Residual Impact	A	D	L	L	S	I	L	L
	Traffic accidents and injuries							
Assessed Impact	A	D	H	L	S	I	M	H
Residual Impact	A	D	M	L	S	I	L	L
	Worker health and safety							
Assessed Impact	A	D	H	L	S	I	M	H
Residual Impact	A	D	M	L	S	I	L	L

8.1.3.7. Noise

Impacts

Sources of noise during construction include excavators, generators, concrete mixers and other construction machinery and vehicles. These equipment and machinery are used for the installation conveyance pipeline and the ponds within the study area. Increased noise levels during construction can be a source of nuisance to local residents, especially in populated areas. In addition, increased noise levels might be a source of disturbance to wildlife including animals and birds that use the project area for foraging and breeding. Moreover, these increased noise levels could potentially cause hearing impairment and other health problems to the construction workers. Noise levels are highly dependent on the extent and duration of the construction activities and are temporary and specific to the construction phase.

Due to high variability, estimation of noise generated from construction activities is difficult. The noise generated during the construction phase depends on specific activities and equipment. Some activities could be continuously generating noise, whereas others are momentary. Table 8-1 shows the typical noise levels from various equipment used for construction activities, some of which will be deployed during the construction phase of the Project.

Table 8-1: Typical Noise Emissions from Construction Equipment [33]

Equipment	Capacity/type	SPL at 20-30 m (dB)
Concrete pump on truck	120 m^3/hr, 40 m boom	70
Concrete truck mixer	10 m^3	70
Mobile compressor		70
Crawler cranes		70

[33] COWI, "EIA for the New Port Project, Doha," 2011.

Equipment	Capacity/type	SPL at 20-30 m (dB)
Excavator with bucket		75
Diesel Generator set	2500 kvA, 11kv	75
Water sprinkler truck	20 m^3	75
Tipper truck	16 m^3	75
Single drum compactor	10 t	80
JCB	3X	80
Bull Dozer 80 dB	CAT D9	80
Rebar yard	shear line normal / multiline	85
Welding machine	Semi-auto COMMERCY	85
Bending machine	Robot smart future	85

Mitigation

Noise mitigation measures can be summarized as follows:

- Schedule noisy operations at the same time whenever possible to reduce the high noise periods
- Maintain noise levels within permissible limits of Instruction for Reduction and Prevention of Noise for 2003 when using major construction equipment
- Schedule high noise activities (drilling, excavation) during daytime
- Place noisy equipment and generators as far as possible from working and residential areas
- Install noise insulators around the stationary noise sources including generators and pumps (if required)
- Use temporary noise insulators and barriers (plywood barriers) in residential areas
- Switch off the equipment when not in use for long periods
- Regularly maintain all noisy equipment and machinery
- Abide by **Traffic and Transportation Management Plan**

Summary of Impacts:

Parameter	Nature	Type	Magnitude	Extent	Duration	Reversibility	Likelihood	Significance
	Noise generation							
Assessed Impact	A	D	M	L	S	R	H	M
Residual Impact	A	D	L	L	S	R	M	L

8.1.3.8. Solid and Hazardous Waste Management

Improper solid waste disposal and inappropriate discharge of wastewater could lead to various detrimental environmental impacts including pollution of water and soil resources within and beyond the project area. A detailed description of the sources of wastewater and solid waste during project construction.

Impacts

8.1.3.8.1. Solid Waste

A large amount of solid waste will be generated from the implementation of the proposed project, including wood piles of sand and dirt due to excavation, debris, cement and their resulting empty bags. In addition, domestic waste will be generated from workers onsite. Inappropriate waste handling and improper disposal

practices of construction waste may result in soil, ground and surface water contamination due to leaching and runoffs, leading to a reduction in overall soil and water quality. In addition, these materials could be directly discharged into nearby wadis within the project area thus polluting surface water especially during the wet season.

8.1.3.8.2. Construction Wastewater

Major construction activities that lead to the generation of wastewater include:

- Washing of machinery;
- Concrete mixing;
- Maintenance of heavy machines and vehicles that generates wastewater contaminated with oil and grease;
- Excavation of the site thus generating runoffs contaminated with suspended solids, especially during rainy days;
- Storm water runoff that contains high amounts of oil, grease and suspended solids

This wastewater may pollute nearby water bodies and soils if not discharged and managed properly.

8.1.3.8.3. Domestic Wastewater

The implementation of the proposed project will require a high number of daily workers who will generate a significant amount of domestic wastewater. Disposal of the generated domestic wastewater may cause water and soil contamination if not disposed appropriately

Mitigation

To ensure that generated solid waste and wastewater during the construction phase do not have a negative impact on the surrounding environment, the following measures should be adopted by the Contractor:

- Prepare and abide by a **Waste Management Plan**
- Ensure that constructed septic tanks during the construction phase are well contained and impermeable to prevent leakage of wastewater into soil and groundwater; and ensure that septic tanks are emptied and collected by wastewater contractor at appropriate intervals to avoid overflowing
- Coordinate with JVA to hire a private contractor for the collection of generated wastewater from the site to an authorized WWTP, such that the tankers must have a GPS system installed to track their movement
- Prohibit illegal disposal of wastewater to land
- Maintain records and manifests that indicate volume of wastewater generated onsite, collected by contractor, and discharged into authorized WWTP. The numbers within the records are to be consistent to ensure no illegal discharge at the site or other areas.

Summary of Impacts:

Parameter	Nature	Type	Magnitude	Extent	Duration	Reversibility	Likelihood	Significance
	Waste and wastewater generation causing pollution							
Assessed Impact	A	D	M	L	S	R	M	M
Residual Impact	A	D	M	L	S	R	L	L

8.1.3.9. Cultural Resources

Impacts

None of the listed archaeological sites within this zone are located near areas where project excavation or construction activities will occur. As such, no adverse impacts on such cultural heritage and archaeological sites and resources are expected to occur during the installation of the intake, settling basins, conveyance pipeline or the ponds. However, due to the presence of archaeological sites within the area, unknown artifacts may be uncovered during the excavation activities.

In addition, construction activities considered to be a source of vibration and dust resulting from the drilling operations vehicles movements that may affect nearby sites.

Mitigation

Mitigation measures for the impacts on archaeology and cultural heritage during construction include the following:

- Ensure all chance finds of cultural heritage (e.g. graves, old ceramic, old building fragments) are reported immediately to DoA, excavation stopped, and contractor awaits instructions from DoA.
- Ensure coordination between the Contractor and DoA
- Prepare and abide by **Spill Prevention and Management Plan**
- 15 m buffer zone around each site

Parameter	Nature	Type	Magnitude	Extent	Duration	Reversibility	Likelihood	Significance
	Damage to sites of historical importance							
Assessed Impact	A	I	M	L	S	R	M	L
Residual Impact	A	I	M	L	S	R	L	N

8.2. During Operation

8.2.1. Physical Environment

8.2.1.1. Geology and Soil

Impacts

Accidental spills from fuel, oil and other chemicals used for maintenance and operation of the conveyance pipe or the PSs may occur due to irregular maintenance and inadequate monitoring of storage tanks. Thus, accidental chemical spills and leakages could negatively affect soil. Improper disposal of solid waste generated at the pumping stations will also lead to soil pollution.

Mitigation

The following mitigation measures should be implemented in order to prevent the adverse effects of fuel spills on the soil:

- Regularly maintain PSs
- Develop contingency plan in case of malfunctioning of PSs
- Develop and adopt a **Spill Prevention and Management Plan**

Summary of Impacts:

Parameter	Nature	Type	Magnitude	Extent	Duration	Reversibility	Likelihood	Significance
	Soil and water pollution from improper maintenance activities							
Assessed Impact	A	I	L	L	L	R	L	L
Residual Impact	A	I	L	L	S	R	L	N

8.2.1.2. Water Resources (Surface Water and Groundwater)

Impacts

As mentioned previously, the total water losses for the Southern KAC as estimated in this study were 38.1% of the maximum flow, allocated between 14.5% being constant/seepage, 23.0% being unmetered/illegal uses, and 0.6% being evaporation. Under this project, water saving has been estimated to reach around 15 – 20 MCM. Thus, the operation of this project will increase and enhance domestic fresh water supply and decrease the pressure on groundwater resources in the country.

Summary of Impacts:

Parameter	Nature	Type	Magnitude	Extent	Duration	Reversibility	Likelihood	Significance
	Water saving							
Assessed Impact	B	D	L	R	L	R	H	H

8.2.1.3. Energy Resources

Impacts

One of the main aims of the project is to improve energy efficiency of the KAC system. By eliminating 5 pumping stations from KAC-S, the project will reduce this section's energy consumption by an estimated 63%.

Mitigation

The following mitigation measures should be implemented to enhance this energy saving throughout the lifetime of the project:

- Regular maintenance of generators to ensure that they are functioning in an efficient way.
- Use eco-friendly light bulbs in the offices
- Raise awareness of operators on energy consumption reduction practices.

Summary of Impacts:

Parameter	Nature	Type	Magnitude	Extent	Duration	Reversibility	Likelihood	Significance
	Reduction in Energy Consumption							
Assessed Impact	B	D	L	R	L	R	H	H

8.2.1.4. Air Quality

As mentioned above, the project will reduce energy consumption and accordingly, reduce GHG emissions. **Annex 2** the GHG calculations for the project presents these savings and proposes measures to enhance them.

8.2.2. Biological Environment

Impacts

The sections at TTH1 and TTH2 are anticipated to witness substantial reduction in the volume of water inflow into it which will be at least equivalent to the abstracted volumes to be diverted into the settling tanks and accordingly into the conveyance system. This reduction is anticipated to cause adverse/negative direct impacts on the wetland ecosystem and biodiversity with the section, and these impacts are assessed to be of high significance.

It is important to note that the impacts will first be in the form of reduction in water budget available to the ecosystem, which will then cause gradual reduction in the wetland habitat (loss of habitat), and consequently will also result in loss of species diversity, noting that the impact will be more severe on the identified threatened species. Such impacts are also cumulative, as drought conditions, climate change and changes in the amount of water intake from the water regime into the water conveyance system will altogether cause the same impacts.

These impacts are naturally reversable, and such reversibility is directly linked to maintaining natural water follow (quantity and quality wise) and maintain the land character as per its natural condition. Hence, noting the objectives and aims of the subject project, such reversion is not anticipated in at least the short or medium terms.

Given the information available to date, it is difficult to assess residual impacts as the project will commence and continue water taking from the system to be pumped through the conveyance system downstream the valley. It is not clear how much water will continue to run through the indicated high biodiversity value section, and how much biodiversity value would the new (i.e., post project) water flow characteristics would maintain through this section.

Mitigation

In order to mitigate the project anticipated impacts on the biological environment, the following protection and monitoring measures should be implemented:

- Avoid the removal of native tree community and translocation of those unavoidable ones (if applicable) in coordination with related authorities including the Ministry of Agriculture, the Ministry of Environment and local municipalities.
- Avoid and strictly prohibit wildlife persecution, hunting, and all forms of animal and plant collection and active taking.
- Avoid introduction of pets.
- Avoid unnecessary burning and accumulation of waste.
- Design and implement an extensive terrestrial biodiversity monitoring program as part of project requirements to assess environmental conditions before, during, and after the completion of the construction works so that the ‘new’ baseline conditions before operation commences are determined. The Monitoring Program is a research program to develop the tools necessary to monitor and assess the environmental settings status and trends in response to the different project activities. Also, it is necessary to assess the project performance against the desired mitigation measures, and compliance with the regulations and standards in order to protect people health and safety, and the environment health and performance. Monitoring activities should be applied to direct monitoring indicators whenever applicable, indirect indicators can be monitored instead of direct ones whenever it would provide acceptable indication to the impact occurrence and/or performance non-conformance. Such monitoring programme should include:
    a. **Conducting pre-construction bassline survey:** to be conducted detailed biodiversity field survey (aquatic species, flora, birds and mammals) in the spring season before the commencement of the project construction activities with focus on sections TTH1 and TTH2.
    b. **Conducting site inspection.** To be conducted on daily basis to monitor all construction activities according to the prepared construction schedule from an environmental point of view. Authorized representatives from the related government authorities and the

responsible municipalities should have a free passage and access to all parts of the project and at all times.

c. **Terrestrial biodiversity monitoring**. The frequency of monitoring is mostly periodical (preferably every three months) combined with Annual Auditing. The following are the biological environment monitoring indicators and responsibilities:
   - **i.** Maintained pre-project land utilization and access
   - **ii.** Maintained natural conditions of the habitat and geomorphology, and occurrence of habitat deterioration
   - **iii.** Monitor of key herpeto-faunal, avifaunal and mammalian species, with emphasis on threatened species and identified flagship species.
   - **iv.** Hunting is banned, accidental kills of wildlife are minimum
   - **v.** Breeding seasons are undisturbed
   - **vi.** Monitor workers bites by venomous snakes and scorpions, parasitic infections and other epidemiological accidents

8.2.3. Socio-economic Environment

8.2.3.1. Economic Activities

Impacts

Once the project is implemented, permanent job opportunities will be created for operation of the pumping stations, settling tanks and ponds and may be beneficial to the local population. Operation of the project requires the employment of skilled technicians, professionals and security guards.

Mitigation

The Project Operator shall develop and implement a Labour and Employment Plan relevant to operation activities including adopting a transparent recruitment procedure and a local hiring and skills development strategy to encourage local employment and manage expectations.

Summary of Impacts:

Parameter	Nature	Type	Magnitude	Extent	Duration	Reversibility	Likelihood	Significance
	Creation of job opportunities							
Assessed Impact	B	D	L	L	L	R	M	L

8.2.3.2. Land Use/Land Cover and Aesthetics

Impacts

The installation of the conveyance pipeline and diverting part of the flow may dry part of the southern KAC. In case the diverted part of the canal was not closed, this would result in nuisance and safety risks for residents due to random littering and falls. Regarding the PSs, settling basins and ponds, a permanent change in the land use/land cover will take place potentially slightly lowering the value of the surrounding lands.

Mitigation

To mitigate negative impacts resulting, the following measures are required:

- Close the part of the canal related to the project (diverted segment)
- Maintain cleanliness within the PS, settling basins and ponds sites
- Fence and screen PS, settling basins and Ponds sites with green belt to muffle any residual noise generation

Parameter	Nature	Type	Magnitude	Extent	Duration	Reversibility	Likelihood	Significance

	Risks to local community due to the dry part of the canal							
Assessed Impact	A	D	M	R	P	I	H	H
Residual Impact	A	D	L	R	P	I	L	L
	Change in land use resulted from the PSs, settling basins and ponds							
Assessed Impact	A	D	H	L	S	I	M	M
Residual Impact	A	D	M	L	S	I	L	L

8.2.3.3. Infrastructure and Public Services

Impacts

The operation of the project will positively affect water services quality due to the reduction in water losses and illegal connections and increasing the supply of domestic water. The project will also improve reliability of irrigation water supply and decreasing operational costs due to the reduction in number of pumping stations.

Summary of Impacts:

Parameter	Nature	Type	Magnitude	Extent	Duration	Reversibility	Likelihood	Significance
	Abandon of water losses and illegal connection							
Assessed Impact	B	D	M	R	P	I	H	H

8.2.3.4. Health and Safety

Impacts

There is a potential for worker exposure to risks of accidents, injuries and health impacts associated with operating the settlings basins, ponds and pumping stations. This includes activities such as working in confined spaces, exposure to chemicals and exposure to pathogens and vectors causing illness and disease.

There is also a potential for community exposure to risks of accidents, drowning and health impacts associated with the ponds and leaving part of the canal open.

Mitigation

In order to protect workers and the community from exposure to health and safety risks, a Health and Safety Plan should be developed and implemented. As for the ponds and the opened part of the canal, a fence and a buffer zone (clearance) around the ponds and the open canal related to the project shall be constructed. The operator shall also monitor the sites and prevent non-employees to enter the sites.

Summary of Impacts:

Parameter	Nature	Type	Magnitude	Extent	Duration	Reversibility	Likelihood	Significance
	Risks of accidents, injuries and health							
Assessed Impact	A	D	M	R	P	I	H	H
Residual Impact	A	D	L	R	P	I	L	L

8.2.3.5. Noise

Impacts

During operation, noise is expected to arise mainly from operation of PSs. This noise may also disturb existing wildlife in the area of the PSs (refer to Section 8.1.2.3 for additional discussion).

Mitigation

Mitigation measures should include:

- Insulate equipment such as PSs or any source of loud noises
- Regularly maintain equipment in accordance with manufacturer's instructions
- Fence and screen PS, settling basins and ponds sites with green belt to muffle any residual noise generation.

Summary of Impacts:

Parameter	Nature	Type	Magnitude	Extent	Duration	Reversibility	Likelihood	Significance
	Noise disturbance							
Assessed Impact	A	D	L	L	L	I	M	M
Residual Impact	A	D	L	L	L	I	L	L

8.2.3.6. Solid and Hazardous Waste Management

Impacts

Solid waste will be generated by settling basins and workers (operators of PSs and guards) and office related activities. If not properly managed or if disposed in open areas or burned onsite, this will lead to the degradation of soil, air and water quality. This is also the case if domestic wastewater generated from the workers is being discharged into the environment.

Mitigation

In offices and on site, solid waste must be disposed in specific bins before collection and disposal. Solid waste must not be disposed in open areas under any conditions and should not be burned onsite. In addition, workers during operation should implement office and domestic waste reduction and recycling techniques. The generated domestic wastewater from PSs operators and guards should be connected to the sewage network if available, or a septic tank if not. In case of septic tank, ensure that they are well contained and impermeable to prevent leakage of wastewater into soil and groundwater and ensure that septic tanks are emptied and collected by wastewater contractor at appropriate intervals to avoid overflowing. In any case, it is prohibited to discharge wastewater into the environment. Settling basin cleaning shall be disposed in coordination with relevant municipalities and authorities.

Summary of Impacts

Parameter	Nature	Type	Magnitude	Extent	Duration	Reversibility	Likelihood	Significance
	Waste generation							
Assessed Impact	A	D	L	R	L	R	M	M
Residual Impact	A	D	L	L	L	R	L	L

8.2.3.7. Cultural Resources

Impacts

Impacts on cultural heritage are not anticipated during maintenance activities as these activities will not require excavating undisturbed ground or major earthworks that could be potential disturb archaeological assets. Thus, the proposed project will not impact the cultural heritage during operation.

9. Management Plans and Institutional Setup

9.1. Roles and Responsibilities

9.1.1. Ministry of Water & Irrigation / Jordan Valley Authority

As Owner of the Project, MWI / JVA is in charge of its implementation, with support from the Supervision Engineer. As such, it has the overall responsibility for ensuring implementation of all environmental and social management for the Project. Specifically, its role is to:

- Ensure that the implementation of construction activities is conducted in accordance with the Project environmental and social management plan (ESMP) framework included in the ESIA;
- Appoint a health, safety and environmental officer to follow up and report on all matters related to implementation of the project ESMP.
- Formally review and approve the Construction Environmental and Social Management Plan (CESMP) that will be prepared by the contractor prior to commencement of the construction activities;
- Ensure compliance with all relevant national environmental and social legislation and EIB requirements;
- Ensure that a grievance redress mechanism is in place and that stakeholder complaints related to implementation of the Project addressed with corrective action and adequately documented;
- Conduct periodic environmental and social audits at the Project site to ensure that the CESMP is being effectively implemented; and
- Ensure that the ESMP for the operation phase of the Project is developed and implemented.

As Operator of the project, the JVA is responsible for developing the Operational ESMP for the Project in line with the ESMP Framework found in the ESIA and incorporate its provision into the company's management system as appropriate. JVA should have on staff at least one environmental and social safety officer in charge of following up on implementation of the ESMP/system and report periodically to company management.

A female CLO should be appointed, or a female contact identified within JVA or the main contractor's organisation to facilitate direct communication and household visits with women within the affected communities.

9.1.2. Project Contractor

The Contractor is responsible to comply with the ESMP framework and to ensure the compliance of all their sub-contractors. For this purpose, the contractor must prepare a CESMP prior to commencement of the construction activities addressing all issues set out in the ESMP framework and develop site specific management strategies and implementation and monitoring plans to manage and monitor all identified environmental and social risks. The CESMP shall include the following sub-plans:

- Spill Prevention and Management Plan;
- Waste Management Plan;
- Dust Suppression Measures;

- Emergency Preparedness and Response Plan;
- Traffic and Transport Management Plan;
- Site Security Management Plan;
- Health and Safety Plan;
- Code of Conduct; and
- Chance Finds Procedure.

In the CESMP, the Contractor should clearly describe the environmental and social roles and responsibilities of its personnel, such that at a minimum, a health, safety and environmental officer with relevant experience is recruited on a full-time at the site.

9.2. Staff Training

The ESMP and its ESIA study will not be effectively implemented unless all MWI/JVA, Contractor and Operator staff are aware of their specific responsibilities and required actions. Therefore, the MWI/JVA shall ensure that an induction training has been offered to its employees as well as the Project Contractor (and its subcontractors) and Operator personnel working on the project prior to commencement of construction and operation activities. At a minimum, the induction training shall cover:

- ESMP objectives and approach;
- Roles and responsibilities for ESMP implementation;
- Committed impact mitigation and environmental monitoring program; and
- ESMP procedures including the environmental and social monitoring, incident reporting and corrective actions.

The ESMP training shall be carried in the presence of at least three MWI/JVA engineers.

The Contractor shall prepare a detailed training plan for all construction workers in line with this ESIA and the LEP. This plan needs to be approved by the MWI/JVA represented by the Supervision Engineer. The objective of the training is to ensure that all staff are aware of the Contractor's environmental and social mitigation and management commitments. The training will cover the following topics:

- Health and Safety Plan/procedures at the construction site
- Dust control measures
- Traffic Management Plan
- Worksite Management Plan
- Site Emergency and Evacuation Plan
- Waste Management Measures
- Spill Prevention and Management
- Biodiversity Management and Conservation
- Project's Grievance Mechanism
- Worker rights
- Code of Conduct.

In addition to all staff, all temporary visitors to the site will be required to undergo an abbreviated version of environmental awareness training/induction to ensure they are aware of environmental, health and safety requirements.

The Contractor's Health and Safety Officer shall maintain records of trainings conducted; these records should be submitted periodically to MWI/JVA for review.

9.3. Environmental and Social Management Plan

9.3.1. During Construction

Table 9-1 presents the mitigation measures to be implemented by the Contractor in order to eliminate or minimize potential environmental and social impacts associated with the construction activities of the Project. Several plans and procedures need to be developed by the Contractor for that purpose and tailored to the work site. The ESMP framework for the construction phase should be included in the contractor's tender documents to ensure that all requirements have been taken into consideration by them and will be developed and implemented during the construction phase.

Table 9-1: Environmental and Social Mitigation Plan during Construction

Environmental / Social Component	Potential Impact	Significance	Mitigation Measures	Residual Impacts	Institutional Responsibility
Physical Environment					
Geology and Soil	• Soil erosion, compaction, and disturbance	M	• Schedule construction activities to reduce the amount and duration of soil exposed to erosion • Preserve existing vegetation to the extent possible and ensure revegetation when possible • Ensure stabilization of disturbed slopes • Immediately remediate any localized erosion during excavation and drilling activities	L	Contractor
	• Soil quality degradation	M	• Prepare and abide by a Spill Prevention and Management Plan • Abide by measures for proper disposal of wastewater • Abide by Waste Management Plan	L	Contractor
Water Resources	• Surface water quality deterioration	M	• Prepare and abide by a Spill Prevention and Management Plan • Use barriers or other measures to prevent transportation or contaminants through runoff • Schedule works during dry season if possible	L	Contractor
	• Groundwater quality deterioration	L		N	Contractor

Environmental / Social Component	Potential Impact	Significance	Mitigation Measures	Residual Impacts	Institutional Responsibility
			• Abide by measures for proper disposal of wastewater • Abide by Waste Management Plan		
	• Overconsumption of water resources	M	• Reduce water wastage whenever possible • Whenever possible, use dry-cleaning instead wet cleaning • Regular site inspection to detect water leakages • Raise awareness among workers on water conservation measures	L	Contractor
Energy Resources	• Overconsumption of energy resources	M	• Regularly maintain the generators, vehicles and construction machinery • Shut down lighting at site offices during the night • Switch off machinery and equipment when not in use • Raise awareness among site staff on energy conservation	L	Contractor
Air Quality	• Air quality degradation	M	• Implement dust suppression measures • Regularly maintain all vehicles and construction machinery • Prepare and abide by Spill Prevention and Management Plan • Abide by measures for proper disposal of wastewater • Abide by Waste Management Plan	L	Contractor
Biological Environment					

Environmental / Social Component	Potential Impact	Significance	Mitigation Measures	Residual Impacts	Institutional Responsibility
Biological Environment	• Impact on Local Morphology and Surface Hydrology	H	• Reduction measures as described in section 8.1.2.1 • Abide by measures for proper disposal of wastewater • Implement a Solid Management Plan • Implement Spill Prevention and Management Plan • Restoration of the areas used as temporary storage grounds	M	Contractor
	• Pollution of Flora and fauna	H	• Abide by measures for proper disposal of wastewater • Implement a Solid Management Plan • Implement Spill Prevention and Management Plan	L	Contractor
	• Disturbance, Noise and Vibration	H	• Use construction machineries with lowest possible noise generation, at least at the specified biodiversity sensitive habitats at TTH2 and TTH1.	L	Contractor
	• Lightening	M	• Avoid night shifts and avoid unnecessary lights at the construction camps	N	Contractor
	• Hunting and Active Taking of Wildlife	M	• Avoid and strictly prohibit wildlife persecution, hunting, and all forms of animal and plant collection and active taking. • Strictly prohibit tree cutting by the project staff and workers and apply fines and charges on none-compliance by the staff. • Design and implement an extensive terrestrial biodiversity monitoring program as part of project	L	Contractor

Environmental / Social Component	Potential Impact	Significance	Mitigation Measures	Residual Impacts	Institutional Responsibility
			requirements to assess environmental conditions before, during, and after the completion of the construction works so that the 'new' baseline conditions before operation commences are determined.		
Social Environment					
Economic Activities	• Creation of job opportunities and increase local business	M	• Develop and abide by Labour and Employment Plan	M	Contractor
	• Disruption to surrounding local businesses	M	• Install temporary structures from the road where pipe laying is being done to local businesses • Inform local businesses owner about construction activities and schedule • Proper communication and coordination with affected owners	L	Contractor
Social Tension	• Social tension between local and foreign workers • Culturally insensitive behavior by workers • Gender discrimination • Recruitment of minors	M	• Implement and abide by Labour and Employment Plan • Draft a Code of Conduct for workers • Ensure that workers sign Codes of Conduct • Respond to culturally insensitive behaviours and incidents as a matter of priority	L	Contractor
Land Use/Land Cover and Aesthetics	• Land acquisition impact on owners	M	• All lands in the project area of the PSs shall be acquired and compensated according to the Jordanian Land Acquisition Law No. 12 for 1987 and its amendments and EIB Standard 6 for Involuntary Resettlement.	L	WAJ

Environmental / Social Component	Potential Impact	Significance	Mitigation Measures	Residual Impacts	Institutional Responsibility
	• Negative aesthetics at active construction sites	M	• Adequate fencing around the construction sites • Organize stockpiling works to minimize construction area	L	Contractor
Infrastructure and Public Services	• Disturbance of public infrastructure services • Use of public utilities	M	• Detailed investigation of existing and planned underground pipes and cables should be undertaken prior to construction commencing • Include Project's work procedures including detailed method statements from contractors prior to site activities taking place • Abide by emergency preparedness and response plan • Coordination with the relevant municipal agencies, Balqa Governorate, and local police to avoid disruption	L	Contractor
Traffic	• Traffic congestion	M	• Develop and abide by a Traffic and Transport Management Plan	L	Contractor
Health and Safety	• Health risks from the generated dust and noise	M	• Develop and abide by Health and Safety Plan • Abide by Traffic and Transport Management Plan	L	Contractor
	• Traffic accidents and injuries	H			
	• Worker health and safety	H			

Environmental / Social Component	Potential Impact	Significance	Mitigation Measures	Residual Impacts	Institutional Responsibility
Noise	• Noise generation	M	• Schedule noisy operations at the same time whenever possible • Schedule high noise activities (drilling, excavation) during daytime • Place noisy equipment and generators as far as possible from working and residential areas • Install noise insulators around the stationary noise sources including generators and pumps • Use temporary noise insulators and barriers (plywood barriers) around noisy areas at residential areas • Switch off the equipment when not in use for long periods • Regularly maintain all noisy equipment and machinery • Abide by Traffic Management Plan	L	Contractor
Solid and Hazardous Waste Management	• Waste and wastewater generation causing pollution	M	• Prepare and abide by a Waste Management Plan • Provide workers with nearby sanitation facilities • Ensure that constructed septic tanks are well contained and impermeable to prevent leakage of wastewater into soil and groundwater • Coordinate with JVA for collection and discharge of the generated wastewater to WWTP • Prohibit illegal discharge of wastewater	L	Contractor
Cultural Resources	• Damage to sites of historical importance	L	• Ensure all chance finds of cultural heritage (e.g. graves, old ceramic, old building fragments) are reported immediately to DoA, excavation	N	Contractor

Environmental / Social Component	Potential Impact	Significance	Mitigation Measures	Residual Impacts	Institutional Responsibility
			stopped, and contractor awaits instructions from DoA. • Ensure coordination between the Contractor and DoA • Prepare and abide by Spill Prevention and Management Plan • 15 m buffer zone around each site		

Table 9-2 presents the Monitoring Plan during construction including the frequency of monitoring, location and institutional responsibility.

Table 9-2: Monitoring Plan during Construction

Environmental / Social Component	Monitoring Actions	Frequency	Location	Institutional Responsibility
Physical Environment				
Geology and Soil	• Visual inspection of disturbed areas in and around construction sites for erosion. • Visual inspection of vehicles, machinery and equipment for leaks of oils, grease, etc	Monthly	Construction Sites	JVA / Supervision Consultant / MoEnv.
Water Resources	• Ensure that collection tanks are emptied on a regular basis. • Visual inspection of waste storage area, chemical storage area and fuel storage area for spills and leaks. • Visual inspection of vehicles, machinery and equipment for leaks of oils, grease, etc.	Monthly	Construction Sites	JVA / Supervision Consultant
Energy resources	• Regular visual inspection and monitoring of used machinery and equipment.	Monthly	Construction Sites	JVA / Supervision Consultant
Air Quality	• Ensure that stored materials are covered. • Regular visual inspection and monitoring of used machinery and equipment. • Keep a record of maintenance activities. • Monitoring of water spraying.	Weekly	Construction Sites	JVA / Supervision Consultant / MoEnv.
Biological Environment				
Biological Environment	• Observation and recording of removed trees if any • Monitor construction site for evidence of hunting	Daily	Construction Sites	JVA / Supervision Consultant / Ministry of Agriculture / RSCN
Socioeconomic Environment				
Social tension	• Check compliance records	Monthly	Construction Sites	JVA / Supervision Consultant

Environmental / Social Component	Monitoring Actions	Frequency	Location	Institutional Responsibility
Local businesses	• Check compliance records	Monthly	Construction Sites	JVA / Supervision Consultant
Land Use/Land Cover and Aesthetics	• Visual inspection of general cleanliness at site, rehabilitation of damaged roads and waste management.	Monthly	Construction Sites	JVA / Supervision Consultant
Land acquisition	• Ensure compliance with the Jordanian Land Acquisition Law No. 12 for 1987 and its amendments and EIB Standard 6 for Involuntary Resettlement	Prior to construction activities	All potential sites	JVA / Ministry of Agriculture
Infrastructure and Public Services	• Check compliance records	Monthly	Construction Sites	JVA / Supervision Consultant
Traffic	• Monitor road condition and signage and traffic calming needs.	Monthly	Construction Sites	JVA / Supervision Consultant / Traffic Department
Public health and safety	• Ensure a decent condition of supplier vehicles (tires, loading, etc.) and general driving behavior. • Maintain vehicle and resident safety. • Completed mobility and access facilitation procedures. • Regular check of compliance records	Monthly	Construction Sites	JVA / Supervision Consultant / Ministry of Health
Occupational health and safety	• Site supervisor daily reports. • Ensure the availability and proper use of PPE.	Weekly	Construction Sites	JVA / Supervision Consultant / Ministry of Labour
Noise Level	• Monitor compliance. • Monitor the use and efficiency of noise suppressors used. • Keep a record of maintenance activities.	Weekly	Construction Sites	JVA / Supervision Consultant / MoEnv.
Solid and Hazardous Waste Management	• Waste Management Plan in place and implemented. • Monitor cleanliness on site.	Monthly	Construction Sites	JVA / Supervision Consultant / MoEnv.

Environmental / Social Component	Monitoring Actions	Frequency	Location	Institutional Responsibility
Cultural Resources	• Chance finds procedure in place. • Chance finds are reported to DoA.	Monthly	Construction Sites	JVA / Supervision Consultant / DoA

9.3.2. During Operation

Table 9-3 presents the mitigation measures to be implemented by the Operator of the Project in order to eliminate or minimize potential environmental and social impacts associated with operation of the Project. Several plans need to be developed by the Operator for that purpose and incorporated into the overall management system.

Table 9-3: Environmental and Social Mitigation Plan during Operation

Environmental / Social Component	Potential Impact	Significance	Mitigation Measures	Residual Impacts	Institutional Responsibility
Physical Environment					
Soil and Geology	• Soil and water pollution from improper maintenance activities	L	• Regularly maintain PSs • Develop contingency plan in case of malfunctioning of PSs • Develop and adopt a Spill Prevention and Management Plan	N	Operator
Biological Environment					
Biological Environment	• Disturbance and change wildlife and habitat	-	• Avoid the removal of native tree community and translocation of those unavoidable ones (if applicable) in coordination with related authorities including the Ministry of Agriculture, the Ministry of Environment and local municipalities. • Avoid and strictly prohibit wildlife persecution, hunting, and all forms of animal and plant collection and active taking. • Avoid introduction of pets. • Avoid unnecessary burning and accumulation of waste. • Further description in section 8.2.2	-	Operator
Social Environment					

Environmental / Social Component	Potential Impact	Significance	Mitigation Measures	Residual Impacts	Institutional Responsibility
Land Use/Land Cover and Aesthetics	• Risks to local community due to the dry part of the canal	H	• Close the part of the canal related to the project (diverted segment) • Maintain cleanliness within the PS, settling basins and ponds sites • Fence and screen PS, settling basins and Ponds sites with green belt to muffle any residual noise generation	L	Operator
	• Change in land use resulted from the PSs, settling basins and ponds	M		L	Operator
Health and Safety	• Risks of accidents, injuries and health	H	• Develop and implement a Health and Safety Plan • As for the ponds and the opened part of the canal, a fence and a buffer zone (clearance) around the ponds and the open canal related to the project shall be constructed. • The operator shall also monitor the sites and prevent non-employees to enter the sites.	L	Operator
Noise	• Noise disturbance	M	• Insulate equipment such as PSs or any source of loud noises • Regularly maintain equipment in accordance with manufacturer's instructions • Fence and screen PS, settling basins and ponds sites with green belt to muffle any residual noise generation.	L	Operator
Solid and Hazardous Waste Management	• Waste generation	M	• Solid waste must be disposed in specific bins before collection and disposal. • Solid waste must not be disposed in open areas under any conditions and should not be burned onsite. I • Workers during operation should implement office and domestic waste reduction and recycling techniques. • The generated domestic wastewater from PSs operators and guards should be connected to the sewage network if available, or a septic tank if not.	L	Operator

Environmental / Social Component	Potential Impact	Significance	Mitigation Measures	Residual Impacts	Institutional Responsibility
			• In case of septic tank, ensure that they are well contained and impermeable to prevent leakage of wastewater into soil and groundwater and ensure that septic tanks are emptied and collected by wastewater contractor at appropriate intervals to avoid overflowing. • In any case, it is prohibited to discharge wastewater into the environment. Settling basin cleaning shall be disposed in coordination with relevant municipalities and authorities.		

Table 9-4 presents the Monitoring Plan during operation including the frequency of monitoring, location and institutional responsibility.

Table 9-4: Monitoring Plan during Operation

Environmental / Social Component	Monitoring Actions	Frequency	Location	Institutional Responsibility
Physical Environment				
Geology and Soil	• Visual inspection of the intake, conveyance, ponds, settling basins and PSs unit's operational status • Maintenance schedules.	Continues	Intake, conveyance, ponds, settling basins and PSs	MWI / JVA
Socioeconomic Environment				
Land Use/Land Cover and Aesthetics	• Visual inspection of general cleanliness at site. • Check compliance records. • Record proving the safe disposal of waste in approved dumpsites and hazardous wastes in coordination with the Ministry of Environment	Monthly	Intake, conveyance, ponds, settling basins and PSs	MWI / JVA
Public health and safety	• Regular check of maintenance records	Monthly	Intake, conveyance, ponds, settling basins and PSs	MWI / JVA / Ministry of Health
Occupational health and safety	• Site supervisor daily reports. • Ensure the availability and proper use of PPE.	Monthly	Intake, conveyance, ponds, settling basins and PSs	MWI / JVA / Ministry of Labour
Noise Level	• Monitor compliance. • Keep a record of maintenance activities.	Inspections: twice a year for a period of 3 days, in one of the accredited agencies by the Jordan standards and metrology organization	PSs	MWI / JVA / MoEnv

Environmental / Social Component	Monitoring Actions	Frequency	Location	Institutional Responsibility
Solid and Hazardous Waste Management	• Waste Management Plan in place and implemented. • Monitor cleanliness on site.	Monthly	Intake, conveyance, ponds, settling basins and PSs	JVA / MoEnv.

9.4. Plans and Procedures

9.4.1. During Construction

The following sections provide a framework for all the plans and procedures that need to be developed by the contractor in order to mitigate some of the above-mentioned impacts.

9.4.1.1. Spill Prevention and Management Plan

The Contractor should prepare and abide by a Spill Prevention and Management Plan that should include, at minimum, the following measures:

- Spill clean-up procedure to reduce the risks of accidental leakages
- Carry out all refuelling in designated areas with impervious surfaces and guarantee no fuel spills
- A spill collection tank must be installed under generators and specific equipment
- All chemicals shall be stored in dedicated areas on a paved or sealed floor and in tightly closed containers and be protected from adverse weather conditions
- Used oil or chemical must be stored in an appropriate area until it is collected and disposed in licensed sites
- Use of secondary containment basins for long term storage of lubricants and fuels
- Ensure that the plan is present at the construction site and that oil spill response kits are available
- Train all workers to implement this plan in case of accidental spillage

9.4.1.2. Waste Management Plan

This plan should be developed and implemented by the Contractor to manage the generated waste effectively. The plan should include the following components:

- Dispose the generated domestic solid waste in licensed landfills
- Reuse of excavation materials generated during cutting and filling activities whenever possible and disposal of remaining material at licensed disposal sites
- Proper waste management practices
- Reuse or recycle the generated waste whenever possible
- Train workers on waste reduction procedures
- Provide workers with nearby sanitation facilities and inform them about their location
- To use cut materials in the fill process whenever applicable. This should also note the need for avoiding accumulation of excavated material through synchronizing excavation and filling processes.
- A specific area should be designated as a temporary solid waste dumping area. The generated solid waste during the construction phase should be placed in that area emptied preferably on a daily basis and transferred to the defined appropriate solid waste landfill or designated final dumping area. Such landfills / dumping sites should comply with the stated criteria and should be approved from the related authorities including the MoEnv. and the Ministry of Local Administration.
- The municipal solid waste generated by the project employees should be collected properly and transferred to the closest municipal landfill. Such activity requires prior coordination with the related municipalities.
- The contractor should ensure the efficiency of waste collection and transport system though no waste is being mismanaged or accumulated.

- Whenever cut materials are not suitable to be used for filling during the construction phase, the contractor should identify final destination site that is neither ecologically sensitive nor important to be used for final disposal of the cut materials. These sites should qualify to all avoidance measures listed in this report and needs to be approved by the related authorities. Conducting ecological assessment of these sites is pre-quest to use and all assessment reports should be approved by the related authorizes.
- Avoid un-necessary and/or prolonged solid waste accumulation especially at the wadies and other sensitive areas.
- Whenever waste accumulation, prolonged storage or use of area close to the intermittent water courses is unavoidable, the contractor should reduce disposal of waste, leakage of leachate and blocking of water courses.

9.4.1.3. Dust Suppression Measures

The following measures must be implemented by the Contractor to reduce the impacts air quality during construction:

- Sprinkle water on the ground to suppress dust, especially in residential areas where the wastewater networks will be installed
- Stop dust generating activities during windy weather especially in residential areas
- Cover dusty stockpiles
- Ensure proper handling and storage of materials thus minimising the areas of stockpiled materials
- Ensue that loading of raw and excavated material should be done in closed areas away from residential areas
- Minimise dust generating activities
- Cover all trucks transporting material such as excavated material used to cover the pipelines
- Regular maintenance of construction machinery and vehicles
- Control on-site vehicle speeds to reduce dust generation especially on unpaved areas and near residential areas

9.4.1.4. Emergency Preparedness and Response Plan

An Emergency Preparedness and Response Plan (EPRP) will be developed so that JVA and relevant third parties (local authorities and emergency services) are prepared to respond to accidental and emergency situations in a manner that prevents and mitigates harm to people and the environment. The EPRP needs to be discussed and disclosed to service providers and local affected communities prior to construction. The EPRP will identify:

- Accidents and emergency situations and the communities and individuals that may potentially be impacted
- Response procedures, provision of equipment and resources, designation of responsibilities, communication systems and channels and periodic response training

The Project will need to implement EPRP training and drills at all the construction sites. In addition, the Project will also need to liaise with the district and municipal departments in charge for emergency response for the project, in order to ensure they have trained for project-specific emergency procedures.

9.4.1.5. Traffic and Transport Management Plan

A Traffic and Transport Management Plan (TTMP) will need to be developed the contractor. The TTMP should be a starting point for further discussion between the main contractor, local authorities and road agencies. The plan will include preventative measures to manage the risks from potential increases in traffic from construction activities including transportation of material and workers to and from the Project site. In

addition, it will include measures to protect workers and manage the risks from civilian traffic within close proximity to construction sites. The TTMP will be refined and updated as access routes are confirmed and the timing and type of abnormal loads become known.

The TTMP should include the following:

- Regular inspection and maintenance of roads used by the Project
- Regular inspection to ensure that construction activities are not blocking roads. If blocking a road is necessary, an alternative route should be clearly marked
- Driver training for heavy goods vehicle drivers and refresher courses for Project drivers
- Speed restrictions for Project traffic travelling through communities (to be agreed with the local transport authority)
- Pedestrian awareness programme along the main site access routes
- Proper deliveries and road movements schedule to avoid peak periods
- Site security to ensure that all construction sites are effectively secured at the end of the working day to avoid pedestrians or vehicles falling into excavated areas such as all pits, trenches and excavations to be fenced
- Installation of effective road signs at the requisite locations to warn motorists and pedestrians of any potential danger of construction sites and heavy-duty trucks using the roads
- Installation of warning notices (for example 'no entry') will be placed at vantage points
- Engagement of traffic controllers to direct vehicles to minimise potential traffic conflicts and accidents
- Equipment and construction materials will be properly secured to avoid load-spills during transport
- Appropriate road safety signals such as red flags and flashing amber lights will be displayed by trucks and vehicles conveying construction materials and equipment
- Transportation of construction materials and equipment to construction sites during the day
- Deliveries of construction materials and equipment during the night will be prohibited
- Abnormal loads will not be delivered during peak traffic hours (morning and evening)
- Observance of speed limits within communities will be enforced to minimize potential accidents
- Establishment of a register to record any road accidents such that any incident is reported highlighting the root cause, analysis and preventive actions taken

The TTMP must be prepared in line with national legislation and EIB standards. Among other items, the plan should include measures to protect workers from collusions with non- Project traffic, barriers to stop non-Project traffic driving into construction areas (e.g. pits, excavated trenches), transport local workers from nearby communities, inform and remind workers road safety via toolbox talks and staff notice boards, and elaborate monitoring requirements.

9.4.1.6. Site Security Management Plan

JVA will need to develop this plan that informs how security companies and staff will be vetted. The plan will need to be revised prior to the commencement of operations so it reflects the changes in the nature of security threats, deterrents and procedures. Any security company should be accredited. Security staff will need to be vetted for previous offences and trained in human rights and the use of force.

A site security management plan will be required to:

- Safeguard site personnel and property through equipment and processes
- Ensure standard training for all security staff

- Identify deterrents to theft, break-in, sabotage

For an effective site security management, the plan should:

- Identify procedures for accessing the site and safeguarding materials
- Identify the types of security issues the Project must defend against
- Indicate personnel who will be responsible for security
- Define training for security personnel including what elements the training will include, and how often refresher training may be given
- Elaborate use of force and code of conduct policies for security personnel
- Explain how the Project will approach access control, detection of threats, delay and deterrence (such as signage, gates, perimeter fences, lighting, patrols, alarms)
- Describe procedures for visitor inspection, delivery vehicle inspection, periodic inspection of work site perimeters, security equipment maintenance, security equipment calibration, personnel background checks, emergency response, entry or access to Project equipment
- Describe procedures for incident investigation and reporting
- Establish a time period in which this plan and its procedures will be reviewed, changed or updated

9.4.1.7. Health and Safety Plan

An effective Health and Safety Plan for construction should include at least the following components:

- Fence the construction area from all sides to prevent access to the site
- Prohibit unattended/unauthorized public access
- Install proper fence marked by red warning lights at night around excavations, material dumps or other obstructions at the construction sites (especially along the proposed roads were sewer networks will be installed)
- Install warning signs for drilling and construction at the external part of the site and at a distance of 100 meters
- Equip Project drivers with telephones for contacting the emergency services and the JVA's head office to enact the EPRP if necessary in case of emergency.

Although a number of measures outlined above will include initiatives to safeguard community health and safety, a specific community health and safety plan is recommended to capture additional measures to be implemented to safeguard local community members and the public. It should include the following:

- Measures to address increase demands on local health facilities from in-Project migration arising from the construction workforce and support to health facilities located in the Project area (e.g. in terms of infrastructure, equipment, staff or financial/running costs)
- Conduct influx management forums throughout the construction phase with the local communities to identify their experiences and concerns of impacts
- Monitor local inflation of food and other staples
- Information dissemination and education programmes regarding safety awareness around construction sites and traffic as well as sanitation and hygiene, particularly in schools in the area of the Project
- The community health and safety plan should cross reference with other relevant management plans such as the TTMP, EPRP and Site Security Plan. Local health care and emergency services should be consulted in the development of the plan.

In addition, the Contractor should ensure the workers' health and safety against possible accidents and injuries from the various construction activities by applying the Labour and Employment Plan. At minimum, the following mitigation measures should be incorporated into the Health and Safety Plan and implemented:

- Workers should wear personal protective equipment (PPE)
- First aid kit should be available at each working site
- Train at least one onsite worker on basic first aid. If number of workers in one site exceeds 100, appoint a full-time nurse
- Label and handle chemicals stored onsite
- All electrical tools and equipment should be maintained and checked regularly for any defect
- Conduct training and awareness meetings including safety toolbox talks, correct use of PPE, health and safety procedures, and handling hazardous material containers and related wastes
- Adopt the following measures, as per guideline (12) published by Ministry of Labour of Jordan regarding Corona Virus prevention procedures during construction projects:
    - Raising awareness of the recommended measures to prevent the spread of COVID-19 by providing easily available educational materials
    - Cleaning and sterlising work sites, housing, bathrooms, kitchens, buses, and others frequently used locations daily
    - Distributing masks to all employees/ workers
    - Temperature tests for all workers before site entrance, during work and upon leaving

9.4.1.8. Code of Conduct

The Project Contractor should develop and commit to a Code of Conduct for the Project related worksites and facilities, which should address the following: safety rules, zero tolerance for substance abuse, environmental sensitivity of areas around the Project worksites and facilities, the dangers of sexual transmitted diseases (STDs) and HIV/AIDS, gender issues (and in particular sexual harassment) and respect for the beliefs and customs of the populations and community relations in general.

The key rules set out in the Code of Conduct shall be clearly displayed at the different Project worksites and posted in the Contractor's vehicles and machinery driving cabs.

Any new Contractor's personnel and existing Contractor's personnel should be made aware and acknowledge their understanding of subject rules of procedure and the associated provisions. This acknowledgement should be manifested through provided signing on the Code of Conduct by the Contractor's personnel prior to the start of any physical work at any Project worksite.

The Code of Conduct shall include a list of acts which as considered as serious misconduct and which must result in dismissal from any Project worksite by the Contractor, or by the Construction Supervision Consultant of the Promoter if the Contractor is not acting in due course, should a Contractor's personnel repeatedly commit an offence of serious misconduct despite awareness of the rules of procedure, and this is without prejudice to any legal action by any public authority for non-compliance with applicable regulations relative to:

- Drunkenness during working hours, leading to risks for the safety of local inhabitants, customers, users, and personnel;
- Punishable statements or attitudes, and sexual harassment in particular;
- Violent behaviour;
- Intentional damage to the assets and interests of others, or the environment;

- Repeated negligence or imprudence leading to damage or prejudice to the environment, the population or properties, particularly breaching provisions intended to prevent the spreading of STD and AIDS;
- Drug use;
- Possession and/or consumption of meat or any other part of an endangered animal or plant as defined in the Washington convention (CITES) and national regulations.
- Entering property of neighbouring people without permission of the landowners or those cultivating/renting the land.

The Project Contractor should establish a record for each case of serious misconduct, and a copy will be provided to the Contractor's personnel in question, indicating all action taken to terminate the misconduct by the Contractor's personnel in question and to bring the attention of other Contractor's personnel to the type of incident detected. This record will be provided to the Construction Supervision Consultant of the Promoter as an attachment to the Contractor's Environmental and Social and Health and Safety (ESHS) progress report. In case of serious misconduct, the Project Contractor should without delay inform the Construction Supervision Consultant who should immediately inform the Project Promoter.

9.4.1.9. Chance Finds Procedure

"Chance Finds" are defined as potential cultural heritage objects which are located outside the designated areas of cultural heritance protection and preservation by competent national authorities and which are discovered unexpectedly during the implementation of the Project. The discovery of chance finds can be made by any party involved in the Project.

The Contractor shall develop a Chance Finds Management Plan (CFMP) as part of his Construction ESMP, which will detail the necessary mitigation measures to ensure the prevention of negative effects on cultural heritage, focusing on chance finds, as a result of the Project related activities during construction at all Project worksites. Where prevention is not technically feasible, the plan should include procedures to minimise the negative effects on cultural heritance as far as reasonably possible. The objectives of the CFMP should be to ensure that the undertaking of the cultural heritage management relative to the Project operations complies with applicable Jordanian laws and regulations, international best practices and all relevant EIB's environmental and social standards and performance requirements.

The Contractor's CFMP should be structured to include at minimum the following contents:

- Introduction
  - *Project Description*
  - *Purpose of the CFMP*
  - *Scope of Application of the CFMP*
  - *Terms and Definitions*
- Involved Parties, Roles and Responsibilities
- Regulatory Framework and Standards
  - *Jordanian Legislation*
  - *International Standards (EIB)*
- Implementation Schedule of the CFMP
- Chance Finds Mitigation and Management Procedures
- Monitoring, Audit and Control Procedures
- Reporting Procedures
- Training Requirements
- Review and Updating Procedures

9.4.2. During Operation

9.4.2.1. Spill Prevention and Management Plan

The operator should present and abide by a spill prevention and management plan that should include, at minimum, the following measures:

- Spill clean-up procedure to reduce the risks of accidental leakages
- Carry out all refuelling in designated areas with impervious surfaces and guarantee no fuel spills
- A spill collection tank must be installed under generators and specific equipment
- All chemicals shall be stored in dedicated areas on a paved or sealed floor and in tightly closed containers and be protected from adverse weather conditions
- Used oil or chemical must be stored in an appropriate area until it is collected and disposed in licensed sites
- Use of secondary containment basins for long term storage of lubricants and fuels
- Ensure that the plan is present operation site (pumping stations) and that oil spill response kits are available
- Train all operation workers to implement this plan in case of accidental spillage

9.4.2.2. Health and Safety Plan

Health and Safety Plan should be developed and implemented by the operator to protect health and ensure the safety of both the operation workers and the community. As such the following should be implemented for the workers' health and safety:

- Wear personal protective equipment onsite when dealing with critical processes that includes direct contact with wastewater
- Chemicals used at the PSs sites should be stored in a location with properly sealed floors and well-ventilated chambers
- Warning signs and Material Safety Data Sheets (MSDS) should be provided around the site
- Proper training should be provided to all workers before they commence their work, along with periodical occupational health and safety procedures training
- Report all incidents and accidents. A designated safety officer onsite should investigate the incidents/accidents, to eliminate the causes and prevent reoccurrence
- Pest control must be implemented within the facility in an effort to prevent disease transmission

As for community health and safety, the operator should ensure the following:

- Proper operation of the PSs
- Regular maintenance of the PSs, canal, conveyance pipeline, Settling basins and intake
- Evaluate during the first few years of operation, the health and well-being changes for the Project beneficiaries

9.4.3. Labour and Employment Plan

The purpose of the Labour and Employment Plan (LEP) is to ensure the construction and operation of the project guarantee:

- fair treatment for all workers;
- non-discrimination and equal opportunities of workers;
- a sound worker-management relationship;
- compliance with national labour and employment laws;
- protecting and promoting the safety and health of workers;
- preventing the use of forced labour and child labour (as defined by the ILO and Jordanian legislation).

This LEP sets out the basic procedures and requirements to be implemented by the Contractor and Operator of the project to ensure the rights of workers through promoting health, safe and decent working conditions.

Implementation of the LEP is also essential to maximize the opportunity for local employment and ensuring access to jobs to all affected communities. This will help promote a positive relationship between the Project and the local community. Abiding by the LEP will also help the Contractor meet the requirements set out in Tender Documents.

The following procedures should be put in place to ensure that implementation of all project components abide by fair and non-discriminatory recruitment and employment practices and safeguard the health and safety of field workers. The Project Contractor and Operator should adhere to throughout the recruitment process during implementation, construction and operation of the projects.

9.4.3.1. Non-Discrimination and Equal Opportunity

In order to comply with these procedures during both construction and operation, the Project Contractor and Operator will:

- Not make employment decisions on the basis of personal characteristics such as gender, race, nationality, ethnic origin, religion or belief, disability, age or sexual orientation, unrelated to inherent job requirements;
- Base the employment relationship on the principle of equal opportunity and fair treatment, and will not discriminate with respect to all aspects of the employment relationship, including recruitment and hiring, compensation (including wages and benefits), working conditions and terms of employment, access to training, promotion, termination of employment or retirement, and discipline.

9.4.3.2. Preventing Discrimination at the Workplace

The Project Contractor/Operator should ensure that employees responsible for recruitment decisions are applying the criteria developed by the organization for the position equally to all applicants or candidates. For example, if the Project Contractor/Operator requires some of its applicants to have a certain amount of experience, that requirement should be applied equally to all groups of applicants.

Additionally, contractors/operators should review their compensation policies to make sure employees are not subject to wage discrimination. They should also examine employee access to opportunities affecting compensation, such as: work assignments, training, preferred or higher paid shift work, access to overtime hours, pay increases, and incentive compensation.

Women must receive equal pay for work of equal value. This means that rates of remuneration (including the basic wage and any additional cash or non-cash benefits) must be established without any discrimination based on sex.

Steps should be taken to enable workers with disabilities to retain their jobs and make accommodations required by national law for physically disabled persons

Providing a formal anti-harassment training for all employees would also be considered a best practice to prevent discrimination in the workplace.

9.4.3.3. Best Recruitment Practices

To get the most out of their recruitment, the Project Contractor and Operator should regularly review their outreach and hiring practices to learn whether certain groups are being excluded, not just from being hired, but from even entering the applicant pool. The Project Contractor and Operator should consider whether practices such as word-of-mouth recruiting, hiring only previous workers when new positions or opportunities for work arise, or picking up day laborers in particular locations are having an adverse impact on hiring.

The Project Contractor and Operator should work with local apprenticeship programs and community based organizations to seek a diverse pipeline of qualified workers. Worker referral programs located within the same geographic area as the project can also help contractors draw from the available workers in the recruitment area.

9.4.3.4. Situations to Avoid

Below are some examples of practices that may lead to discriminatory recruitment that the Project Contractor and Operator should avoid:

- Failing to prevent sexual harassment directed at female employees, and then failing to take adequate corrective action;
- Failing to prevent racial or ethnic harassment, including the use of racial and ethnic language, and then failing to take adequate corrective action;
- Terminating employees for complaining about a hostile work environment;
- Denying women regular and overtime work hours comparable to those of their male counterparts;
- Failing to provide adequate restroom facilities for female employees, for example by not allowing restroom breaks or failing to furnish sanitary facilities to female workers;
- Assigning certain employees (such as women or non-nationals) to the most difficult, dirty, and least desirable jobs;
- Systematically excluding certain employees (such as women or non-nationals) from promotion opportunities.

Subjective hiring practices that may result in discriminatory practices and should be avoided by the Project Contractor and Operator as much as possible include:

- Word-of-mouth recruitment or referrals where the workforce predominantly consists of one race, sex or ethnicity;
- Job announcements, application forms or interviews that refer to an applicant's gender, marital status, age, race, disability or other personal characteristic that is irrelevant to the job;
- Use of an "eyeball test," where an employer looks at an applicant to determine whether that person appears to be strong;
- Requesting job applicants or workers to undertake health or pregnancy tests (except as strictly required by health and safety laws);
- Not posting or giving notice of hiring or promotional opportunities, vacancies and/or selection criteria, and relying too heavily on friends of supervisors or of current employees to fill positions;

9.4.3.5. Forced Labor

The Project Contractor and Operator should ensure that:

- Workers are paid their wages in full and on time;
- Workers are not charged recruitment, processing or placement fees to obtain employment which entail a significant debt that can only be repaid by continued employment with the same employer
- Only reputable recruitment and employment agencies are used, and there are procedures in place to check their practices and policies
- Workers are provided with an employment contract which will include, at minimum, the following:
  - Expected working hours
  - Overtime requirements
  - Annual leave entitlements
  - Total salary and payment frequency
  - Notice period and conditions of termination by each party
  - Disciplinary procedures
  - Confirmation that the employer will cover the worker's medical insurance;

- Workers retain control and possession of their passports and other personal documents;
- Workers are free to leave the worksite and their accommodation when they are not working;
- Workers are free to leave their employment without penalty on giving reasonable notice (in accordance with national law);
- Workers are not forced to work overtime above national limits.

9.4.3.6. Child Work

In certain types of work deemed harmful or detrimental, Lebanese law prohibits employing any child under the age of sixteen years. Furthermore, in addition to other restrictions no child shall be employed for more than six hours per day and he shall be given at least one-hour rest whenever the total working hours exceed four per day. Therefore, the Project Contractor and Operator should at minimum:

- Comply with minimum age requirements set out in the national legislation (whichever offers the greatest protection to young people under the age of 18) and keep records of the dates of birth of all employees verified by official documentation;
- Check the activities carried out by young workers and ensure that under-18s are not employed in hazardous work as defined in national legislation;
- Assess the safety risks relating to any work by under-18s and carry out regular monitoring of their health, working conditions and hours of work.

9.4.4. Employee Grievance Mechanism

The employee/worker grievance mechanism will allow employees to address workplace disputes or concerns in a fair, easily accessible and transparent manner. Although an employee grievance mechanism must be in accordance with the Human Resources (HR) policy, the following is a standardized procedure for employee grievance applicable to all employees/workers involved in the project.

A brief procedure for filing a grievance is listed below and shall be used as a guidance throughout the project:

- When a concern or an action has occurred the employee/worker must file a written grievance to his or her supervisor.
- The direct manager must respond back. If the employee/worker was not satisfied with the supervisors' response, he/she can direct the grievance to the HR Department.
- The HR must respond back. If the employee/worker was not satisfied with the response and wishes to appeal, he or she can direct the grievance to higher level or management.
- If the employee was not satisfied with the response of top management, then he or she can approach the workers organization (that he or she belongs to) where applicable for further advice and assistance.
- The employee can approach the client / client representative for an amicable resolution.
- If an employee is not satisfied with the final determination of the internal grievance procedure, the employee can still hire a lawyer and resolve the issue at court.

9.5. Public Grievance Mechanisms

A formalized grievance mechanism is to be adopted to monitor and promptly resolve potential conflicts with stakeholders whose interests may be affected, and to ensure that all comments and complaints from any stakeholder are considered and addressed in an appropriate and timely manner.

The public grievance mechanism must include the following steps:

- Responsibility for dealing with community grievances must be assigned to a specific Community Liaison Officer during project construction and operation phases. Each complaint whether from an individual or a community will be considered and a response to each specific complaint will be directly communicated to the party that raised it.
- The comments of complaints must be summarized and listed in a formal logbook/register containing the name and contact of the person or group who made the complaint, and the date of response sent to the complainant. However, individuals have the right to request that their name to be kept confidential.
- Any person or entity may send comments and/or complaints in person, via the call center, post, email or fax to the contact information announced by JVA or its implementing parties (i.e. the contractor / the operator).
- All comments and complaints will be responded to either verbally or in writing as specified by the person or entity that made the complaint, as per the grievance form.
- Grievances must be acknowledged within 5 days, and then responded to within 20 days.

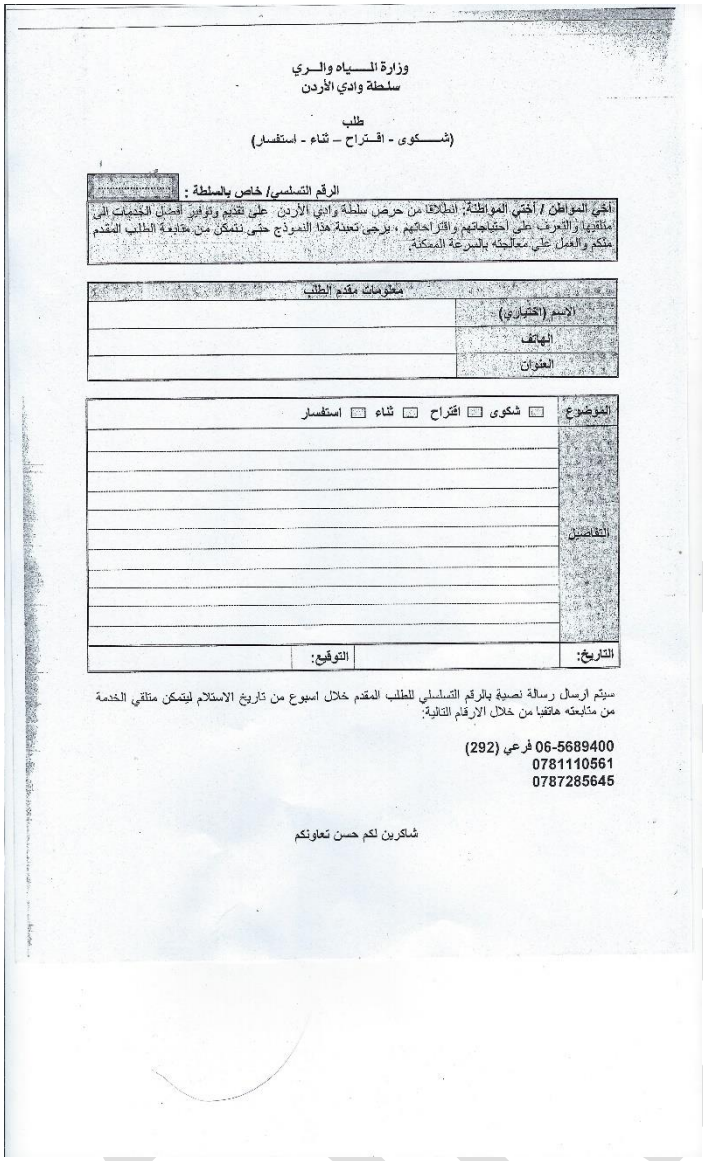
Grievances related to construction activities will be managed by the contractor(s) and supervised by JVA with support from the supervision engineer who will be responsible for managing and supervising the works and activities of the contractors, ensuring that construction activities are carried out in compliance with the project's requirements set forth by the ESMP. The contractors' contact information must be announced for public prior to the commencement of construction activities through local media (e.g. newspapers) or through project signboards in public places.

During the operation phase, the Operator (i.e. JVA) will be responsible to dealing with public grievances through the concerned department responsible for community liaison.

Grievance mechanisms can also be through MWI/JVA forms as per the following contact information:

- The complaints center on the number 117166
- WhatsApp application on the number: 0791500686
- JVA public relation department: 06-5689400 / 0796748887

Complaints form provided by JVA as shown in (Figure 9-1)



وزارة المـــياه والـــري
سلطة وادي الأردن

طلب
(شـــكوى - اقـــتراح – ثناء - استفسار)

الرقم التسلسلي/ خاص بالسلطة :

أخي المواطن / أختي المواطنة: انطلاقا من حرص سلطة وادي الأردن على تقديم وتوفير أفضل الخدمات إلى متلقيها والتعرف على احتياجاتهم واقتراحاتهم ، نرجى تعبئة هذا النموذج حتى نتمكن من متابعة الطلب المقدم منكم والعمل على معالجته بالسرعة الممكنة.

معلومات مقدم الطلب	
الاسم (اختياري)	
الهاتف	
العنوان	

الموضوع	☐ شكوى ☐ اقتراح ☐ ثناء ☐ استفسار
التفاصيل	
التاريخ:	التوقيع:

سيتم ارسال رسالة نصية بالرقم التسلسلي للطلب المقدم خلال اسبوع من تاريخ الاستلام ليتمكن متلقي الخدمة من متابعته هاتفيا من خلال الارقام التالية:

06-5689400 فرعي (292)
0781110561
0787285645

شاكرين لكم حسن تعاونكم

Figure 9-1: JVA grievance form

Functional organization of the grievance management lies under four main levels, which are Grievance Receiving, Grievance Processing, Grievance Solving Decision, and Decision Implementation. Table 9-5 presents the main tasks and the responsible entities for each level.

Table 9-5: Functional Organization of the Grievance Management

Level	Tasks	Phase	Responsible Entity
Grievance Receiving	Receipt, handling, screening and documenting of grievance	Construction	The Contractor
		Operation	The Operator
Grievance Processing	▪ Inspection for causality/relevance to the Project ▪ Inspection for causality link Assessment ▪ Valuation suggesting measures / recommendations	Construction	The contractor, JVA / the Supervision Engineer
		Operation	The Operator / JVA
	▪ Making respective decisions	Construction	

Level	Tasks	Phase	Responsible Entity
Grievance Solving Decision	▪ Discussing decision with respective ag-grieved person/entity ▪ Investigating satisfaction ▪ Signing grievance resolution/agreement	Operation	JVA / the Supervision Engineer
Decision Implementation	▪ Decision Restoration Measures ▪ Monitoring of implementation Supervision	Construction Operation	The Contractor JVA / the Supervision Engineer

9.6. Documentation and Reporting

9.6.1. During Construction

During construction phase, regular environmental and social monitoring will be undertaken to track and analyse the frequency of potential impacts and accidents that may occur. The Environmental and Social Officer at the JVA is responsible for this reporting and establishing a comprehensive database for all monitoring activities. Monitored data such as water and air quality and noise levels will be compared with relevant national and EIB standard limits and targets in the ESMS. The supervision engineer will prepare reports regarding monitoring activities whereby each report will include the following key information:

- Type of the activity monitored
- Date of monitoring and weather conditions
- Photographic documentation
- Name of the person that is conducting the monitoring
- Method of monitoring (sampling, visual inspection, …)
- Number and type of samples
- Results of the monitoring (concentrations, accidents, frequency, etc.)
- Number of internal and external grievances as per the log
- Code of conduct trainings, attendance sheets to GBV trainings, worker's age, GRM log, etc.
- Dates of trainings
- Mitigation measures undertaken

9.6.2. Incident Reporting

In addition, any incident or near miss event will be reported by the contractor to the supervision engineer immediately to be reported to JVA within 24 hours of its occurrence.

An Incident Report will be prepared by contractor, verified by the supervision engineer and submitted to JVA and contain at least the following information:

- Name/title/contact information of person reporting
- Persons involved in incident
- Date, time and location of incident

- Indicate if incident or near miss and type of incident
- Detailed description of incident (with photographic documentation if possible)
- Immediate action taken.
- Preventative or corrective action will be identified and agreed by all parties.

9.6.3. During Operation

Quarterly environmental monitoring reports will be prepared to analyse the collected data, assess monitoring activities and provide recommendations to ensure the effectiveness of the overall environmental monitoring and management plan during the project life span. The operator is responsible for submission a report each month concerning the different updates of the project status during post-completion phase.

10. Annexes

10.1. Annex 1 - Obstacles Locations

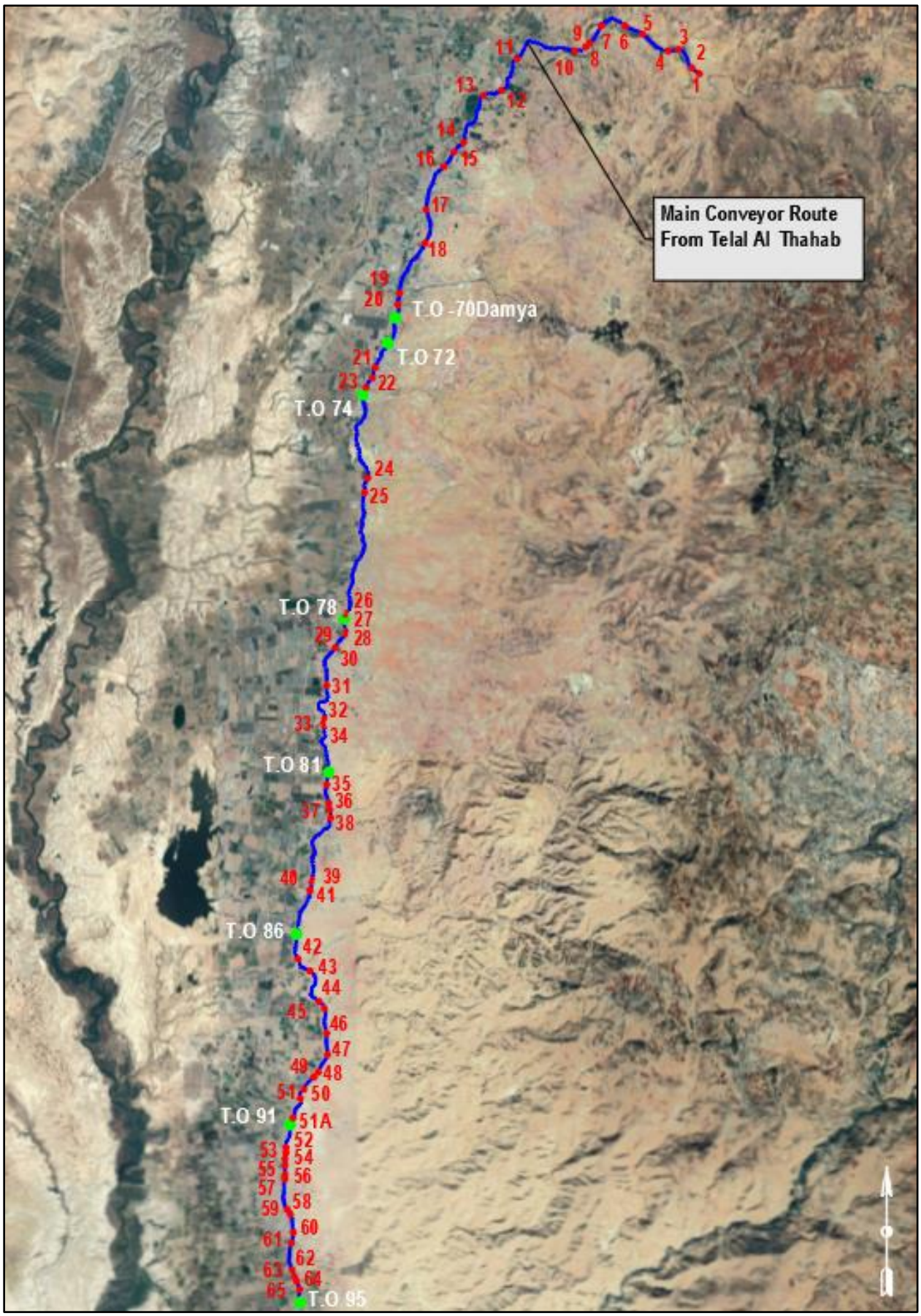
10.2. Annex 2 - GHG

10.3. Annex 3 - Overview of Alternatives

10.4. Annex 4 - Gender analysis

10.5. Annex 5 - Consultation Session

No.	Obstacles
1	Culvert
2	Riprap
3	Culvert/Water Stream
4	Culvert/Water Stream
5	Riprap
6	Riprap
7	Culvert/Water Stream
8	Culvert/Water Stream
9	Tree Area
10	Culvert
11	Culvert/Water Stream
12	Protection for pipe along water stream
13	Culvert
14	Culvert
15	Siphon
16	Culvert
17	Culvert , Wall ,Canal under ground level
18	Culvert
19	Canal under ground level
20	Road Intersection
21	Culvert
22	Culvert
23	Canal over stormwater bridge
24	Culvert
25	Canal over stormwater bridge
26	Culvert
27	Culvert
28	Culvert
29	Culvert
30	Canal over stormwater bridge
31	Culvert
32	Culvert
33	Culvert
34	Canal under ground level
35	Culvert
36	Culvert
37	Canal under ground level
38	Culvert
39	Riprap
40	Culvert
41	Canal under ground level
42	Culvert
43	Culvert
44	Culvert
45	Culvert
46	Culvert
47	Culvert
48	Concrete slab
49	Culvert
50	Culvert
51	Culvert
51A	Culvert
52	Culvert
53	Culvert
54	Culvert
55	Culvert
56	Culvert
57	Culvert
58	Concrete slab
59	Culvert
60	Culvert
61	Concrete slab
62	Concrete slab
63	Concrete slab
64	Concrete slab
65	Culvert


Main Conveyor Route
From Telal Al Thahab
T.O -70Damya
T.O 72
T.O 74
T.O 78
T.O 81
T.O 86
T.O 91
T.O 95

GHG – Annex 2 of Task 2.3 report

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Glossary of Terms and Abbreviations

Abbreviation	Description
AMSL	Above Mean Sea Level
CH_4	Methane
CO_2	Carbon Dioxide
CO_2e	Carbon Dioxide Equivalent
CRVA	Climate Risk Vulnerability Assessment
°C	Degree Celsius
DI	Ductile iron
E	East
E	Exposure
EIB	European Investment Bank
GEF	Global Environmental Facility
GHGs	Greenhouse Gases
GLOWA	Globaler Wandel im Wasserkreislauf
GoJ	Hashemite Kingdom of Jordan (Government of Jordan)
GWP	Global Warming Potential
H	Horizontal
HFC	Hydrofluorocarbons
HRT	hydraulic retention time
JICA	Japan International Cooperation Agency
JV	Jordan Valley
JRV	Jordan Rift Valley
JVA	Jordan Valley Authority
KAC	King Abdullah Canal
KAC-N	Northern KAC
KAC-S	Southern KAC
km	Kilometre
KTD	King Talal Dam
KWh	Kilo Watt Hour
m	Meter
m^3/day	Cubic Meter per Day
m^3/hr	Cubic Meter per Hour
m^3/sec	Cubic Meter per Second
MCM/a	Million Cubic Meters per Annum
MCM/year	Million Cubic Meters per Year
mm	Millimeter
Mm^3	Million Cubic Meters
MoEnv	Ministry of Environment
MWI	Ministry of Water and Irrigation
N	North
N_2O	Nitrous Oxide
PCL	Programmable Logic Controllers
PFCs	Perfluorocarbons
PS	Pumping Station
S	Sensitivity
SCADA	Supervisory Control and Data Acquisition
SF_6	Sulphur Hexafluoride

Abbreviation	Description
SNC	Second National Communication
t	Tonne
tCO_2e/y	Tonne of Carbon Dioxide Equivalent per Year
ToR	Terms of Reference
T.O.	Turnout
TTH	Telal Al Thahab
UNFCCC	United Nations Framework Convention on Climate Change
UPS	Uninterrupted power supply
UNDP	United Nations Development Programme
USAID	United States Agency for International Development
V	Vertical
V	Vulnerably
WMO	World Metrological Organization
WRI	World Resource Institute
ZCs	Zarqa Conveyors

1. GHGs Emissions Calculations

1.1. Introduction

GHGs are gases that warm the atmosphere and surface of the planet. Human activity has been increasing the amount of GHGs in the atmosphere, leading to changes in the earth's climate. The primary GHGs are carbon dioxide (CO_2), nitrous oxide (N_2O), methane (CH_4), sulphur hexafluoride (SF_6), and two classes of compounds called hydrofluorocarbons (HFCs) and perfluorocarbons (PFCs) (EIB, 2020). Carbon dioxide is the most abundant of these GHGs and has had the largest effect on our climate. Other GHGs are emitted in smaller amounts, but can trap heat more effectively than carbon dioxide, and some stay in our atmosphere for a very long time.

Global warming potential (GWP) is a relative measure of how much heat a GHG traps in the atmosphere (Table 1) (EIB, 2020). In order to compare different emissions and pollutants, we use the effect of carbon dioxide on our climate as a common reference. In this report, emissions are reported as carbon dioxide equivalent (CO_2e), meaning emissions are stated in terms that reflect their GWP.

Table 1: Primary GHGs and Their Global Warming Potentials (Source: EIB, 2020)

Greenhouse Gas (GHGs)	Global Warming Potential (GWP)
Carbon Dioxide (CO_2)	1
Methane (CH_4),	28
Nitrous Oxide (N_2O)	265
Sulphur Hexafluoride (SF_6)	23,500
Hydrofluorocarbons (HFCs)	Up to 12,400
Perfluorocarbons (PFCs)	Up to 11,100

1.2. Quantification Process and Methodologies

The first step in the quantification process will be to set boundaries for absolute and relative emissions calculations (EIB, 2020):

- **Absolute emissions** are based on a project boundary that includes all significant scope 1 and scope 2 emissions that occur within the project.
- **Relative emissions** are based on a project boundary that adequately covers the "with" and "without" project scenarios. It includes all significant scope 1 and scope 2 emissions, but it may also require a boundary outside the physical limits of the project to adequately represent the baseline.

Figure 1 Project Carbon Footprint Calculation Flow (Source: EIB, 2020)below illustrates a calculation flow in order to quantify the carbon footprint as well as the associated relative emissions compared to the baseline.

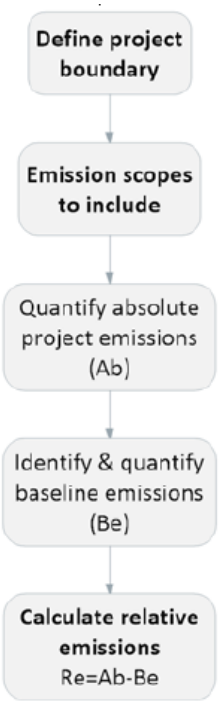

Figure 1 Project Carbon Footprint Calculation Flow (Source: EIB, 2020)

A series of emissions factors from which GHGs emissions can be calculated have been derived from the literature and from internationally recognized sources.

The absolute emissions are calculated as such (EIB, 2020):

Absolute Emissions (tCO_2e) = **Activity Data (e.g. quantity of fuel, electricity or product)** x **Emissions Factor (e.g. tCO_2e/unit of fuel or product)**

The relative emissions can then be calculated as (EIB, 2020):

Relative Emissions = Absolute Emissions – Baseline Emissions, or

Relative Emissions = "With" Project Emissions (Wp) – "Without" Project Emissions, or Baseline Emissions (Be)

(Re = Wp – Be)

1.3. Project Boundaries

The project boundaries define what is to be included in the calculation of the absolute, baseline and relative emissions. The methodology uses the concept of "scope" as defined by the WRI GHG Protocol 'Corporate Accounting and Reporting Standard' (WRI, 2004), when defining the boundary to be included in the emissions calculation.

For the definition of the scope of GHGs emissions to be considered in a carbon footprint calculation, the literature has generally accepted the approach developed by the WRI/WBCSD GHG Protocol (WRI, 2004), which differentiated between the following types of emissions:

- **Scope 1: Direct GHG emissions**. Direct GHGs emissions physically occur from sources that are operated by the project. For example, emissions produced by the combustion of fossil fuels.
- **Scope 2: Indirect emissions**. Scope 2 accounts for indirect GHGs emissions associated with energy consumption (e.g. electricity) consumed but not produced by the project. These are included because the project has direct control over energy consumption, for example by improving it with energy efficiency measures or switching to consume electricity from renewable sources.

- **Scope 3: Other indirect GHG emissions**. Scope 3 emissions are all other indirect emissions that can be considered a consequence of the activities of the project (e.g. emissions from the production or extraction of raw material and vehicle emissions from the use of road infrastructure.

According the methodology for the assessment of JV Project GHGs emissions, only scope 1 and scope 2 GHGs emissions of the project will be included in the footprint exercise. The following items will be also excluded from the calculations:

- Emissions associated with the production and transportation of the water pipes (intake pipeline and conveyor) from the manufacturers to the location of the project since it is not clear yet if the pipes will be produced in Jordan or shipped from outside the country.
- Emissions associated with future maintenance activities have not been included in the assessment because the exact nature of these maintenance activities is not currently known, and the emissions associated with these activities are expected to be negligible.
- Emissions associated with the establishment of temporary accommodation facilities close to the Project site during construction for the workforce have not been included because it is not certain that any such temporary accommodation facilities will be established or what the nature of any such facilities would be.

Table 2 below provides an overview of the scope of GHGs emissions produced by JV project.

Table 2: Scope of GHG Emissions Produced by JV Project

Activity	Net direct GHGs emissions (scope 1)	Indirect GHGs emissions (scope 2)	Avoided GHGs emissions
Intake Structure & Intake pipeline	CO_2e from construction	CO_2 from electricity consumption	
Settling basins	CO_2e from construction	CO_2 from electricity consumption	
Conveyance	CO_2e from construction	CO_2 from electricity consumption at T.O. 72 and 78	CO_2 from electricity consumption at T.O. 81 to 95
Storage ponds	CO_2e from construction		

1.4. GHGs from the Intake Structure

As stated in Section 2.1 of the EIA report, a weir with a crest elevation approximately 3.0m above the existing water surface, will be constructed to impound the wadi flow and to divert the water to a side intake structure (Figure 2).

1.4.1. GHGs Emissions During Construction

Since the dimensions of the weir (width and length) and the intake structure are not available currently, calculations of the GHGs emissions during construction will not be conducted. Once these dimensions are final, calculations will be done and included in a revised report.

1.4.2. GHGs Emissions During Operation

At the current design stage, the electrical demand of the intake structure is available in combination with the electrical demand of the settling basins, which amounts to a total of 75 KWh/year.

The energy requirements for the operation of intake structure and settling basins are translated into GHGs emissions using a conversion factor based on the specific country's electricity mix ($kgCO_2/kWh$) (Teodosiu and Fiore, 2019). For Jordan, the grid emission factor is 0.4585 $kgCO_2/KWh$ (MoEnv/UNDP/GEF, 2020). Accordingly, the GHGs emissions from the operation of the intake structure and settling basins are 0.034 tCO_2e/y.

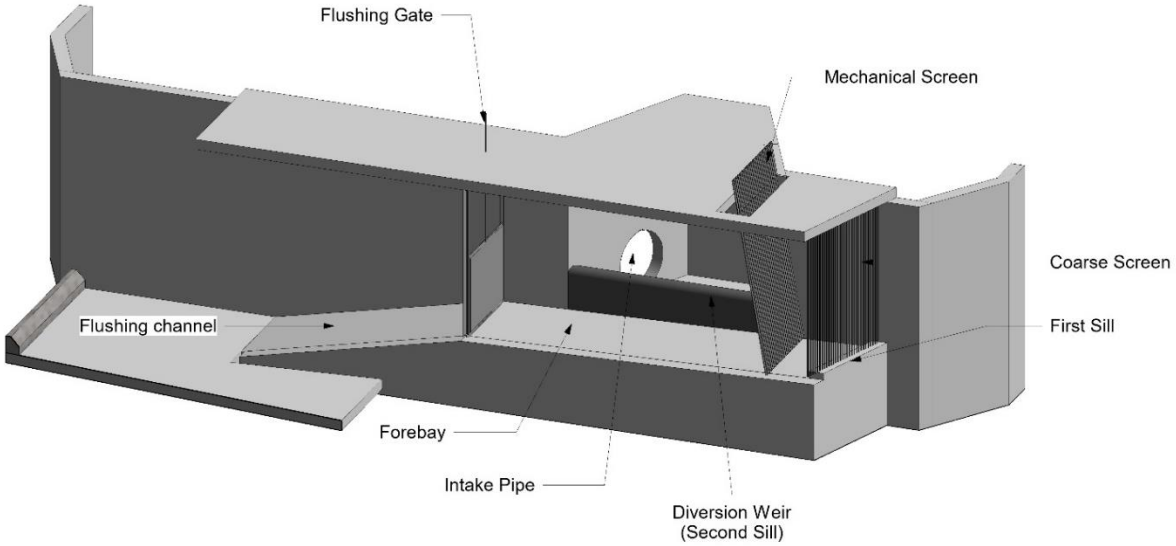

Figure 2: Longitudinal Section in Proposed Intake Structure

1.5. GHGs Emissions from the Intake Pipeline

1.5.1. GHGs Emissions During Construction

The installation stage of a pipeline is of great importance, as it involves material removal, excavation and use of energy. The main factors contributing to the GHGs emissions during the construction phase are transport and excavation (Herz and Lipkow, 2002). As stated in Section 1.3 above, production and transportation will not be included in the calculation of the emissions.

As shown in **Error! Reference source not found.**, the 1800 mm in diameter intake pipeline will be constructed in the following method: the first 190 m will be in open excavation trench followed by 25 m as exposed segment and ending with 290 m tunneling segment using pipe jacking.

According to a study conducted by the World Bank (2011), the GHGs emissions of the excavation of one cubic meter of pavement is 4.2 kg of CO_2e. Savings of up to 75% in carbon emissions have been demonstrated by a tool that compares open cut installation with non-disruptive solutions for installing utilities (Pipe Jacking Association, 2013).

By assuming an start trench depth of 3.175 m (outer diameter + 1.2 m cover over pipeline + 0.25 m bedding) and an ending trench of 4.275 m using the 0.05% adopted in the design, the total emissions from the excavation of the conveyor system in the JV project are shown in Table 3 below.

Table 3: GHGs Emissions from Excavation of the Intake Pipeline

Inner Diameter (mm)	Method of Installation	Length (m)	Outer Diameter[1] (mm)	Trench width[2] (m)	Volume (m^3)	Emissions (tCO_2-e)
1800	Open trench	190	1875	2.5	1,670	7.0
1800	Exposed	25	1875	-		0.0
1800	Microtunneling	290	1875	2.5	2,548	8.0
					Total	**15.0**

[1] The wall thickness of the different diameters DI pipelines are obtained from https://eadips.org/wp-content/downloads/handbuch-en/chap-05-wall-thickness-calculation.pdf

[2] The trench width is calculated based on the design criteria from Engicon / GOPA Infra GmbH and GOPA Jordan LLC (2021) where the maximum trench width = pipe diameter (mm) + 600 mm according to the WAJ specifications. The width of trench is rounded up to the next decimal.

1.5.2. GHGs Emissions During Operation

No GHGs emissions are associated with the operation of intake pipeline.

1.6. GHGs Emissions from the Settling Basins

1.6.1. GHGs Emissions During Construction

According to Change (2006), the emission factor used for emission estimation for land clearing for the settling basins sites is 10.5 tCO_2e/ha. The fuel and electricity consumed by each construction machinery give rise to carbon emissions. The total carbon emission from energy consumption can be calculated by multiplying the number of mechanical shifts by the construction energy consumption and then multiplying it by the corresponding energy carbon emission factor in the construction stage. In practical engineering, the labor and time required for construction are relatively small (Kong et al., 2020). Therefore, artificial carbon emissions of these two parts are not considered.

According to Circular Ecology (2019), the emission factor for reinforced concrete production is assumed to be 373 kg CO2e/m^3. As for the GHGs emissions from the excavation of one cubic meter of pavement is, accordingly to a study conducted by the World Bank (2011), it is 4.2 kg of CO_2e.

The calculation of carbon emissions during the construction stage of the settling basins is presented in Table 4 below.

Table 4: GHGs Emissions During Construction of the Settling Basins

Construction Activity	CO_2e Emissions (tCO_2e)
Land clearing	2.0
Excavation	9.1
Construction of reinforced concrete basins	151.4
Total	**162.5**

1.6.2. GHGs Emissions During Operation

As stated in Section 1.4.2, the electrical demand of the intake structure is available in combination with the electrical demand of the settling basins, which amounts to a total of 75 KWh/year. Accordingly, the GHGs emissions from the operation of the intake structure and settling basins are 0.034 tCO_2e/y.

1.7. GHGs Emissions from the Conveyor

1.7.1. GHGs Emissions During Construction

The installation stage of a conveyor system is of great importance, as it involves material removal, excavation and use of energy. The main factors contributing to the GHGs emissions during the construction phase are transport and excavation (Herz and Lipkow, 2002). As stated in Section 1.3 above, production and transportation will not be included in the calculation of the emissions.

According to a study conducted by the World Bank (2011), the GHGs emissions of the excavation of one cubic meter of pavement is 4.2 kg of CO_2e. Hence, by assuming an average trench depth of 2.55 m (average diameter + 1.2 m cover over conveyor + 0.25 m bedding under conveyor) the total emissions from the excavation of the conveyor system in the JV project are shown in Table 5 below.

Table 5: GHGs Emissions from Excavation of the Conveyor

Inner Diameter (mm)	Length (m)	Outer Diameter[3] (mm)	Trench width[4] (m)	Volume (m^3)	Emissions (tCO_2-e)
800	4,270	807.5	0.80	5,272	22.1
1000	5,210	1,009.3	0.85	8,680	36.5
1200	4,060	1,211.1	0.90	7,312	30.7
1400	24,660	1,412.9	1.10	4,554	19.1
				Total	**780.2**

1.7.2. GHGs Emissions During Operation

The GHGs emissions during operation of the conveyor are resulting from the power consumptions of the pump stations at T.O. 72 and 78 since the pumping stations at T.O. 81 to 95 are bypassed in the selected design alternative.

The energy requirements for the operation of JV pump stations at T.O. 72 and 78 are translated into GHGs emissions using a conversion factor based on the specific country's electricity mix ($kgCO_2$/kWh) (Teodosiu, and Fiore, 2019). For Jordan, the grid emission factor is 0.4585 $kgCO_2$/KWh (MoEnv/UNDP/GEF, 2020). The total estimated power consumption associated with the existing pumping station at T.O. 72 and 78 is 644,880 KWh. Accordingly, the GHGs emissions from the operation of the conveyor are equal to 295.7 tCO_2e/y.

1.8. GHGs Emissions from the Storage Ponds

1.8.1. GHGs Emissions During Construction

The fuel and electricity consumed by each construction machinery give rise to carbon emissions. The total carbon emission from energy consumption can be calculated by multiplying the number of mechanical shifts by the construction energy consumption and then multiplying it by the corresponding energy carbon emission factor in the construction stage. In practical engineering, the labor and time required for construction are relatively small (Kong et al., 2020). Therefore, artificial carbon emissions of these two parts are not considered. The GHGs emissions from the excavation of one cubic meter of pavement is, accordingly to a study conducted by the World Bank (2011), is 4.2 kg of CO_2e. Since the ponds will be lined, the emissions from installing the lining are considered negligible.

At the current design stage, the dimensions of the storage ponds (length and width of bottom and top sections) are not available, hence the emissions from land clearing will be excluded and the volumes to be excavated will be assumes as equal to the percent of the total volume of the 3 ponds by using the same ratio of excavated volume to actual volume of the settling basins.

The calculation of carbon emissions during the construction stage of the storage ponds is only related to excavation which amounts to 1,710 tCO_2e.

1.8.2. GHGs Emissions During Operation

Freshwater storage ponds are usually sources of GHGs (St Louis et al., 2000), as accumulation of organic matter in the sediment zone and the highly anoxic conditions found there favour the production of methane (CH_4) in particular (Figure 3). CH_4 escapes the water surface following two major pathways, either via diffusion or bubbling, and then can be emitted from the water surface.

[3] The wall thickness of the different diameters DI pipelines are obtained from https://eadips.org/wp-content/downloads/handbuch-en/chap-05-wall-thickness-calculation.pdf

[4] The trench width is calculated based on the design criteria from Engicon / GOPA Infra GmbH and GOPA Jordan LLC (2021) where the maximum trench width = pipe diameter (mm) + 600 mm according to the WAJ specifications. The width of trench is rounded up to the next decimal.

Diffusive emissions are greatly reduced via the consumption by methanotrophic microbes primarily located at the oxycline of the water column (Grinham et al., 2018).

Since the storage ponds in this project are lined, there is no anoxic conditions from the sediment zone and hence no GHGs are emitted during operation of these ponds.

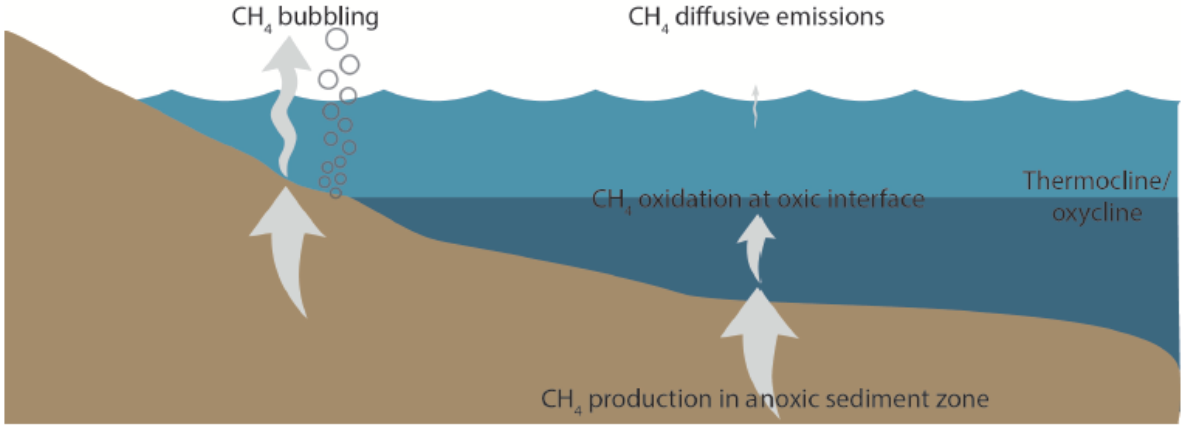

Figure 3: Conceptual Model Highlight Two Major Pathways of Methane (CH_4) Emissions from Stratified Freshwater Systems (Source: Grinham et al., 2018)

1.9. GHGs Emissions During Baseline Scenario

The baseline emissions from the no-project scenario results from current energy consumption of pumping stations at T.O. 70-96 which is 1,780,770 (KWh/year) which will amount to 816.5 tCO_2e/y.

1.10. Total GHGs Emissions from JV Project

The total emissions from JV Project are summarized in Table 6 below.

Table 6: Total GHGs Emissions from JV Project

Component	Emissions (tCO_2e)
Emissions During Construction	
Intake Structure and Intake Pipeline	15
Settling basins	162.5
Conveyor	780.2
Storage Ponds	1,710
Total Emissions During Construction	**2,667.7**
Emissions During Operation	
Intake Structure and Settling Basins	0.034
Conveyor	295.7
Subtotal	**295.7**
Baseline Emissions	**816.5**
Total Savings During Operation	**-520.8**

As it can be seen from Table 6 above, the project will contribute positively in the climate change mitigation and adaptation as it will result in GHGs emissions savings of -520.8 tCO_2e in year 2046.

2. Mitigation Measures

2.1. During Design

The JV project components has been designed to provide satisfactory structural, hydraulic and operational performance. The materials selected are robust and chemically resistant. Issues were considered such are materials, linings, minimum cover, minimum flow velocity, maximum depth and access. The local conditions regarding applied loads, soil conditions (type, cohesiveness…etc.) and water table imply a consideration that was taken regarding the structural stiffness and tightness of the pipeline.

A trash rack is recommended to be installed at the upstream face of the intake structure in order to present large size debris from reaching the intake. The control of the flushing gate at the intake structure can be done either manually or remotely by SCADA. A control room and site office have been proposed near the weir to monitor and control the water diversion according to the demand of various water users.

The JVA office building located near the intake structure will house the Programmable Logic Controllers (PLC) which will monitor and control the operation of the electromechanical facilities; this PLC will be fed from a UPS (Uninterrupted power supply) to ensure continuous working in the event of power failure.

In the settling basins, the flow will be subject to a minimum detention time to allow the large, suspended solids and sediments to settle by gravity. The settling basins shall be built in a way that facilitate regular cleaning by using flushing gates or by allowing heavy equipment to enter the basin and remove the sediments from the bottom, once a year. Ramps have been designed to facilitate access of equipment to the settling basins.

The settling basins are sized to remove the gravel and large size sand particles. Lighter sand particles, silt, clay and colloidal matter are not expected to settle. The settling basins are sized to have a hydraulic retention time (HRT) of 30 minutes for the settling compartments in addition to a storage volume at the bottom of the basins to allow for a one year of sediments storage.

The sediments storage volume at the bottom of the tanks are sized assuming:

- 10% settling efficiency.
- 30% solids concentration in the storage volume of the tank.

Ductile iron material was selected for the intake pipeline and conveyor for the advantages of safe and reliable operation, low damage rate, convenience and fast construction and maintenance, in addition to its long-projected service life.

The conveyor will be laid along the west side of the KAC canal after a thorough evaluation and comparison with using the east side of the canal for that purpose.

The advantages of selecting the west side of KAC-S are as follows:

- The pipe along the west side will be located within the Canal’s service road or right-of-way.
- Easy access to turnouts.
- The as-built drawings of irrigation network were reviewed; the existing pipes are small in diameter and the roads are wide enough to accommodate the proposed conveyor with minimal conflicts with these existing pipes.

Storage ponds will be used for the gravity connections at turnouts 81 to 95. The ponds have been sized based on a one-day demand for the gravity turnouts, resulting in 3 ponds with a total volume of about 77,000 cubic meters. The ponds will be filled at a rate of approximately 7,700 m3/hr for 10 hours from the same conveyor pipe that serves the pumping-fed farms over the first 12 hours of the day.

The locations of the ponds were identified based on the available space near the turnouts on the canal's East-side, where most of the lands East of canal are understood to be owned by JVA. This will avoid or minimize land acquisition. Furthermore, the KAC-S west-side includes high water table levels as per JVA and to avoid crossing the turnouts on the west-side.

The pumping stations at T.O. 72 and T.O.78 are proposed to remain in operation with an energy saving estimated at 1,135,890 (KWh/year) representing a reduction of 63% in energy consumption based on residual pressures along the reach between T.O. 81 to T.O.95 of the canal where the existing pump stations can be by-passed.

Ductile Iron pipes have been selected for the intake pipeline and conveyor system. They are strong and with suitable lining provide long term service. They can, however, be subject to erosion by aggressive ground conditions but this can be overcome by suitable protection (tape wrapping). The most economical size of the force mains was selected with adequate carrying velocities for the entire range of initial and design flows.

The hydraulic design was undertaken to ensure that the selected pipe is of enough diameter and appropriate gradient to convey a quantity of water at an acceptable velocity and pressure. The hydraulic design criteria of the pipeline used for the modelling are as follows:

- C (Roughness Coefficient) was taken as 110 for ductile iron pipes.
- Allowable pipe pressure in the conveyance pipe between 1 and 9 bars
- Velocity ≤ 2.10 m/s
- The head-loss gradient shall be maximum 7m/km

During the project design, if new pump station is needed, then all electrical systems will be designed for this pump station. These electrical systems can be summarized as follows:

1. Electrical load estimation in KiloWatts based on the number of pumps and their flows, heads, and efficiencies.
2. Main power supply comprising of installing power transformer with capacity in KVA based on the needed electrical load.
3. Main distribution board and control panels for pumps using soft starters or variable frequency drives.
4. Main and branch power cables.
5. Distribution board for the pump house building to serve lighting and small power facilities.
6. Lighting system using LED luminaires.
7. Small power system using sockets.
8. Earthing system.
9. External lighting for the pump site using lighting poles and LED lighting fixtures.
10. External lighting control panel.
11. Fire alarm system.
12. Lightning system if needed.
13. Instrumentation and PLC System which will be connected to existing SCADA system in Deir Alla via fiber optic and /or GPRS system.

2.2. During Construction

The following management measures are proposed to minimise GHGs emissions during construction of the Project:

- As far as reasonably possible, construction materials will be sourced from within or close to the Project area to reduce fuel use from transport of materials;
- Maximum re- use of cleared material;
- Construction equipment will be maintained in good working to maximise fuel efficiency of equipment;
- Appropriately sized equipment will be used for construction activities;
- Reducing the cooling energy use in JVA building near the intake side by building shape and orientation;
- Waste from construction will be minimised; and
- Greenhouse reduction initiatives will be undertaken at construction camps and construction sites.

2.3. During Operation

Best practice in managing energy efficiency and GHGs emissions for the Project can be achieved through:

- Estimating annual energy consumption and GHGs emissions;
- Estimating direct GHGs emissions; and
- Identifying and evaluating opportunities to reduce GHGs emissions by using renewable energy sources.

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1.1. Introduction

The Jordan Valley Water Resources Efficiency Project aims to improve the water supply efficiency in the Jordan Valley through the construction of a closed water carrier to replace (either fully or partially) a section of the Southern King Abdullah Canal (KAC), which is prone to significant losses. During this study, several communications were held with the project stakeholders, via reports, meetings and workshops, to review alternative schemes to achieve this aim. This section of the Feasibility Study briefly reviews the schemes investigated under the previous submittals, with supporting additional information included in Annex ___ to this report.

1.2. Zarqa River diversion schemes

In order to accomplish the project objective, conveyance schemes, by means of closed conduits, have been investigated to convey the irrigation demands of the KAC-S farms from Zarqa River to the Canal's turnouts. The diversion of the Zarqa River water to the proposed conveyor has been investigated at three locations along the river: Telal Al-Thahab, Hwarat and Abu Zeghan. A map of Zarqa River showing these three locations is included in Figure **Error! No text of specified style in document.**-1 below.

Figure **Error! No text of specified style in document.**-1: Diversion Locations

1.3. Groups of Alternatives

The project alternatives to divert water from Zarqa River and to convey it to the KAC-S Turnouts have been divided into three groups of alternatives. The alternatives investigated within each group have in common the quantity of water that is to be abstracted from the River and conveyed via the closed conduit. On the other hand, the various alternatives investigated with each group differ according to the location of the diversion point and the conveyance scheme considered. The following discussion present the three groups of alternatives.

1.4. Group 1 Alternatives

1.4.1. Group 1 Flowrates

The Group 1 alternatives divert from Zarqa River the combined irrigation demands of both the pumping-fed farms and the gravity-fed farms, at a maximum daily diversion rate of approximately 308,000 m^3/d. The computation of this demand figure is shown in the following table.

Turnout	Supply Mode	Irrigated Area (dunom)	Gravity Demand (m^3/d)	Pumping Demand (m^3/d)
٧٠ داميا	gravity	767	3,743	
72	pumping	3,631		17,719
٧٤ داميا الجديدة	pumping	767		3,743
٧٤ داميا الجديدة	gravity	3,399	16,587	
78	gravity	9,130	44,554	
78	pumping	2,330		11,370
81	gravity	6,033	29,441	
81	pumping	5,185		25,303
82	pumping	2,923		14,264
86	pumping	5,001		24,405
87	pumping	5,521		26,942
91	pumping	4,560		22,253
92	gravity	3,980	19,422	
95	gravity	5,634	27,494	
95	pumping	4,368		21,316
Total		**63,229**	**141,242**	**167,316**
			308,558	

Four alternative diversion locations were considered under Group 1. Three of these alternatives are at Telal Al-Thahab, referred to as TTH1a, TTH1b and TTH2, and one Hwarat. The daily demand considered under Group 1 would be supplied over a period of 22 hours per day at a rate of approximately 14,000 m^3/hr. The demand of the pumping farms would be supplied during the day, over a period of 12 hours, while the demand of the gravity farms would be supplied during the night, over a 10 hour period. The gravity farms demand would be delivered to proposed storage ponds - located in the vicinity of the turnouts - during the night in order to be released for the farms the following day. A schematic diagram of the four Group 1 alternatives is presented in the following figure, and a description of the sites is presented in the following paragraphs.

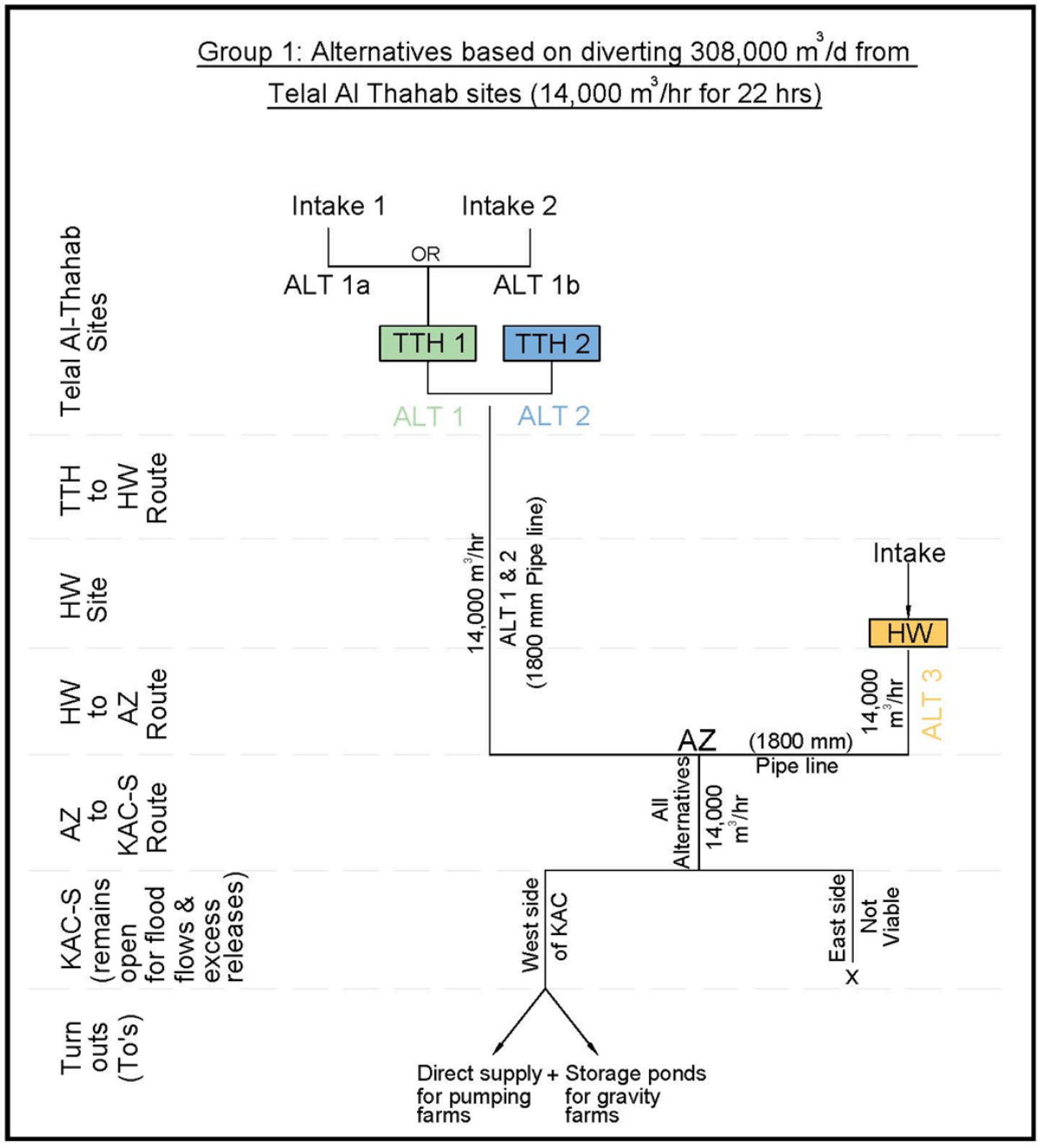


Figure **Error! No text of specified style in document.**-2: Group 1 Alternatives Schematic

1.4.2. Telal Al-Thahab TTH1 Sites

Telal Al-Thahab TTH1 site is located to the west of the existing Telal Al-Thahab settling basins, adjacent to the JVA office, as shown in the following figure.

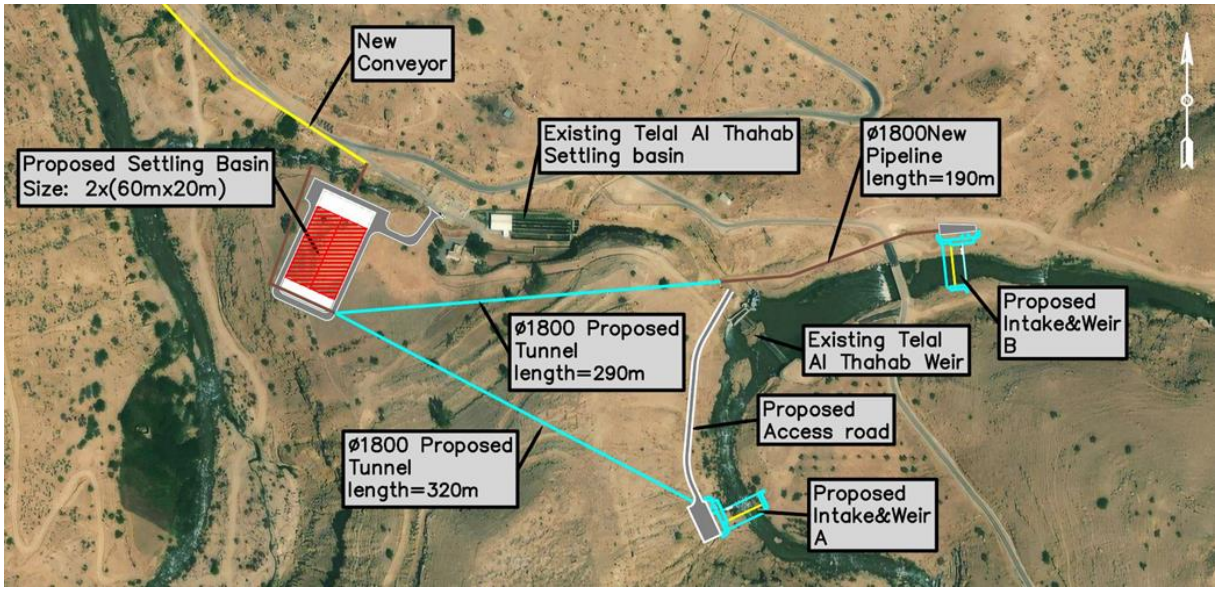


Figure **Error! No text of specified style in document.**-3: Telal Al-Thahab TTH1 Site Plan

The site has been designed to accommodate two settling tanks, approximately 60m long by 20m wide, each, with a depth of approximately 4.7m to allow for a one-year sedimentation volume. As shown in the above figure, two possible locations for the intake arrangement were investigated: first one would be located approximately 120m downstream from the existing weir, referred to as TTH1a, and the second one would be located approximately 150m upstream from the existing weir, referred to as TTH1b. From either of the proposed intake locations, the river flow will be intercepted and conveyed via a tunnel, 1.8m diameter, to the western side of the hill, to the settling basins.

1.4.3. Telal Al-Thahab TTH2 Site

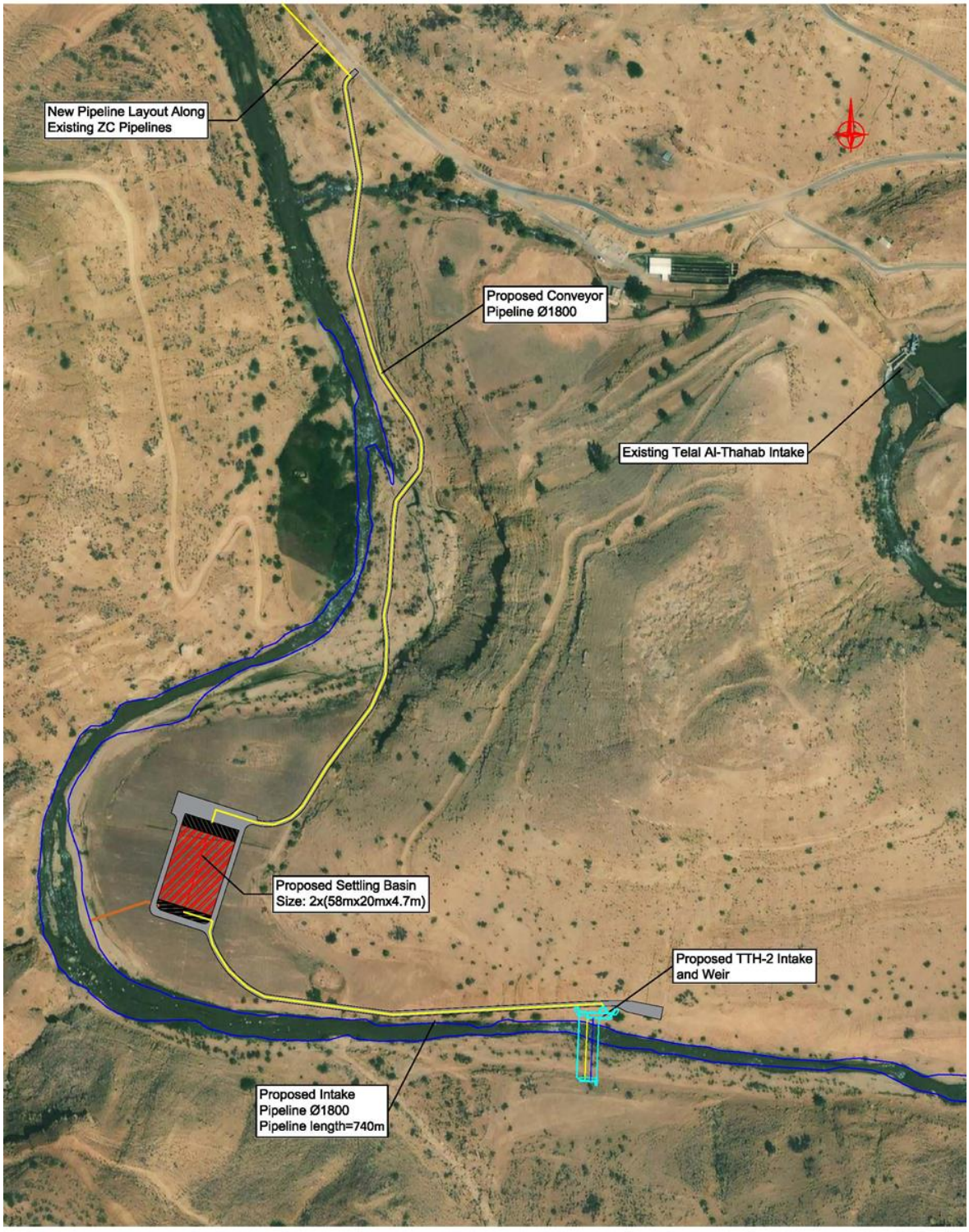


Figure **Error! No text of specified style in document.**-4: TTH2 Site

The proposed Telal Al-Thahab TTH2 site is located around the wadi bend formed by Zarqa River, approximately 1.15km downstream from the existing intake, as shown in Figure 3-3. The site is currently cultivated and is used as a picnicking area, with existence of aquatic habitat, as will be presented later in the biodiversity discussion. Similar to Site TTH1, two settling tanks, approximately 60m long by 20m wide, each, with a depth of approximately 4.7m, will be constructed in this area.

As shown in the above figure, an intake structure is proposed approximately 740m upstream from the settling basins site.

1.4.4. Hwarat Site

The Hwarat scheme proposed in this alternative includes rehabilitating the existing Hwarat weir and intake structure and adding a new settling basin 700m to the southwest of the existing weir as shown in the following figure.

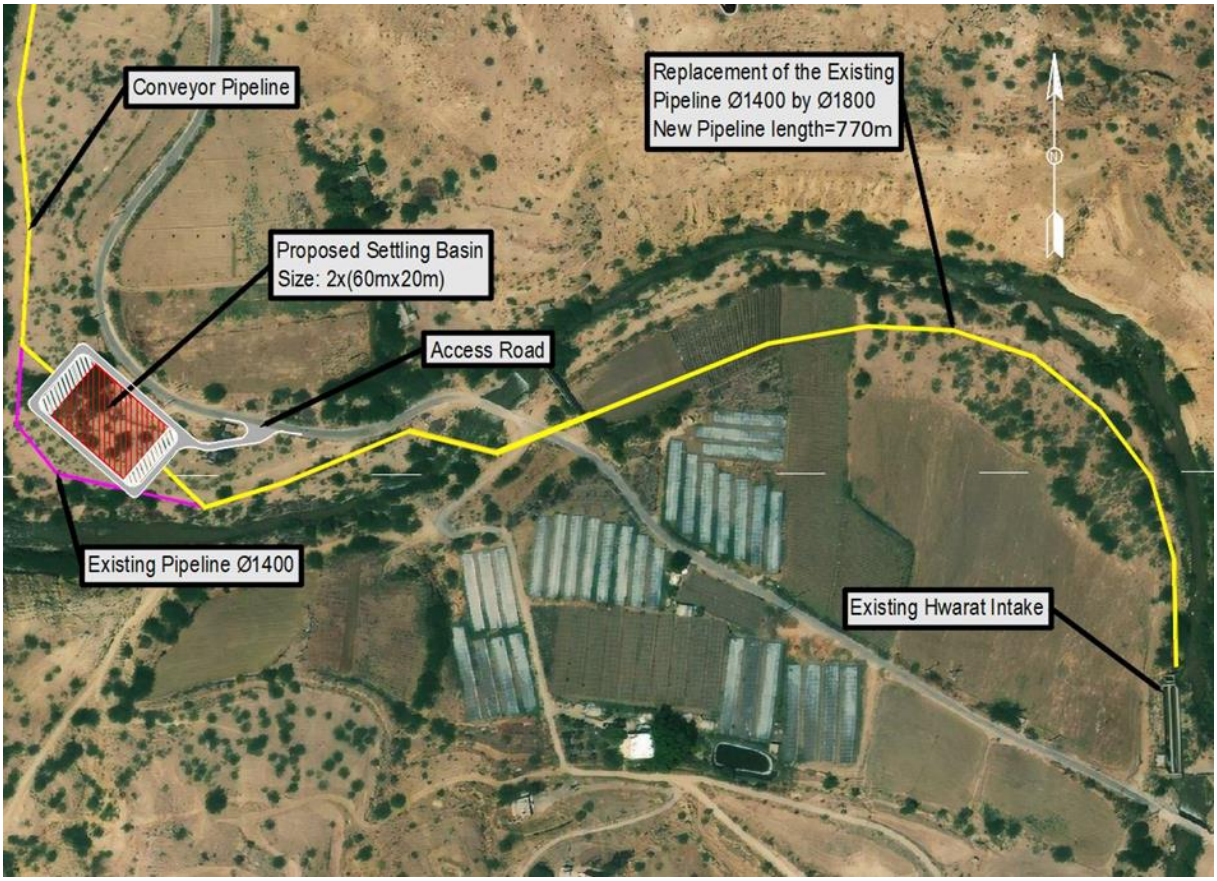


Figure **Error! No text of specified style in document.**-5: Hwarat Site Plan

The existing Hwarat intake, which used to divert flow to a conveyor 1400mm in diameter that conveyed the wadi flow to Abu Zeghan, is currently blocked with debris and is out of operation. Therefore, this intake is proposed to be rehabilitated and upgraded to prevent future blockings due to debris and bedload being carried into this intake.

A proposed pipeline, 1800 mm in diameter, approximately 770m long, will extend from the existing intake structure to the new settling basins, along the same route of the abandoned 1400mm Hwarat conveyor. Downstream from the settling basins, a proposed pipeline, 1800mm diameter, approximately 2.0km long, will be constructed to connect the sedimentation basins to the main conveyor.

1.4.5. Storage ponds

As mentioned above, the gravity flows would be conveyed during the night, over a period of 10 hours. These flows would be stored in six storage ponds located near the turnouts to be delivered to the farms the following day. The locations of these ponds are shown in the following figure.

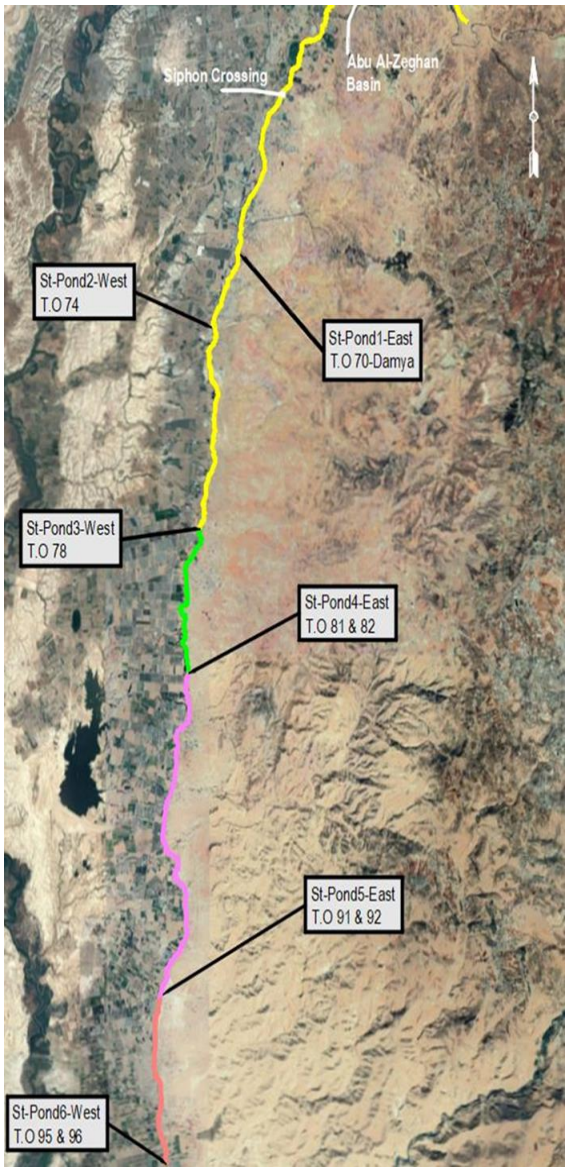


Figure **Error! No text of specified style in document.**-6: Storage ponds locations

1.5. Group 2 Alternatives

1.5.1. Biodiversity Concerns

The Group 2 alternatives have been developed as alternative solutions to diverting the entire irrigation demands provided by Zarqa River in order to maintain baseflow in the Zarqa River and preserve the rich biodiversity of the River. We understand from JVA that the farms extending on both sides of the river do not use the wadi flows for irrigation, but they get their needs from the ZCs.

The biodiversity study conducted under this project concluded that the reach downstream from Telal Al-Thahab constitute aquatic and riparian habitat which are considered limited habitats in Jordan and are of particular concern. The study noted that diverting the Zarqa River water at Telal Al-Thahab will cause a drastic impact on biodiversity, most importantly in the first few kilometers downstream from Telal Al-Thahab. Accordingly, the biodiversity study recommends limiting the change to the absolute minimum, especially in the TTH2 section, and to maintain/conserve the flow and habitat given its high biodiversity value. The damage arising from a major change to biodiversity will be a grave loss of aquatic and riparian habitat which are of high biodiversity value, and this requires creating an equivalent habitat within a low land near Telal Al Thahab and ensuring sufficient inflow of fresh water, in addition to implementing an effective habitat management program and monitoring at the new site.

Under the current scope, it is not possible to quantify the minimum amount of water that should remain in the wadi to maintain its biodiversity as this requires a detailed habitat investigation including sampling, testing and modelling of habitat change due to proposed action, etc. For this purpose, the irrigation water amounts to be extracted from the River were limited for this group as well as for Group 3, as will be discussed below.

Hence, the Group 2 alternatives have been developed to allow the flow of the gravity-fed farms (approximately 140,000 m3/d) to continue to flow in Wadi Zarqa, downstream from Telal Al-Thahab diversion points. While the flows designated for the pumping-fed farms (approximately 168,000 m3/day) would be diverted at Telal Al-Thahab, similar to the Group 1 schemes, and conveyed downstream via a closed carrier.

Irrigation water designated for the gravity-fed farms are maintained in Wadi Zarqa until it reaches Abu Zeghan, where two alternatives are investigated: (a) the flows can either continue down AZ Channel and KAC-S, as the case is now; or (2) diverted at Abu Zeghan to be conveyed via a second closed conduit parallel to the one from Telal Al-Thahab. These alternatives are discussed in more detail below.

1.5.2. Schematic Layout of Group 2 Alternatives

In order to maintain a baseflow in Wadi Zarqa, as discussed above, the Group 2 alternatives investigated three schemes for the diversion of the pumping flows at Telal Al-Thahab and two schemes for diverting the gravity flow at Abu Zeghan. These schemes are depicted graphically in the following schematic diagram, and a description of the sites involved in the Group 2 alternatives is presented in the following paragraphs.

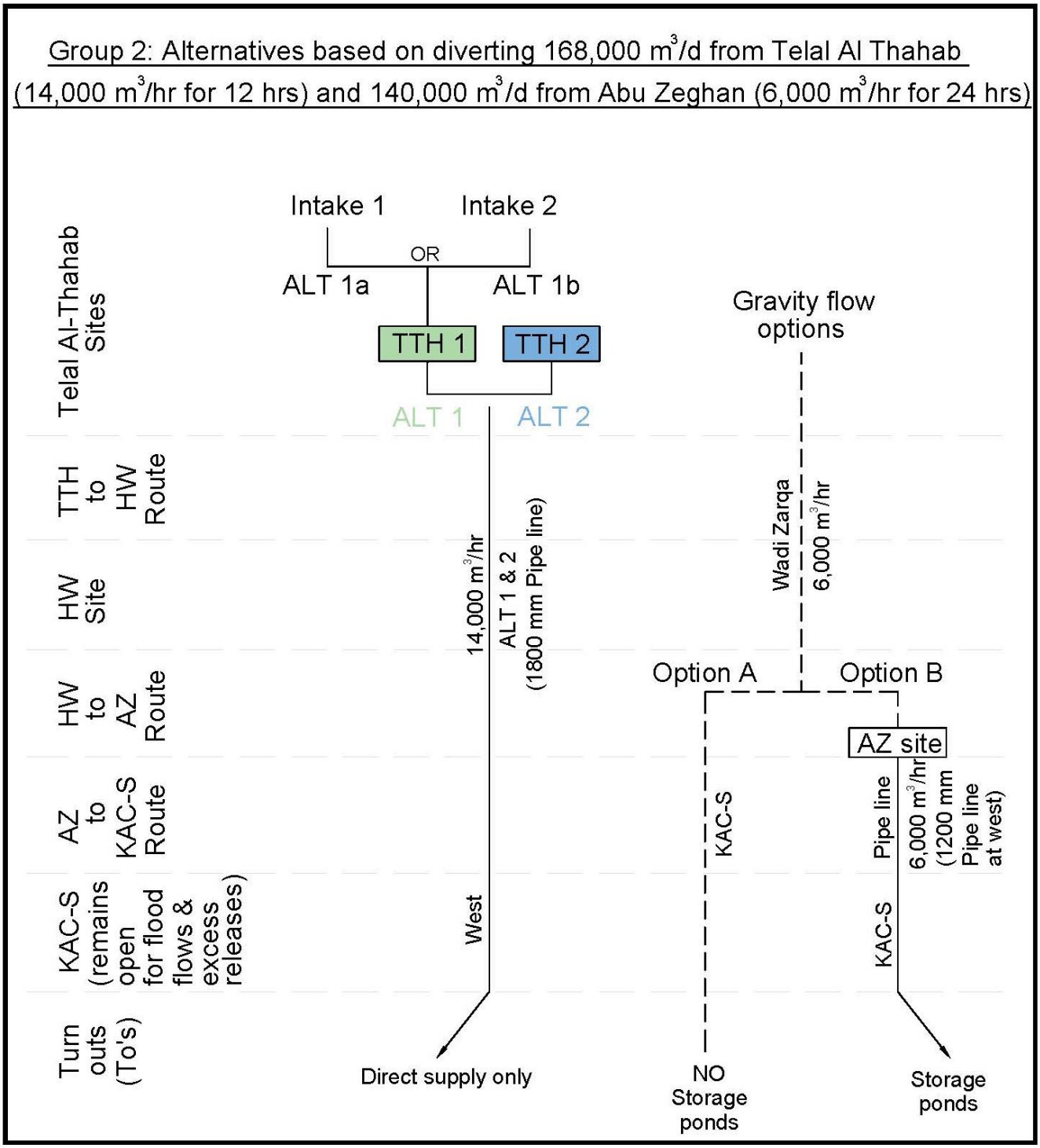


Figure **Error! No text of specified style in document.**-7: Schematic Diagram of Group 2 Alternatives

1.5.3. Telal Al-Thahab Sites

Under the Group 2 alternatives, Telal Al-Thahab schemes TTH1a, TTH1b and TTH2 would be identical to those which would be developed under the Group 1 alternatives. The diversion weirs, conveyance pipelines and the settling basins would be designed for 14,000 m3/d, operating for 12 hours during the day, as discussed above. However, under Group 2, there will be no diversion during the night unlike the case of Group 1 alternatives. Also, similar to Group 1, the downstream conveyance scheme from Telal Al-Thahab to the Turnouts would be identical in design to that presented above for the Group 1 alternatives.

1.5.4. Abu Al-Zeghan Site

As presented earlier in the report, the existing weir at Abu Zeghan diverts the Wadi Zarqa flows to Abu Zeghan Channel, which is a 2.0 km long open channel that conveys the flows of Wadi Zarqa to KAS-S. This existing weir is considered the downstream-most diversion point on Zarqa River to deliver water supplies the KAC-S. Therefore, this site was selected as the site for diverting the gravity flow to the gravity-fed farms. From Abu Zeghan Weir, the demands of the gravity-fed farms can either continue down AZ Channel and KAC-S (Option A), as the case is now, or they can be diverted at Abu Zeghan to be conveyed via a second closed conduit parallel to the one from Telal Al-Thahab (Option B). These options will maintain baseflow in Zarqa River.

1.5.5. Gravity Flow Options

As mentioned above, in the Group 2 alternatives, the new pipeline originating from TTH1 or TTH 2 will convey the demand of the pumping-fed farms (approximately 168,000m3/d), while an approximate daily demand of 140,000m^3 will be diverted at Abu Zeghan Weir to supply the gravity-fed farm, at a continuous flowrate of 6,000 m3/hr.

Gravity flow option to existing canal (Option A)

In this option, the existing Abu Zeghan Channel is proposed to remain the main carrier of the gravity flows to KAC-S that is to be delivered to the gravity-fed farms via the existing turnouts 70-95 on KAC-S. Therefore, the existing AZ Channel and KAC-S will continue to operate under the current mode, but they will be delivering only the gravity flow of 140,000m^3/d to the gravity-fed farms.

A second settling basin at Abu Zeghan (Option B)

This option was developed to convey the irrigation water demand of the gravity-fed farms in a closed conduit originating at Abu Zeghan site instead of the open channel scheme of Option A. Under this scheme, a new settling basin is proposed at AZ site to pre-treat the gravity flows diverted from Zarqa River. The flows diverted at the existing Abu Zeghan Weir will go through screens and settling basins before they are pumped to the proposed second carrier. A new pump station is proposed at this site to maintain enough pressure head to deliver the flow to the new storage ponds proposed at the turnouts.

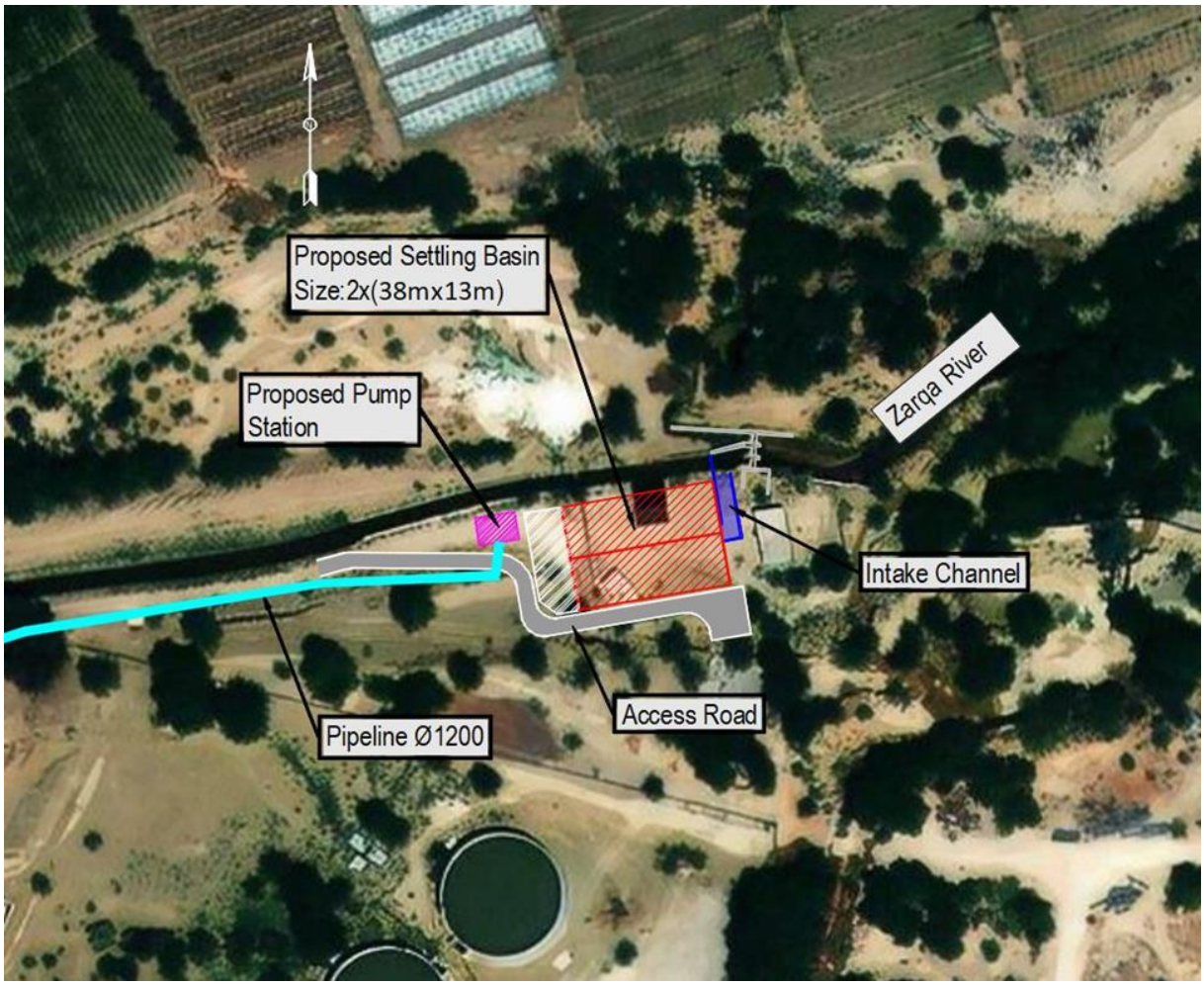


Figure **Error! No text of specified style in document.**-8: Abu Zeghan Settling Basins

1.6. GROUP 3 ALTERNATIVES

1.6.1. Group 3 Scheme and Flowrates

The Group 3 alternatives have been developed as alternative solutions to keeping the KAC-S open for conveying the gravity flows as proposed in the Group 2 schemes. Similar to Group 2, the Group 3 schemes would address the biodiversity of the Zarqa River by maintaining baseflow in the Wadi. Meetings with JVA concluded that utilizing KAC-S to convey the irrigation flows of the gravity farms requires continuous operation and maintenance of the 30km open canal, and it will not address the reduction of water losses in the canal according to the objectives of the project.

Hence, considering that baseflow shall be maintained in Zarqa River at all times, Group 3 has been developed to keep the entire irrigation demand of turnouts 70 to 78, a 12 km stretch, both the pumping and gravity water demands, flowing in the open channel of KAC-S, as per the current operation. The remaining demands of TO 81-95, both the pumping and gravity demands, would be diverted at Telal Al-Thahab similar to the schemes presented for Groups 1 and 2, and they would be conveyed via a closed conduit. Under this group, approximately 211,000 m3/d would be diverted at Telal Al-Thahab to feed TOs 81-95, while about 97,000 m3/d would continue to flow down Zarqa River, AZ Channel and KAC-S to feed TOs 70-78. The computation of the design flow for the closed conveyor is presented in the following table.

Turnout	Supply Mode	Irrigated Area (donum)	Gravity Demand (m^3/d)	Pumping Demand (m^3/d)
81	gravity	6,033	29,441	
81	pumping	5,185		25,303
82	pumping	2,923		14,264
86	pumping	5,001		24,405
87	pumping	5,521		26,942
91	pumping	4,560		22,253
92	gravity	3,980	19,422	
95	gravity	5,634	27,494	
95	pumping	4,368		21,316
Total		43,205	76,357	134,483
			210,840	

As may be noted from the above table, approximately 134,000 m3/d would need to be delivered during the day, within a period of 12 hours, resulting a design flowrate of 11,200 m3/hr. The gravity flow would be delivered during the night over a period of approximately 7 hours at the same flowrate. A schematic diagram of two Group 3 alternatives is presented in the following figure.

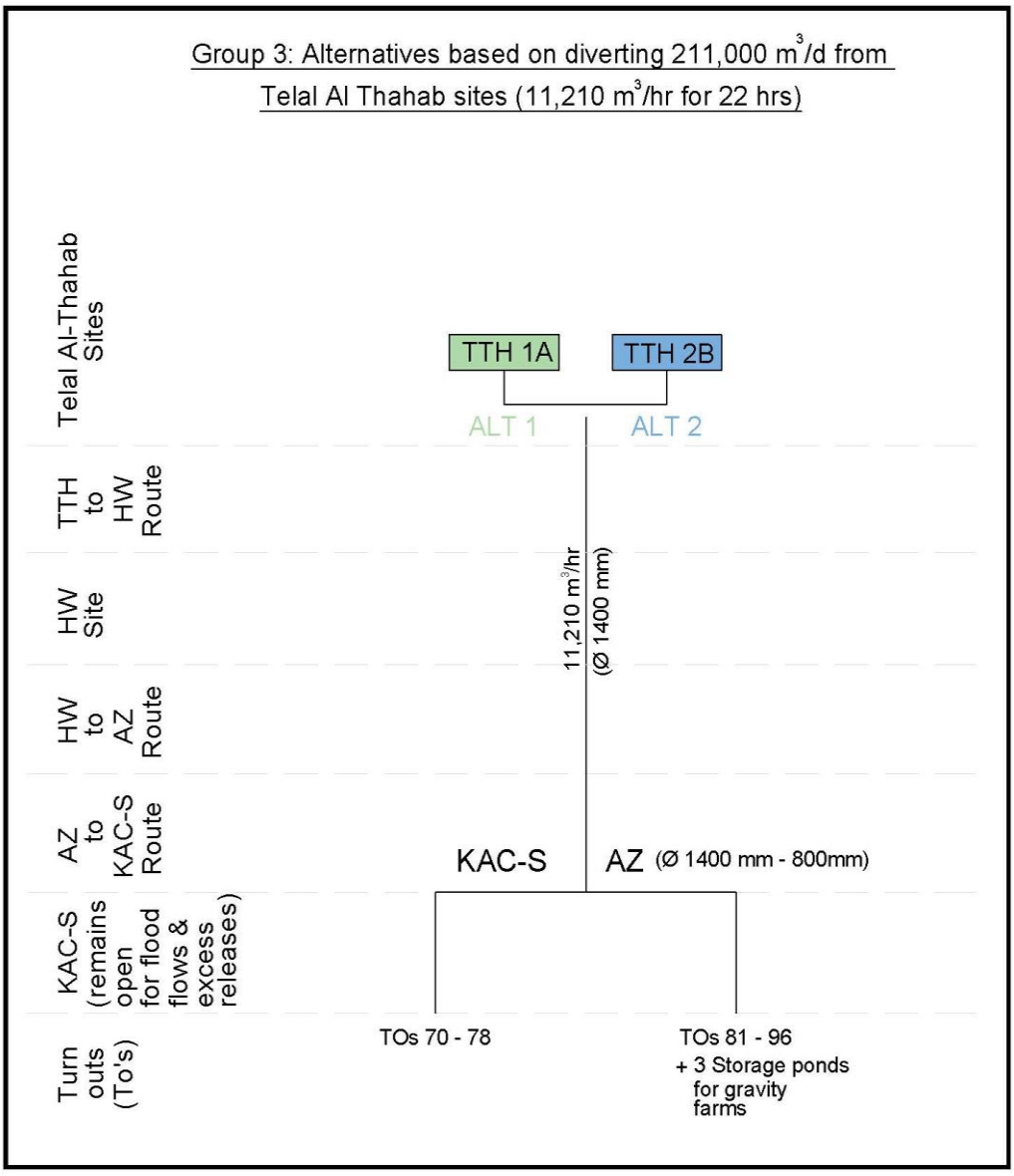


Figure **Error! No text of specified style in document.**-9: Abu Zeghan Settling Basins

1.6.2. Group 3 Components

1.6.2.1. Telal Al-Thahab Sites

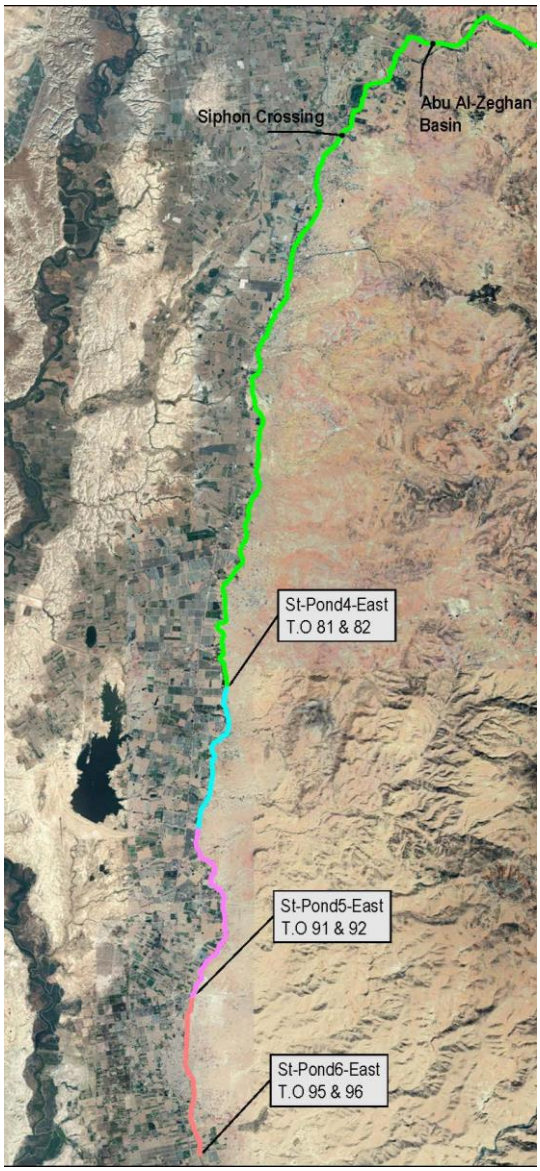
Under Group 3, Telal Al-Thahab schemes TTH1a and TTH1b have been considered for flow diversion, and they would be similar to those which would be developed under Groups 1 and 2, except that Group 3 would have smaller size elements due to the smaller demands to be supplied by the conveyor. The diversion weirs, supply pipelines and the settling basins would be designed for 11,200 m3/d, operating for 12 hours during the day and 7 hours during the night.

1.6.2.2. Conveyance pipeline

Also, similar to Groups 1 and 2, the conveyance scheme from Telal Al-Thahab to the turnouts would be similar in design to that presented earlier, except that the pipeline diameters would be smaller, and there would be no connections to the existing facilities feeding TOs 70-78.

1.6.2.3. Storage Ponds

Three storage ponds would be required under Group 3 schemes in order to store the flows conveyed during the night. They are proposed to be located on the east side of KAC-S, near TOs 81/82, 91/92 and 95/96, as shown in the following figure.



1.7. Comparison of Capital Costs

The following table summarizes the capital costs estimated for all the investigated alternatives.

	Groups	Group 1			Group 2				Group 3	
	Alternatives	Alt 1	Alt 2	Alt 3	Alt 1		Alt 2		Alt 1	Alt 2
		TTH 1	TTH 2	HW	Option A	Option B	Option A	Option B	TTH 1	TTH 2
No.	KAC-S	Not used	Not used	Not used	Used	Not Used	Used	Not Used	Used	Used
1	Intake & Sedimentation Basin	4.6	4.1	3.9	4.6	4.6	4.1	4.1	3.8	3.4
2	Main Pipeline	56.4	57.3	49.8	56.4	57.5	57.3	58.4	46.6	47.2
3	Storage Ponds @ Turnouts	6.5	6.5	6.5	0	6.5	0	6.5	3.9	3.9
4	Abu Al Zighan Gravity Flow	0	0	0	0	30.7	0	30.7	0	0
	Total Cost (EURO)	**67.5**	**67.9**	**60.3**	**61**	**99.4**	**61.4**	**99.8**	**54.3**	**54.5**
	Total Cost with 15% Contingency	**77.7**	**78.1**	**69.3**	**70.1**	**114.4**	**70.6**	**114. 8**	**62.4**	**62.7**

1.8. Geotechnical Assessment

1.8.1. Introduction

The geological investigation was based in addition to the field survey on the geological reports concerning the Project Areas, namely, Handbook of the Geology of Jordan, Burden (1959); Geology of Jordan, Abed (2000); Geology of Jordan, Bender (1974) and the Geology of As Salt area by S. Muneizel and B. Khalil, NRA (1993).

1.8.2. General Geology

The project areas of are situated to the east of the Dead Sea rift. It is dominated by predominantly Jurasic and early Cretaceous sedimentary rocks. Quaternary and Recent deposits are also present in the area. A general geologic map of scale 1:25000 is shown in Figure 1.

The study areas consist of the three sites Telal El Thahab, Hwarat and Abu Ez Zeighan. The general geology of the study areas shows that the rock outcrops are of sedimentary origin and consist of carbonates and siliceous rocks which belong to the Kurnub sandstone and Azab Groups of middle Jurasic to Albian Neocomian age. The bedrock is covered by quaternary and Recen deposits.

1.8.3. Stratigraphy

Azab Group, Jurassic (Az)

The Azab Group incorporates the following seven formations (from bottom to top); the Hihi Claystone Formation, the Nimr Limestone Formation, the Silal Sandstone Formation, the Dhahab Limestone Formation, the Ramla Sandstone Formation, the Hamam Sandstone-Limestone Formation and the Mughanniyya Limestone Formation. Only the Dhahab Limestone, the Ramla Sandstone and the Mughanniyya Limestone Formations are presented at the study sites.

Dahab Limestone Formation (DH)

This almost completely carbonate rock unit is distinctive in the field. It is overlain and underlain by sandy classic, and forms steep rock walls and cliffs in all its outcrops. The formation consists of four dolomitized limestone and limestone with marl and clay . The thickness of this formation is about 60 m. This unit belongs to Bajocian age:

Ramla Sandstone Formation (RM)

This rock unit occurs towards the top of the Jurassic succession of the Wadi Azab. It is of siliciclastic nature and consists mainly of sandstone, claystone and clay with a few thin limestone or dolomite interbeds. Thickness of this formation is 80-85 m. The formation is Bajocian in aga .

Mughanniyya Limestone Formation (H/M)

This limestone, mark, clay and dolomite unit from the uppermost part of the Jurassic sequence in Jordan. The Mughanniyya Formation differs from the underlying Ramla formations in its almost complete lack of a pure sandstone facies (except for some granular sandstone-filled scours and channels about 1 m deep near the top of the formation). The outcrops of this formation characterized by alternation of hard and soft lithologies result in cliff lines separated by gentle topographies, consisting of dolomitic sandstone, dolomite fossiliferous limestone, argillaceous limestone and wackestone. The thickness of the Mughanniyya Formation is about 110 m. It belongs to Bathonian to Callovian-Kimmeridgian aga.

1.8.4. Kurnub Sandstone Group (Ks) Early Cretaceous

Morphologically, this group is characterized by alternating massive and hard cliffy units with thin bedded, less expressed units. It can be subdivided into eight units consists mostly of fine-grained sandstone, siltstone dolomite-cemented sandstone, sandstone and occasionally clay. The unit is 250-300 m thick in the study area. The Kurnub sandstone is early Cretaceous in age, ranging from Neonomian to Albian

1.8.5. Lisan Marl Formation (Lm) Quaternary

The formation rests unconformably on strata of Mesozoic (Jurassic, Cretaceous) and Cenozoic ages. The formation consists of two alternating lithofacies: laminated evaporites and massive mudstone (with occasional sandstone). The formation is 40 m thick. Age of this formation is upper Middle to Late Pleistocene.

1.8.6. Holocene To Recent Sediments

Superficial Deposits of Alluvial Gravel (Alg) and Soil (s) covers the older geologic formations.

1.8.7. Structural Geology

Dead Sea – Jordan Valley Fault

The study area lies on the eastern side of the Dead Sea-Jordan Valley Transform Fault. The Dead Sea Transform Fault zone connects the active sea-floor spreading center of the Red Sea in the south of Turkey in the north. The Dead Sea Transform Fault is composed of a number of transform faults trending north northeast on the eastern side and south southwest on the western side. It has a large vertical downthrow to the west and about 107 km of sinistral movement.

Zarqa River Fault and other E-W Faults

The Zarqa River Fault is not always clear due to the nature of the sandstone beds which are exposed on both sides of the fault. This fault has an east-west trend and there are some indications on dextral shifting along the fault. Few faults of this trend are present in the study area and they have different downthrows.

Faults Present in the Study areas

These faults are relatively short in length and different in the amount and direction of throws. The faults generally have NW-SE, NNW-SSE and ENE-WSW trends. The site of Telal El Thahab is highly faulted.

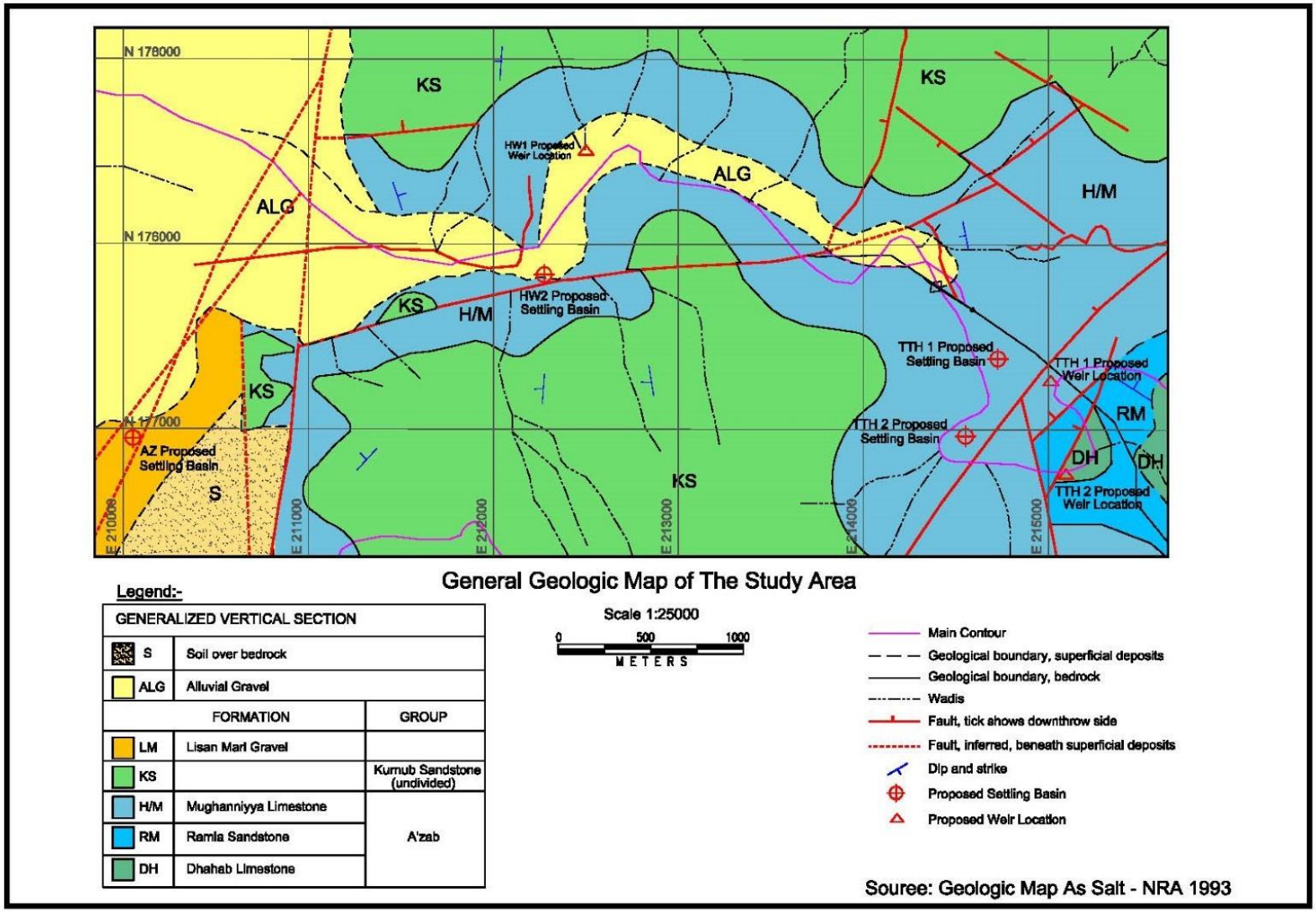


Figure **Error! No text of specified style in document.**-10: General Geologic Map

1.8.8. Geology of The Project Areas

The study areas consist of the three sites Telal El Thahab, Hwarat and Abu Ez Zeighan. The general geology of the study areas shows that the rock outcrops are of sedimentary origin and consist of carbonates and siliceous rocks which belong to the Kurnub sandstone and Azab Groups. The bedrock is covered by quaternary and Recent deposits.

1. **Telal El Thahab**

1. **Telal El Thahab existing weir and stelling basin site**

At this site the rock outcrops consist of sandstone, siltstone and dolomite which belong to the Mughneyya Formations of Azab Group of late Jurassic Age. Recent sediments of colluvial deposits cover the Formation.

The area is highly faulted NE SW and NNW SSE as well as the presence of an anticline trending NW SE, The area can be considered instable area specially the open cut gorge between the existing weir and stelling basins as shown in photos 1 and 2. Geotechnical study should be carried out for the purpose of stability

Photo 1: Existing Stelling basin site

Photo 2: Instable cut and Rock Falls (weir to stelling basin)

2. **Alternative TH 1**

The site of the proposed Telal El Thahab Weir is located adjacent to the existing weir (downstream) , the rock outcrops is highly fractured and weathered limestone and marly limestone, the location of the proposed stilling basin is covered by is covered colluvial deposits. The pipe between the weir and the stilling basin may be placed through a tunnel, it is not recommended to expand the existing cut since it is not stable on its existing conditions. Geotechnical investigation is highly recommended at this alternative sites.

water to stelling basin the stelling basin (photo 4) is covered colluvium covered bedrock

Phot 3: Existing and proposed Weir location

Photo 4: Proposed Stelling basin location

3. **Alternative TH 2**

edrock of limestone exposed at the proposed weir site which belongs to the Ramla formation (photo 5). At the proposed location of the stelling basin, the site is covered by soil and colluvial deposits (photo 6).

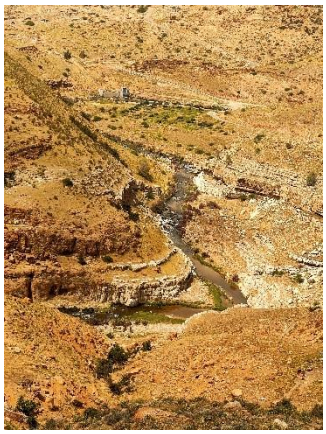


Photo 5 : Proposed weir site

Photo 6: Proposed weir and stelling basin locations

2. **Hwarat**

Hwarat Weir is an existing structure, it is found on the Muggnyya formation (photo 8), the site of the proposed

stelling Basin is covered by soil with gravel and boulders which belongs to the Alluvial Gravel (Alg) formation (photo 7).

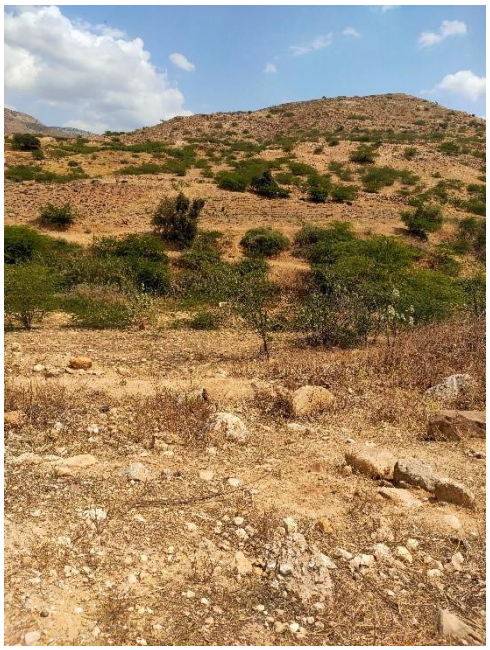
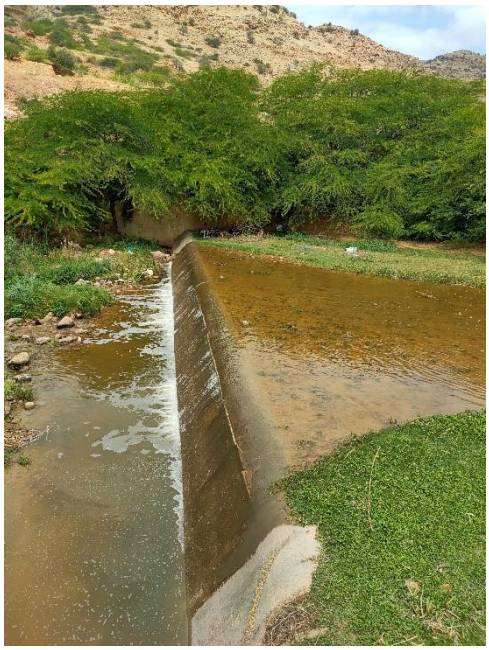



Photo 7 : Hwarat Stelling Basin site Photo 8: Hwarat Weir

3. **Abu Zeighan**

The site of the proposed Abu Ez Zeighan Stelling Basin (Photo 9) is located within the Lisan Marl formation which is covered by thin mantle of superficial soil deposits and partly by artificial fill material.

Photo 9 Abu Ez Zeighan Site

Gender Analysis – Annex 4 of Task 2.3 report

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Annex 4: Maadi and Arda Gender analysis - Women FGD

Arda and Ma'adi Municipalities

Women Focus Group Discussion

12 April 2021

Annex 5: Maadi and Arda Gender analysis - Men FGD

Women Focus Group Discussion

Glossary of Terms and Abbreviations

Abbreviation	Description
AZ	Abu al Zeghan
CAPEX	Capital Expenditure
CPCM	Consultant Procurement and Contract Management
CRVA	Climate Risk Vulnerability Analysis
EIB	European Investment Bank
ERI	Economic Resilience Initiative
ESA	Environmental and Social Assessment
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
EU	European Union
EUFIWACC	European Financing Institutions Working Group on Adaptation to Climate Change
FS	Feasibility Study
GGE	Greenhouse Gas Emissions
IFI	International Financing Institution
IPS	Intake Pumping Station
JVA	Jordan Valley Authority
KAC	King Abdullah Canal
KAC-N	King Abdullah Canal North
KAC-S	King Abdullah Canal South
KD	Kafrain Dam
Km	Kilometre
KTD	King Talal Dam
MCM	Million Cubic Meters
MoEnv	Ministry of Environment
MWI	Ministry of Water and Irrigation
NEPCO	National Electric Power Company
NKE	Non-Key Expert
O/F	Over Flow
OPEX	Operational Expenditure
PD	Preliminary Design
PJ	Projects Directorate
PS	Pumping Station
SEP	Stakeholders Engagement Plan
TA	Technical Assistance (Referring to the team working on this project as part of a WYG-Led consortium under the ERI-ITA multi-facility contract)
TO	Turnout
ToR	Terms of Reference
USAID	United States Agency for International Development
WAD	Wadi Arab Dam
WAR	Wadi Arab Reservoir
ZCs	Zarqa Conveyor

Executive Summary

1. Introduction

On the Global Gender Gap Report 2020, Jordan had ranked 138 between 153 countries. The Gender Index which is by the World Economic Forum is presenting the relative gaps between women and men on health, education, economy and politics.

On the other hand, Jordan had been scored 40.6 according to the World Bank in their annual study "Women, Business and Law 2020" in which they analyse how the laws and regulations in 190 countries affect the women's economic participation. In the same study, it was mentioned that Jordan had took positive steps and was among the 10 economies that showed improvement since 2017. Despite this improvement, Jordan as part of the Middle East is within the region with the lowest scores made at most.

1.1 Legislations and Laws that Affect Gender Equality Issues in Jordan

1.1.1 Jordanian Constitution (1952)

According to article 6 of the Jordanian constitution (1952), Article 6 (1) mandates that all Jordanians are under the law and that prejudice based on race, language or religion is prohibited. The constitution does not however, mention sex or gender and leaving an open a window for discrimination. The Royal Committee on Constitution Review restated in 2011 that the term "Jordanians" includes both women and men, but the actual implementation is still far from what is stated.

Article 36 in the constitution determines the selection of Senators (The Upper House) based on whether they were "present or former prime ministers, ambassadors, speakers of the House of Representatives, presidents of the Court of Cassation and of civil and Sharia courts, retired military officers, representatives who have been elected at least twice and other personalities who enjoy the confidence of the people ". This article is considered as a clear gender-discriminative, as very few of the above mentioned posts have ever been held by women.

1.1.2 Nationality Law

Under the Nationality Law No. 3 of 1954 and its adjustments under article 3, Jordanian women married to non-Jordanian men cannot pass their citizenship to their children or husband in the same way as men. In 2014, the government issued a statement promising to give sons and daughters of Jordanian women privileges in relation to education, access to health services, working permits, assets ownership and driving licences.

Later, it was mentioned in the new amendments on the *Labour Law (2019)* in article 12 that non- Jordanian sons and daughters of Jordanian women are allowed to work without permits.

1.1.3 Personal Status Laws (Amended in 2010)

- Minimum age of Marriage

According to the article 10, the legal age of marriage is 18 years for both men and women. However, a judge / court has discretion to consent to the marriage of a minor girl who is 15 years or older.

- Inheritance

Sharia rules of inheritance apply in Jordan; women have a right to inheritance according to different situations. Daughters are eligible for half the share of the inheritance of sons. A woman's share of inheritance may exceed that of a man's in more than six circumstances and be equal to a man's share in six additional circumstances. There are also situations where women inherit from deceased men, while their male counterparts do not. A non-Muslim wife does not inherit from her Muslim husband, except through a will and no more than one-third of the estate.

1.1.4 Labour Law

- Equal Pay

Very recently in 2019, with the new Labour Law amendments, it was mentioned in articles 2, 52 and 54 the equal pay between women and men doing work of equal value.

- Dismissal for pregnancy

Employers are prohibited from dismissing women because of pregnancy by Article 27 of the Labour Code.

- Paid Paternity Leave

Very recently in 2019, with the new amendments of the Labour Law, it was introduced in the article 66, 3 days paid paternity leave.

- Flexible working system

In 2017, the Jordanian government had endorsed the flexible working system without giving definitions or explanations for employers. In 2018 Ministry of Labour had issues on regulatory procedures that clarifies the law, and in 2019, it was clearly mentioned in article 2 the definition of Flexible working system.

- Child Care spaces at the workplace

Within the new amendments of Labour Law 2019, it was clearly mentioned in article 72 that each employer that have 15 employees (either males or females) who have children under the age of 5 years, the employer is forced to prepare a day care place and employ a care giver to take care of the children. This was not the case before the new amendments, as the old article stated that employer to provide day care services if there are a minimum of 20 married females who need this service. The amended law regulatory procedures also gave different options to the employer to support his/ her employees; one option is to cooperate with other employers to prepare the children day care place if they are in the same area. Another option is that the employer can cover the fees of the children day care at one of the nurseries.

- Minimum Wage

Currently, the minimum wage is 220 JoD with promises from MoL to raise it to 260 JoD for Jordanians and to 230 JoD for non-Jordanians starting from 2021.

- Legal Restrictions on Women's work

In 1997 and 2010, the government had announced in article 69, 11 professions that women are not allowed to work in, most of those professions are in metal and chemical industries, also listed professions that pregnant women are not allowed to work in for safety measures. The same announcement prohibited women from working between 10 pm and 6 am unless for specific professions such as health sector, hotels and restaurants. The decision clearly mentioned that any approval on exceptions on the above mentioned, should be through direct approval from the minister.

In 2018, as a result of different campaigns to change the law, the Minister of Labour had announced the cancelation of the decision from 2010 and replace it with a new decision allowing Jordanian women to work in or during the times and professions that they want, taking into account international standards and agreements in this regard. Unfortunately, the decision was not announced in the Official Gazette (الجريدة الرسمية) yet and was not companied with regulatory procedures, as well as, the decision excluded Non-Jordanian women which also considered a clear discrimination upon nationality.

- Integration of Agricultural Workers in Labour Law.

Since 2008, the government had decided to include the agricultural workers under the Labour Law. Unfortunately, the agricultural workers were not mentioned clearly in the law and the government didn't come up with regulatory procedures to organize the rights and responsibilities of the workers and the employers. In August 2020, the government had announced the draft regulatory procedures to the public and concerned entities to provide feedback, but the procedures were not finalized or endorsed yet. Without those procedures, the agricultural workers are not getting there basic rights such as the minimum wage, decent working environment, limited working hours,,,etc.

- Sexual Harassment in the Workplace

Article 29 of the Labour Law entitles women and men to leave their place of work without notice if they have faced harassment – including sexual harassment - from their employer. However, there is no obligation on the

part of the employer to provide a harassment-free environment in general or sexual harassment policy and no clear definition of what sexual harassment is. The Minister of Labour has the authority to temporarily or permanently shut down an establishment where sexual harassment has occurred.

1.1.5 Social Security Law

- Paid Maternity Leave

Article 45 in the law mentioned that the insured woman is paid from the Social Security Corporation during the maternity leave an allowance equivalent to her wage according to the last subject wage. This made Jordan as the first Middle Eastern country to provide cash maternity benefits for new mothers.

- Social Protection for Maternity

In October 2020, the government had announced the endorsement of the amendment of article 42 of the Social Security Law. The amended law provides working mothers with cash benefits, to enable them to return to work while securing childcare for their children either at a childcare facility or at home. It also allows for registered childcare centres to receive direct cash benefits to cover operational costs.

1.1.6 Criminal Law

- **Domestic Violence:**

Women and girls are protected by the Law on Protection from Domestic Violence, No. 15 of 2017.

- **Exoneration by Marriage**

Article 308 of the Penal Code exonerated a man in cases of rape or sexual assault if he married his victim. Article 308 was removed from the Penal Code in 2017.

- **Honour Crimes: Mitigation of Penalty**

Article 98 of the Penal Code was amended in 2017 to prevent reduction of penalties for ‘honour’ crimes. However, Article 340 has not yet been removed from the Penal Code. Article 340 allows for reduced penalties if a spouse is murdered when caught in the act of adultery.

- **Honour Crimes Protective Detention**

Women and girls whose lives are at risk for reasons related to family honour may be forcibly detained in detention centres for their own protection under the Crime Prevention Law No. 7 of 1954. By-laws have been issued for a new system that will require women and girls who are at risk to be housed in shelters.

2. Demographic Statistics

As the Jordan Valley Water Resources Efficiency Project targets **Arda, Middle Shouneh and Ma'adi municipalities in Al Balqa'a Governorate**, the below are demographic statistics about the governorate in general and the targeted municipalities in specific.

According to the Department of Statistics (DOS)[1], the estimated population of Jordan in 2019 was 10,554,000 with that of Al Balqa Governorate 543,600 representing %5.2 of the total population of the Kingdom. Males constitute 53.7% of the population of Al Balqa'a, compared to a national average of 52.9%. The majority (446,300) of the Governorate's population live in Urban areas while 97,300 living in Rural areas. The Governorate has experienced around a 9% increase in population since 2016.

Error! Reference source not found. presents population indicators for Al Balqa Governorate and its eight districts that can be compared with the national estimates. The most populous district in Al Balqa' with over 35% of the population, followed by As-Salt (23%) and Deir Allah (14%). The household size in the governorate is 4.9, comparable to the national of 4.8. Age group distribution in Al Balqa is also similar to that of the country with around 34% of the population under the age of 15, 62.6% between 15 and 64 and 3.6% over the age of 65.

Table 2-1: Population Indicators (2016)[2]

Administrative Divisions	Total Population	Total Number of Households	Household Size	Age Groups		
				< 15	15-64	> 65
Al Balqa Governorate	491,709	100,126	4.9	%33.9	%62.6	%3.6
As-Salt	105,887	22,701	4.7	%31.8	%64.3	%3.9
Al Ardah	15,644	3,135	5	%32.2	%64.1	%3.7
Zai	19,452	4,139	4.7	%34	%62.1	%4
Eira and Yarga	11,139	2,314	4.8	%34.4	%60.9	%4.8
South Shuneh	52,714	9,819	5.4	%36.7	%60.3	%3.1
Deir Allah	73,477	13,841	5.3	%31.8	%65.2	%2.9
Ain El Basha	176,726	35,695	5	%36.5	%60.2	%3.3
Mahes & Fuhais	36,670	8,482	4.3	%28	%67	%5
Jordan	9,531,712	1,977,534	4.8	%34.3	%61.6	%3.7

In 2018, the percentage of female headed households (FHH) in the Governorate of Balqa was %12 and %88 headed by men[3].

As for non-Jordanian residents, in the Jordan Valley area that is located in Al Balqa governorate, the percentage of Egyptians is %6.6 while Palestinians constituted %2.69[4]. Most Egyptians located in the Jordan Valley work in the agricultural sector.

[1] DOS (2020). Statistical Yearbook of Jordan 2019.
[2] Ministry of Planning and International Cooperation (2020). Development Plan for Al Balqa'a Governorate 2017-2019.
[3] DOS (2019). Household Income and Expenditures Survey 2018.
[4] DOS (2016). Population and Housing Census 2015.

As for Syrian refugees, according to UNCHR[5], the total number of Registered Syrian Refugees in Al Balqa Governorate was 18,417 in September 2020 compared, constituting 3.4% of the 533,825 registered Syrian Refugee living outside the camps in the different governorates of Jordan. An estimated 24.2% of the total number of registered Syrian Refugees in Al Balqa are women in the age between 18-59 compared to men in the same age group, who constitute 23.3% of the total. It is important to note that in addition to Registered Syrian Refugees, it is assumed that there is a significant number of Syrians who are not registered with UNHCR, living outside the camps in the different governorates.

2.1 Poverty and Household Income and Expenditures

In 2018, the poverty rate in Jordan was 15.7% for Jordanians and 78% for Syrian refugees[6]. According to the last Poverty Analysis Report of 2012, the absolute poverty rate in Jordan was 14.4% and the poverty line was 813.7 JD per person annually (or 68 JD monthly). Al Balqa Governorate was among three poorest governorates, with an estimated poverty rate of 20.9% with 2.1% considered extremely poor. The number of poor individuals in the governorate is estimated to be 85,499 constituting %9.7 of the poor individuals in the kingdom, taking into consideration that the governorate accounts for only 5.2% of the country's population. Moreover, Deir Alla and Ain El Basha in Al Balqa were among the 27 poorest areas in Jordan with poverty rates %29.9 and %29.5, respectively and are considered among the Poverty Pockets of Jordan[7].

In 2018, the average annual current income of FHH in Jordan was 8,054 JD compared to 11,913 JOD for households headed by men. As for the average annual household expenditures for FHH was 7,456 JD while it was 10,611 JD for households headed by men[8].

2.2 Education

Illiteracy rates in Jordan have been on a decreasing trend, reaching, in 2017, 3% for men older than 13 years and 6.9% for women of the same age range[9]. Illiteracy rates among non-Jordanians registered higher at 14.5% in 2015. Regarding school age children (6-15 years), 95% of Jordanian children are in schools while only 70% of Syrian children are. As for the Higher Education, 78% of students in public universities are Jordanian compared to %72 of students in the private universities[10].

In Al Balqa Governorate, the Development Program for Al Balqa Governorate 2017-2019 had shown that the illiteracy rate is 9.6% which is significantly higher than the national rate. It also found that the success rate in the official secondary school exam "Al Tawjihi" is 31.1%, over 5% lower than the national rate of 36.6%. Al Balqa Governorate also has one of the three highest school dropout rate with a rate of around 0.63% while the national rate is 0.25%.

The number of public schools differs from one district to another in the governorate. For example, in Dair Allah there is 21 school for boys, 2 schools for girls and 41 mixed schools. In South Shuneh, there are 14 school for boys, 3 schools for girls and 32 mixed schools[11].

2.3 Formal and Non-Formal Employment

The unemployment rate in Jordan for 2019 had increased compared to previous years. **Error! Reference source not found.** shows the economic participation and unemployment rates by gender for Al Balqa'a Governorate and all of Jordan. It shows that while Al Balqa's economic participation rate is slightly lower than the national rate, the female participation rate is slightly higher, at 15.1%, which is still considered very low. As for unemployment, the governorate has a high rate (20.8%), which is above the national average, with high female unemployment (25.6%), compared to a male rate of 19.5%[12].

Table 2-2: Economic Participation and Unemployment Rates in Jordan and Al Balqa by Gender

[5] UNHCR: Operational Portal
[6] UNICEF (2020). Geographical Multidimensional Vulnerability Analysis Report.
[7] DOS (2012). Status of Poverty in Jordan Report (based on The Household Income and Expenditures Survey 2010).
[8] DOS (2019). Household Income and Expenditures Survey 2018.
[9] DOS (2018). Jordanian Women Statistical Report 2017
[10] DOS (2016) Population and Housing Census 2015.
[11] DOS (2020). Statistical Yearbook of Jordan 2019.
[12] Ibid.

Indicator	Al Balqa Governorate	Jordan
Economic Participation Rate	32.90%	34.30%
Male Economic Participation Rate	49.50%	54%
Female Economic Participation Rate	15.10%	14%
Unemployment Rate	20.80%	19.10%
Male Unemployment Rate	19.50%	17.00%
Female Unemployment Rate	25.60%	27.00%

The average monthly wage in Jordan in 2018 was 540 JD for men and 484 JD for women, which is a wage gap over 10%. As for non-Jordanian workers, during 2018, 20,422 Syrian males and 644 Syrian females were employed in the public and private sectors compared to 59,385 Egyptian males and 336 Egyptian females[13].

Regarding the informal work, the ratio of workers in this sector is 41.4%, most of whom are in the age group 31-50 and working in the services sector. The percentage of women working informally either from home or outside their homes is 9.5%. Unfortunately, it is difficult to obtain accurate data on the informal sector due to the fact that only %21.2 of the informal businesses are registered[14].

The Jordan Valley Links Project - Women's Economic Empowerment Program implemented in the Jordan Valley / El Ghour, including the areas in Al Balqa since 2015, stated in its Gender Strategy that only 5.3% of registered small and medium businesses are owned by women, which reflects the discouraging social attitudes about females engaging in entrepreneurial activities. In addition, the level of bureaucracy needed to register a home-based business has prevented many women from doing so, and they prefer to keep their businesses unregistered and unlicensed with limited access to market opportunities and without getting benefits from the social security, to avoid the hassle of registration and licensing.

[13] DOS (2020). Statistical Yearbook of Jordan 2019.
[14] Jordan Strategy Forum Website (2020). Informal Sector in Jordan – Workers and Challenges.

3. Gender Analysis

The gender specialist had conducted Gender Analysis in the three municipalities. The Gender Analysis is a systematic effort to identify and examine the differences between the roles and responsibilities of women and men, their access to and control over resources and benefits and decision-making at the household or community level.

Gender Analysis and Gender Action Plan Objectives:

- To better understand the current Social and Gender related dynamic in the three target communities of Ma'adi, Middle Shouneh and Al Arda Municipalities in Al Balqa Governorate.
- To develop a detailed Gender Action Plan outlining how the project promoter and / or implementer can mainstream gender issues into the project before, during its construction and operation phases.

The gender analysis included conducting Focus Groups Discussions (FGDs) with women and men from the three target communities and Key Informant Interviews (KIIs) with Community Based Organization (CBO) representatives. The information below presents the main outcomes of those FGDs and KIIs.

3.1 Socio-Cultural Context

It was clear from the FGDs and KIIs done that the there are no major difference between the three municipalities in terms of gender and social issues. Women and men from the three areas had similar answers for most of the questions. However, it is worth mentioning that women from Middle Shouneh were more active in their participation in the discussions and were more aware of their community situations. This could be due to the fact that more NGOs and CSOs are working in Middle Shouneh implementing a variety of women empowerment programs. At the same time, the women working in the farms from Middle Shouneh were all educated (had at least finished their high school), unlike the women met from Arda and Ma'adi.

Similar to the rest of the Jordan Valley, the three targeted municipalities are considered tribal communities in which tribal leaders (all are men) are still influential at the community level and sometimes also at the household level. One young man who works in one of the farms from Ma'adi stated that his sister was accepted to join the police, after obtaining her father's and brothers' approval, but their tribe leader stopped her from joining as he believes that a career in the police is not suitable for women.

Most of the participants from the three areas and the community leaders interviewed had stated that the roles of women and men are divided based on the culture and social norms in the community and is not extracted from their religious requirements. Some asserted that in their community, social norms are stronger than religion.

Women's productive (income generating) role has increased in the community during the last 10 years according to both men and women who were interviewed. This was due to the bad financial situations for the families, as well as the increased awareness and support among fathers and husbands. But the type of careers that the women are engaged in should be culturally and socially acceptable. For example, Middle Shouneh is the nearest among the three municipalities to the Dead Sea which has many employment opportunities in the tourism sector. However, families rarely agree to send their daughters to work at the hotels in the area because working with tourists is not socially acceptable for them.

Upon asking if it is acceptable for the community to have women heading their households, the majority of the participants agreed that it is usually not, especially if the woman is divorced, with young children, as she usually returns to live with her family. For widows, it is less strict, but many families still prefer that widows live with their families too when the children are young. Some participants indicated that this situation is changing and due to the bad financial situation and some families are allowing their divorced and widowed daughters to live alone with the children.

The three municipalities had hosted Syrian refuges since the Syrian crises began. According to the KIIs conducted, some Syrian families (husband, wife and children) mainly work in farms and move from one area to another upon the seasonality. Moreover, before the Syrian crisis, people in the Jordan Valley in general hired immigrant workers from different nationalities, mainly from Egypt, Pakistan and Bangladesh, especially for agricultural related work.

3.2 Activity Profile

Division of labor among women and men at the household level in the targeted municipalities is a traditional one. Women's primary responsibility is mainly domestic consisting of household chores and child and elderly care. Women at the house are also responsible for school follow up until the sons become teenagers, after which the fathers / men become responsible for the follow up with the school teachers (most of whom are male). Most of the FGDs participants stated that even if the wife/daughter is working, she is still responsible for household chores and her job is considered as second burden. Few men expressed that men in their community may help their wives at home but this cannot be done in front of others as it is not acceptable in their community because of the Culture of Shame.

At the household level, women are also responsible for water management as they spend more time at home and they are responsible for household chores that consumes the largest amount of water.

As for the type of full-time formal jobs for Jordanian women in the targeted municipalities, women are working mainly in teaching, nursing and basic government jobs as those are considered as safe jobs and socially acceptable. The participants mentioned that few women from their communities are also affiliated with the police and the military, and this is considered as a new accepted job for some families. However, some still do not consider this as appropriate for women (ex. The case mentioned earlier in Ma'adi). All men who participated in the FGDs in Ma'adi and Arda agreed that they would not allow their sisters, daughters or wives to join the police force or the military because according to their beliefs, this is not an appropriate career for a woman.

Regarding informal employment and daily work (عمل المياومة) in which women is engaged in farming and micro Home-Based Businesses (HBBs) whereby women work at the houses and mostly in the food processing sector. At the farms, women of all nationalities (Jordanian, Syrian, Bengali and Pakistani) work in various farming tasks except carrying boxes of crops from the field to the truck, which is the male farmers' responsibility. Women of all nationalities working at farms are paid equally most of the time a rate between 0.6 to 1.5 JoDs per hour.

It is worth mentioning that at farms, it is very common to hire children (under the age of 18) of different nationalities to work on some tasks. Within the FGDs conducted, 6 young Jordanian men and women (ages between 15-17 years) had attended the sessions and mentioned that they left school and work at farms.

Regarding the HBBs, those are mostly unregistered micro businesses in the fields of food processing (ready food, spices, pickling, etc.) and handmade products (accessories, embroidery, etc) is an extension of women's household responsibilities and is an opportunity for women to earn income from their families. Women tend not to register their businesses for various reasons, but mainly because their businesses are not sustainable and they are afraid of paying taxes for those seasonal income generating activities.

As for men, they work in various sectors either inside or outside their communities. Many are/were affiliated with the army, some have their own small businesses/shops and the rest work on farms.

When asked about tasks and daily wages that men from different nationalities are given, all men participating in the FGDs agreed that Egyptian workers are given the highest wage (around 2 JoDs per hour) or they are paid on a monthly basis as they are considered experts in different farming tasks, in addition to residing within the farm during the season. Jordanians, Syrian refugees and other nationalities usually share the same tasks and receive the same wage (60 cents to 1.5 JoDs per hour).

It is worth mentioning that all participants from both sexes and all age groups agreed that the working conditions in the farms are difficult and not appropriate for humans. Most farms do not have sanitary facilities, requiring long working hours under the heat of the sun with no first aid services / kits available. At the same time, some of the female FGD participants mentioned that during their work at farms, they witnessed or had been victims of various kinds of harassment, mainly from non-Jordanians towards Jordanian and Syrian women farmers. One of the women said that the level of harassment had significantly decreased after the pandemic, as men were afraid of getting infected.

All participants from the two areas agreed that both women and men are paid the same salaries for the same formal government job.

When asked about voluntary work and free time, women said that most of them are members in small CBOs in their areas and they go whenever the CBO organizes an activity. Other than that, they spend their free time visiting their friends and neighbors, exploring social media and doing different hand crafts. On the other hand, few men volunteer with any CBO/NGO and they spend their free time with their friends or using social media.

Only 4 men (one owns his own farm) mentioned that they are part of farming and water and irrigation associations; however, all stated that they do not see the added value of these associations.

3.3 Access, Control and Power

3.3.1 Control Over Decision Making

Decision making structures at the household level in the three communities are very similar to the different areas in Jordan and to households. All participants from both sexes agreed that the day-to-day decisions within the house are taken in a participatory manner between the husband and the wife, and in most times, women are more involved. If those decisions have financial implications, men have more power to have the final say. At the community level, women usually do not participate in the tribes' councils and meetings and tend to engage more in civil society activities. Men are leading the tribes with minimal interventions from the women in the tribe. On the other hand, few women in the three municipalities have reached leadership positions with some winning the parliamentary and municipality elections through the quota system as they have good potential to engage in public life. However, these women were mainly supported through their tribes and they reflect their tribes' views in parliament and serve them in the municipalities and governorates councils.

When the participants were asked about the participation and the leadership of women in the farming and water and irrigation associations, all participants agreed that women do not lead or even participate in those associations as most of the farms/land owners are men. Even, if a farm is owned by a woman, it is managed mainly by a man who is engaged in the associations.

3.3.2 Access and Control over Assets, Resources and Services

In the three targeted municipalities, there was mutual agreement that men are the main asset (land and house) owners, as they are the main bread winners. In case of both a working husband and wife, it is accepted by the community for both to own a common asset, if they both contribute to it.

According to both the men and women interviewed within the three communities, inherited assets was considered in the past to be an issue. In fact, it was difficult for women to inherit from her family members as they were pressured to forfeit their rights of inheritance, particularly land/farms, to their male relatives. Women participants said that the situation has positively improved recently and women are more aware of their rights and they are now encouraging their daughters to maintain their rights in inheritance and would like them to attend awareness sessions on this specific issue. Both women and men agreed that inheritance is almost the only way for women to own land or farms. However, if the farm is not managed by the whole family (husband, wife and children), very few women manage their own farms. They usually tend to offer their farms for rental or concession (ضمان) by male farmers who manage them and pay the women owner rental fees that are usually not enough.

Most economically active women participated in the FGDs stated that they spend the largest proportion of their income, if not all, on their household needs, especially after the pandemic hitting the financial situation and many men had lost their jobs.

Regarding the access to banking services, most of the participants had mentioned that employees (women and men) whom have monthly sustainable salaries have their own bank accounts, other than that, women and men who do not have sustainable work, will not need a bank account. On the other hand, most of Syrian refugees have their bank accounts as they receive the cash assistance from the international NGOs on those bank accounts.

For accessing loans from banks and Micro Finance Institutions (MFIs), both women and men agreed that only employees with permanent jobs would apply for a loan from a bank; however, they try to avoid it as payment conditions are difficult to meet. One of the community leaders interviewed mentioned that since men own more land and assets than women, they have better access to bank loans. Moreover, women are expected to have male guarantors to obtain bank loans, which discourages them from applying. As for the MFIs, women are their main clients and usually women who take loans from MFIs do not really benefit from those loans for their businesses or to establish one, but instead, they take it to cover household and family needs.

Women in the three communities had mentioned that they tend to access finance through informal saving groups "Jami'ya" or the newly introduced Saving and Loans groups.

Both women and men have access to health services in the three municipalities. However, women are usually accompanied by a male relative if she is going to receive health services outside the municipality or at the governorate center.

3.3.3 Mobility Freedom and Transportation

Women in the three areas agreed that they can travel freely within their municipality and to other nearby municipalities. Some also mentioned that they also can travel to Amman or Salt (the governorate center) without a male escort joining.

On the other hand, the public transportation network is not effective or efficient at all within one municipality and between municipalities. Public buses and taxis are generally not punctual and are not considered as a safe transport means for women, as they may be exposed to various kinds of harassment. Local community members usually use unregistered private taxis to travel. This situation is discouraging women from working in jobs that are far from their homes, as well as preventing women entrepreneurs who manage their own micro and small businesses from regularly accessing the market.

Women are allowed to drive private cars that are owned by them or their families. However, social perception of women's capacity to drive affects their self-confidence, especially for driving long distances and between governorates.

4. Gender Action plan - Jordan Valley Water Resources Efficiency Project:

Time Span	Main Activity	Sub-Activity	Target Group	Notes
Before implementation / Design Phase	Community Engagement	Mapping of and outreach to farming, water and irrigation associations and orient them about the project, the different alternatives and how this will affect and benefit them	Farming, water and irrigation association members	As all of the association members are men, CBO and NGO women leaders could be invited to those sessions too
		Outreach to farms owners to orient them about the project, the different alternatives and how this will affect and benefit them	Farm owners, with focus on women owners (*even if they are not the ones managing those farms*)	The outreach could be done through the farming, water and irrigation associations and NGOs
		Outreach to community and tribal leaders, religious leaders, CBO and NGO leaders, women activists and youth influencers and orient them about the project, the different alternatives and how this will affect and benefit them	Community, tribal and religious leaders, CBO and NGO leaders, women activists and youth influencers	
	Compensation Distribution	Ensure equal compensation distribution regardless the sex of the farm, land and house owners, if land acquisition is needed.	Farm, land and house owners	
During implementation / Construction Phase	Employment Opportunities Creation	Hire local men and women from the three municipalities during project implementation	Men and women from the three municipalities	The outreach for unemployed men and women could be done through labour offices, municipalities and CBOs
		Encourage women from the three municipalities to apply for administrative (and any socially accepted) employment opportunity created by the project.	Women from the three municipalities	This could be done through: 1. Spreading word of mouth to the local community through CBOs and NGOs 2. Including a sentence in the employment ad that states “women

Time Span	Main Activity	Sub-Activity	Target Group	Notes
				candidates are encouraged to apply"
		Ensure that the recruitment process is fair, transparent, gender sensitive and not affected by tribal connections (Wasta)	Men and women from the three municipalities	
		Provide all employees hired for project implementation with appropriate benefit packages such as health insurance and social security as stated in the Jordanian laws and regulations	Project employees	
		Ensure not to employ any child under the age of 18 years in hazardous work and 16 years for nonhazardous work	Children from the three municipalities	
	Support local micro, small and medium businesses in the three municipalities	Support the micro, small and medium shops and businesses in any needed supplies and materials during the implementation	Micro, small and medium businesses owners	
		Support micro and small home-based businesses managed by women from the local communities especially in providing meals and different kind of food products (if needed) for project employees	Micro and small home-based business owners	
After implementation / Operational Phase	Awareness Raising	Raise the awareness of men and women farmers and farming, water and irrigation association members on best water management tools and methods in the farms	Farmers and association members	
		Raise the awareness of women from the local communities in water efficiency and reusing the household water (gray water)	Women from the local community	Awareness can be done in collaboration with the CBOs and NGOs in the three municipalities

Time Span	Main Activity	Sub-Activity	Target Group	Notes
		Raise awareness of farm owners and farm workers (with focus on women) on the newly issued (May 2021) labour system for workers in the agriculture field.	Farm owners and workers – with focus on women workers-	Awareness raising could be done in collaboration with the labour offices
		Raise the awareness of women owning farms on basic management and financial skills and encourage them to manage their own farms instead of renting the farms to men to manage	Women owning farms	This can be done through connecting women owning farms with some NGOs in the area that provide capacity building and empowerment programs on management and financial skills. At the same time, if some budget is allocated, the JV project can hire trainers / experts in the training fields and arrange for trainings targeting women owning farms.

Annex 1: KII Intreview. Randa Al Sarairah – Jordanian Hashemite Fund for Human Development / Middle Shouneh Community Center Director - 8 April 2021

Question	Answer
Water and Irrigation Associations. Number of participants in any Water and Irrigation Associations? What's the name of this association? Nature of water and irrigation association work? And how do they help the farmers? Regarding the membership, is there any specific conditions to join them, such as the educational level? Being an agricultural engineer? Farms owners? Jordanian men or women? Jordanian on non-Jordanian?	These associations are responsible organize the distribution of water for the farmers, save water to them in case of cut off from dams and channels. A major requirement is to divide the area into three regions: Al Ramah, Al Karamah and Al Kafrein. And each region is responsible to manage its area. The associations also responsible to connect the farmers with other institutions and also help them in the agriculture lending. The members of the associations are the farm's owners, and no specific qualifications are required.
Agricultural Associations. Member of any Agricultural Associations?	Women usually are not part of such associations; their husband take the role as in most cases farms are for men. Jordanians usually own the farms, few non-Jordanians can own farms, they usually work or rent the farms.
Farm's ownership. What is the percentage of the women who own farms?	Few women own farms, most farms are owned by men.
The farm's owner from women, from where do they usually own the farm? (inheritance, from her own money, or from a loan)?	Inheritance, and usually she takes her share as money and leaves the farms for men. Few women who have high ambitious and experience can own farms, most of the time they lease the farms to others to run the work at the farm.
Who negotiate in buying and selling? Do they run the work in the farms	Men
Working in the Farms Who work more in the farms? Men or women? Foreign workers? Syrians? Arabs?	Men work more than women, women can manage and run the work in the farm, but no one will realise that. The culture that men can work, and guide more than women are still existing. If women manage the farms and ask for support, they can get the needed support from the associations and maybe more than what men get. Many foreign workers work in farms from different nationalities such as: Pakistani, Syrians, Egyptians, Sudani and Bengali. The most common foreign workers are Egyptians, Syrians and Pakistani.

Question	Answer
Are there workers in the farms with disabilities?	Yes. There is a farm's owner is from disabilities and got a help from the Princess.
Ages for workers, men and women.	All ages work in farms, 13, 60 and even 70 For young ages, they don't go to school, they only work at farms. The percentage of school dropouts is very high, most of them are Syrians. Many farmers especially from foreign workers bring their families to work with them in the farms.
The marital status for the women	It's mixed, Married, singles, divorces and the most of them are widows who accept all work conditions to support their kids and maintain a decent life.
How they distribute the tasks?	Palm tree, usually the Jordanians work in picking and packaging and taking them to factories.
Are the tasks that assigned to Jordanians different from the ones that are assigned to foreign workers?	They all can do everything, but foreign workers work more than Jordanians.
Are the tasks that assigned to Jordanians different from the ones that are assigned to foreign workers? (Women workers)	Women can work anything in the farms except the tilling and riding a tractor.
Usually who do the irrigation in farms?	Women sometimes can do the irrigation but is observed by men.
Regarding the working climate, environment in farms, is it adequate in terms of working hours, transportation, health facilities and general safety conditions	The transportation is available from the farm's owners, they send pickups for the farmers. No health facilities are available. The environment is not safe, but they work to get money. The usual working hours are from 5 AM till 10 AM and after 10 considered as an overtime. No safety measures are considered.
How is the wage of farm workers determined? According to work nature?	It depends on working hours, usually it's JOD 1.25 to 1.50 per hour and depends on plants and nature of work. For example, working on palm is different than tomato. Foreign workers work more than Jordanians. Before working the farmers agreed on number of working hours and upon that the wage is determined.
What is the common wage for the famers?	They work for 6-7 hours and earn JOD 1.25 per hour.
Social Security and Insurance for farmers.	No
Do you get cases of harassment on farms?	Yes, so many cases. Because of the hot weather, harassment cases are increased.

Question	Answer
	Young ages are the most category who face the harassment, especially from the foreign workers who are without their families. Usually, Egyptians and Pakistani workers who do the harassment. Many marriage cases happened, abut 6-7 women married to Egyptians.
Social characteristics What type of work people work in the area?	Most common work in in agriculture, the percentage of governmental jobs is very law. Women work in education and in health sector. They don't work in military or in commercial sectors, recently from 3 to 4 years women started to involve in military sector.
Unemployment	The area is known as a highest area of Pockets of poverty. (Al Baqaa, Ein Al Basha, Deir Alla and Sweimeh). Some areas are knows with the highest percentage of educated people such as عيرة ويرقا but they have the highest percentage in unemployment.
Roles inside home.	Many men marry educated women to be able to teach their kids and don't allow them to work outside home. Men do the maintenance work at home.
Decision makers.	Both take decisions but women should refer to their husbands before doing anything and taking a decision.
Income management	They both are responsible.
Transportation	They can move freely, and they can go from area to are to buy supplies or even do a picnic.
Ownership	Women usually don't own anything unless being widow. Even if both man and woman work, she can't have anything under her name it should be owned by man. Women can have their inheritance, 90% of women can take their inheritance.
What are the main Economic activities?	Farms. Water desalination Some activities is exclusive to certain people and tribe and no body is allowed to do the same business.
Small businesses.	Some women work in beauty centers or in houses and are responsible for all expenses.

Question	Answer
	Other women have their own home-based busines such as productive kitchen or making pickles and other food processing work. They earn few money that's why they don't to do home businesses a lot.
Tribes' area	It's considered as a tribal area. It's divided into two categories: the powers of the tribes and the quantitative tribes. The powerful tribes are from Al Odwan while the quantitative tribes are from Al Ghour and Al Sabaweyeh.

Annex 2: Middle Shouneh Municipality - Men's Focus Group Discussion – 8 April 2021 (10 Farmers)

Question	Answer
Water and Irrigation Associations. 1. Number of participants in any Water and Irrigation Associations? What's the name of this association?	• No body is a member of any water and irrigation association.
2. Nature of water and irrigation association work? And how do they help the farmers?	• They don't know about such associations and don't know what they do. • They mentioned that they know about King Abdullah II channel, this was the first project and later on it failed. They pump water from Sad Al Kafrein.
3. Regarding the membership, is there any specific conditions to join them, such as the educational level? Being an agricultural engineer? Farms' owners? Jordanian men or women? Jordanian on non-Jordanian?	• They don't know about the associations, so they don't know what are the conditions or qualifications.
Agricultural Associations. 1. Member of any Agricultural Associations?	• No one is member of any association. • They mentioned that there are agricultural associations, but they don't reach the farmers. • The members at theses associations are limited. • The employees distribute the water but according the farmer's turn. • They distribute 144m for 35 acres weekly, and it's not enough for 3 acres. • Famers dig wells to fill the water deficit, but it's so expensive. • Usually, these associations are consist of 15 member. Only one person is benefited and taking salary, insurance and registered in the Social Security and the rest don't benefit anything from them. • The association has a limited quantity of water, during winter the dam is full of water but in the other times there is a huge lack of water. • There is a "14.5" project, which was launched in 1984, but was expand in 1997. The farmers should fill a form in the court which states that: "You can have your land without water". And farmers should sign commitment to take the land without water.
Farm's Ownership. 1. What is the percentage of the women who own farms?	• No women are members of Agricultural Associations. The weather is so hot especially in Summer and they can't go to attend meetings or gatherings.

Question	Answer
	• They are not enrolled in the associations, but they can work in the farms, plant seeds and weed.
2. The farm's owner from women, from where do they usually own the farm? (inheritance, from her own money, or from a loan)?	• 52% inheritance from her father. • They usually don't have the capital to buy their own farms.
3. Who negotiate in buying and selling? Do they run the work in the farms	• Men, and if she own a farms she leases (تضمين) the farm. • Some women do, but the common is the men who are running the farms work.
Working in the Farms 1. Who work in the farms? Men or women? Foreign workers? Syrians? Arabs?	• The percentage of foreign workers is high. • Number of ladies foreign workers is higher than the Jordanians. • The Syrians workers fill the gap and give the chance for the Jordanians women to work in the factories. • For men; The percentage Egyptian workers is higher than the Jordanian. In addition, he's more expensive in terms of wages (Work permits and fees). • Egyptian workers are more qualified than any other workers. • Syrians' workers take the same wage as the Jordanian.
2. Are there workers in the farms with disabilities?	• Yes, sometimes deaf. • People with Impaired mobility is hard to work in farms.
3. Ages for workers, men and women.	• The range of ages forr women are 18-50, and less than 18, they come with their families. • Mostly people who are 15-16 are Syrians.
4. The marital status for the women.	• It's mixed, some are married, some are divorced, others are widow and young ladies come with their fathers, mothers or brothers.
5. How they distribute the tasks?	• They all work in production, picking, weeding, plantings seeds and packaging.
6. Are the tasks that assigned to Jordanians different from the ones that are assigned to foreign workers?	• Egyptian workers usually do tasks that no one can do it better than them. They can perform tasks in 2 hours instead of 4. • Syrians' workers are more in production and breeding.
7. Are the tasks that assigned to Jordanians different from the ones that are assigned to foreign workers? (Women workers)	• Usually, they do the same.
8. Usually who do the irrigation in farms?	• Women
9. Regarding the working climate, environment in farms, is it adequate in terms of working	• The Agricultural situation is very bad, the farm's owner might bring workers who don't understand anything in agricultural, women

Question	Answer
hours, transportation, health facilities and general safety conditions	sometimes bring her whole family just to work 4 hours and to have money, the wage for an hour is JOD 1.25 which is nothing, and the situation is very bad since the curfew and lockdown. • The government import Banana while we plant it here in Jordan. • The agricultural materials and fertilizers are very expensive. • No health facilities available • Transportation is available from the farm's owner.
10. How is the wage of farm workers determined? According to work nature?	• The Egyptian worker is the most expensive, the rest take the same wage
11. What is the common wage for the farmers?	• 2.5 per hour for the Egyptian and 1.25 for the rest
12. Do you get cases of harassment on farms?	• No
13. Do you get cases of harassment on farms?	• No

Annex 3: Middle Shouneh Municipality - Middle Shouneh Municipality

Women Focus Group Discussion – 8 April 2021-10 women farmers

Question	Answer
Water and Irrigation Associations. 1. Number of participants in any Water and Irrigation Associations? What's the name of this association? 2. Nature of water and irrigation association work? And how do they help the farmers? 3. Regarding the membership, is there any specific conditions to join them, such as the educational level? Being an agricultural engineer? Farms owners? Jordanian men or women? Jordanian on non-Jordanian?	• No body is a member of any water and irrigation association. • They don't know about such associations as they work in their own farms and usually men know about these associations.
Agricultural Associations. 1. Member of any Agricultural Associations?	• No body is a member of any water and irrigation association. • They don't know about such associations as they work in their own farms and usually men know about these associations.
Farm's ownership. 1. What is the percentage of the women who own farms?	• Some women got farms from their inheritance, and usually they lease the farms for others to manage and run the work..
2. The farm's owner from women, from where do they usually own the farm? (inheritance, from her own money, or from a loan)?	• Inheritance, and usually she takes her share as money and leaves the farms for men. • Few women who have high ambitious and experience can own farms, most of the time they lease the farms to others to run the work at the farm.
3. Who negotiate in buying and selling? Do they run the work in the farms	• Men, and if she owns a farm she leases (تضمين) the farm. • It's hard for a woman to follow up with the workers. • Some women do, but the common is the men who are running the farms work. • In the past women were able to run the work in the farms but recently it's very hard and the situation is very bad. • Many people want to rent farms and mange them but due to the bad situation they can't.
Working in the Farms 1. Who work more in the farms? Men or women? Foreign workers? Syrians? Arabs?	• Women work in farms more than men. • The percentage of foreign workers is high. • Number of ladies foreign workers is higher than the Jordanians.
2. Are there workers in the farms with disabilities?	• Yes, but very few because it's hard to them to work and perform some tasks.
3. Ages for workers, men and women.	• Many ages, thirties, forties and fifties. • Young girls also work in age of 16 but they usually work with their families, and they are usually Jordanians.

Question	Answer
4. The marital status for the women	• It's mixed, married, divorced, widows and singles.
5. How they distribute the tasks?	• Women usually work in picking.
6. Are the tasks that assigned to Jordanians different from the ones that are assigned to foreign workers?	• All workers from different nationalities can perform the same tasks, they can do the weeding, planting, picking.
7. Are the tasks that assigned to Jordanians different from the ones that are assigned to foreign workers? (Women workers)	• Usually, they do the same.
8. Usually who do the irrigation in farms?	• Men
9. Regarding the working climate, environment in farms, is it adequate in terms of working hours, transportation, health facilities and general safety conditions	• The Environment is very bad. • The working hours are usually divided into two shifts: 6 AM till 10 AM and 2 PM till 4 PM. • The transportation is available, the farm's owner Ensure to send pickup or bus to drop them
10. How is the wage of farm workers determined? According to work nature?	• Men earn more than women. • Egyptians are more expensive than Jordanians.
11. What is the common wage for the famers?	• The Jordanians earn 0.60 cent while the Egyptian earns JOD 1 per hour.
12. Social Security and Insurance for farmers.	• No
13. Do you get cases of harassment on farms?	• Yes, but before Covid-19, now they are afraid from Covid-19. • Usually, women are the victims. • There is marriage cases between farmers and from foreign workers but some families don't accept.

Annex 4: Maadi and Arda Gender analysis - Women FGD

Arda and Ma'adi Municipalities

Women Focus Group Discussion

12 April 2021

Question	Answer
Water and Irrigation Associations. 4. Number of participants in any Water and Irrigation Associations? What's the name of this association? 5. Nature of water and irrigation association work? And how do they help the farmers? 6. Regarding the membership, is there any specific conditions to join them, such as the educational level? Being an agricultural engineer? Farms owners? Jordanian men or women? Jordanian on non-Jordanian?	• They got the fertilizers from the associations. • They also buy the drink water to fill the tanks through the associations
Agricultural Associations. 1. Member of any Agricultural Associations?	
Farm's ownership. 1. What is the percentage of the women who own farms?	• All of them are men. • Some ladies might manage a farm but it's owned by a man.
2. The farm's owner from women, from where do they usually own the farm? (inheritance, from her own money, or from a loan)?	• Some women own farms but they don't manage them, they lease the farms to others. • Most of the farms that owned by women are part of her inheritance.
3. Who negotiate in buying and selling? Do they run the work in the farms	• Men
Working in the Farms 1. Who work more in the farms? Men or women? Foreign workers? Syrians? Arabs?	• Many nationalities work in the farms such as: Jordanians, Egyptians, Syrians, Palestinian and Pakistani. • Women from all the above-mentioned nationalities work in farms except Egyptians.
2. Are there workers in the farms with disabilities?	• Sometimes yes.
3. Ages for workers, men and women.	• The ages start from 15 from all nationalities, Pakistani start working in farms from 8 years. • Some Jordanians start to work in early ages, so they stop learning at school and got to work while other do both study and work.
4. The marital status for the women	• Mixed. • All categories work, they work to fill the gap they have, sometimes the man is unemployed, so his wife goes to work in the farms. • Due to Covid-19 situation, many women who never work before started to work in the farms.
5. How they distribute the tasks?	• No differences they all do the picking, packaging, loading, irrigation and fertilization.

Question	Answer
6. Are the tasks that assigned to Jordanians different from the ones that are assigned to foreign workers?	• No, they perform the same tasks. • Egyptians perform more tasks as he's alone and he doesn't have a family with him, so he can stay longer time at work. • They described the Jordanians workers as lazy persons that's why the Egyptians is more qualified than them. • The Jordanians are looking for office jobs, while the foreign worker is only trying to save money for his family. • The Foreign worker can perform a task within two hours while the Jordanian might take a whole day in performing the same task.
7. Are the tasks that assigned to Jordanians different from the ones that are assigned to foreign workers? (Women workers)	• No, but foreign workers can perform more the Jordanians.
8. Usually who do the irrigation in farms?	• All can do the irrigation.
9. Regarding the working climate, environment in farms, is it adequate in terms of working hours, transportation, health facilities and general safety conditions	• They suffer a lot from the environment. • Unhealthy water • No First Aid Kit available in case of any injury case. • Transportation is available from the farm's owner; he usually sends a bus or a pickup. • No security. • Working hours start from 5 AM till 11 AM • Other shifts may stay till 2 PM or 4 PM it depends on the season and on the workload. • The farm's owner is responsible for the breakfast meal, but in that case, he reduces the daily rate. If the farmers bring their breakfast the daily rate remains the same as agreed with the farm's owner.
10. How is the wage of farm workers determined? According to work nature?	• Men earn more then the women
11. What is the common wage for the famers?	• The wages for the Jordanian man is higher than the woman, he earns JOD 1.50 while for woman JOD 1.25 per hour even if they perform the same task. • The Syrian worker earns JOD 0.50 per hours and the Egyptian worker is paid on monthly basis.
12. Social Security and Insurance for farmers.	• No
13. Do you get cases of harassment on farms?	• No, they work in a group, even if they want to use the bathroom they go in a group.
Social Characteristic 1. Common jobs	• Usually men work in farms, Governmental jobs and in the private sector. • Women work in printing, farms and military.
2. Culture and traditions	• In the current time and due to the bad situation they have, families encourage women to work. • In the past they didn't allow women to work in military but now they started to accept. • The development that happened is very useful to the community, women can be educated, and can drive.

Question	Answer
3. Decision maker	• The man (Father or husband) is the decision maker
4. Expenses	• The mother is the responsible but with consultation with family members. • In case of having a groom for a lady, the father will take the decision then have a consultation with the mother.
5. Look after kids	• The mother.
6. Help in home tasks.	• Wives do everything.
7. Any home-base businesses	• Many women have their own businesses: • A lady is selling home supplies for 17 years, and she got the support from her husband especially during Covid-19. She also can go to Amman to Irbid to buy the needed supplies. • Other lady is selling clothes and blankets and she got the needed support from her husband and children. • They use WhatsApp application to promote their products.

Annex 5: Maadi and Arda Gender analysis - Men FGD

Women Focus Group Discussion

Question	Answer
Water and Irrigation Associations. 7. Number of participants in any Water and Irrigation Associations? What's the name of this association? 8. Nature of water and irrigation association work? And how do they help the farmers? 9. Regarding the membership, is there any specific conditions to join them, such as the educational level? Being an agricultural engineer? Farm's owners? Jordanian men or women? Jordanian on non-Jordanian?	• They don't know about the associations
Agricultural Associations. 1. Member of any Agricultural Associations?	• They don't know about the associations
Farm's ownership. 1. What is the percentage of the women who own farms?	• Men and women but mostly men.
2. The farm's owner from women, from where do they usually own the farm? (inheritance, from her own money, or from a loan)?	• From her inheritance but they usually lease the farm to others.
3. Who negotiate in buying and selling? Do they run the work in the farms	• Men
Working in the Farms 14. Who work more in the farms? Men or women? Foreign workers? Syrians? Arabs?	• Women and men from different nationalities. • Egyptians, Pakistani, Syrians and Jordanians. • Women work from different nationalities except the Egyptians.
15. Are there workers in the farms with disabilities?	• Yes, they know a deaf person work in a farm.
16. Ages for workers, men and women.	• All ages, they all are young and started to work in farms in early ages. • They don't learn at school, they all left the school and work in farms
17. The marital status for the women	• Mixed.
18. How they distribute the tasks?	• Palm trees is one of the men responsibilities especially that the trees are so high, for the lower one's women can be responsible on. • Loading tomato, young men are responsible to carry the boxes.
19. Are the tasks that assigned to Jordanians different from the ones that are assigned to foreign workers?	• No.
20. Are the tasks that assigned to Jordanians different from the ones that are assigned to foreign workers? (Women workers)	• Egyptians work everything, they work as supervisors and they stay and sleep at the farm.
21. Usually who do the irrigation in farms?	• Men
22. Regarding the working climate, environment in farms, is it adequate in terms of working hours, transportation, health facilities and general safety conditions	• No First Aid Kit available. • If there is a serious injury, the worker can go to the hospital and the farm's owner will pay. • Working hours start from 6AM

Question	Answer
	• The transportation is available from the farm's owner who send a bus to all workers. • Health facilities are available for both men and women.
23. How is the wage of farm workers determined? According to work nature?	• Jordanians are paid daily basis, while the Egyptian is paid on monthly basis.
24. What is the common wage for the famers?	• Syrians earn JOD 1 per hour. • Jordanians earn JOD 1.25 while the Egyptian is paid on monthly basis. • Women are paid from JOD 1 to 1.25 it depends on work nature. • The high wage is for the workers who work in Pam, they work from 6AM till 4PM and earn JOD 14, and from 6AM till 2PM for JOD 12.
25. Social Security and Insurance for farmers.	• No.
26. Do you get cases of harassment on farms?	• No harassment cases, they all from the same area.
Social Characteristics 1. What do men and women work in the area?	• Men work in farms, Municipal employees and in military jobs. • Women work in farms; it's not accepted yet to have women working in military.
2. Why the unemployment percentage increased?	• Due to Covid-19 situation • The foreign workers. • Many factories were closed. • Salaries ranges are very low.
3. Where do you prefer to work in a farm or in military?	• Military, a stable job with a permanent salary. • Most of them registered to work in the military.

Category	Agency / English	Agency / Arabic	No.	Attending way	Status
Ministries	Ministry of Environment	وزارة البيئة	1	Virtual	
	Ministry of Planning and International Cooperation	وزارة التخطيط والتعاون الدولى	1	Virtual	
	Ministry of Agriculture	وزارة الزراعة	1	Virtual	
	Ministry of Interior	وزارة الداخلية	1	Virtual	
	Ministry of Tourism and Antiquities	وزارة السياحة والاثار	1	Virtual	
	Ministry of Health	وزارة الصحة	1	Virtual	
	Ministry of Public Work and Housing	وزارة الاشغال العامة والاسكان	1	Virtual	
	Ministry of Transport	وزارة النقل	1	Virtual	
	Ministry of Local administration	وزارة الادارة المحلية	1	Virtual	
	Ministry of Labour	وزارة العمل	1	Virtual	
Governmental institutions	Balqa Police Directorate	مديرية شرطة البلقاء	1	Virtual	
	Balqa Civil Defense Directorate	مديرية دفاع مدنى البلقاء	1	Virtual	
	The Royal Department for Environmental Protection	الإدارة الملكية لحماية البيئة	1	Virtual	
	Balqa Governorate	محافظ البلقاء	1	Virtual	
NGOs & Associations	The Jordanian Hashemite Fund for Human development	جهد	1	Virtual	
	Royal Society for the Conservation of Nature	الجمعية الملكية لحماية الطبيعة	1	Virtual	
	Jordanian Engineers Association	نقابة المهندسين الاردنيين	1	Virtual	
Local community	Water users association	جمعيات مستخدمي المياه	4	in-person (Ghour)	
	Community representatives through Municipalities	ممثلين وممثلات عن المجتمع المحلي من خلال البلديات	6	in-person (Ghour)	
	CBO	جمعيات المجتمع المدنى وجمعيات نسائية	3	in-person (Ghour)	
Academic Institutions	Balqa University	جامعة البلقاء التطبيقية	1	Virtual	
Municipalities	Arda Municipality	بلدية العارضة	1	Virtual	
	Ma'adi Municipality	بلدية معدى	1	Virtual	
	Middle Shounah Municipality	بلدية الشونة الوسطى	1	Virtual	
Donors	GIZ	المؤسسة الألمانية للتعاون الدولى	1	Virtual	
	KfW	بنك الاعمار الالمانى	1	Virtual	
	USAID	الوكالة الأمريكية للتنمية الدولية	1	Virtual	
Organizers	TetraTech and Engicon		2	in-person (Ghour)	
			7	Virtual	
Client	MWI / JVA		4	in-person (Ghour)	
			4	Virtual	
	EIB	بنك الاستثمار الاوروبى	3	Virtual	
Total Virtual			**38**		
Total in-person			**19**		
Total			**57**		

The ERI ITA is funded by the European Investment Bank

Jordan Valley Water Resources Efficiency Project
مشروع رفع كفاءة مصادر المياه في وادي الأردن

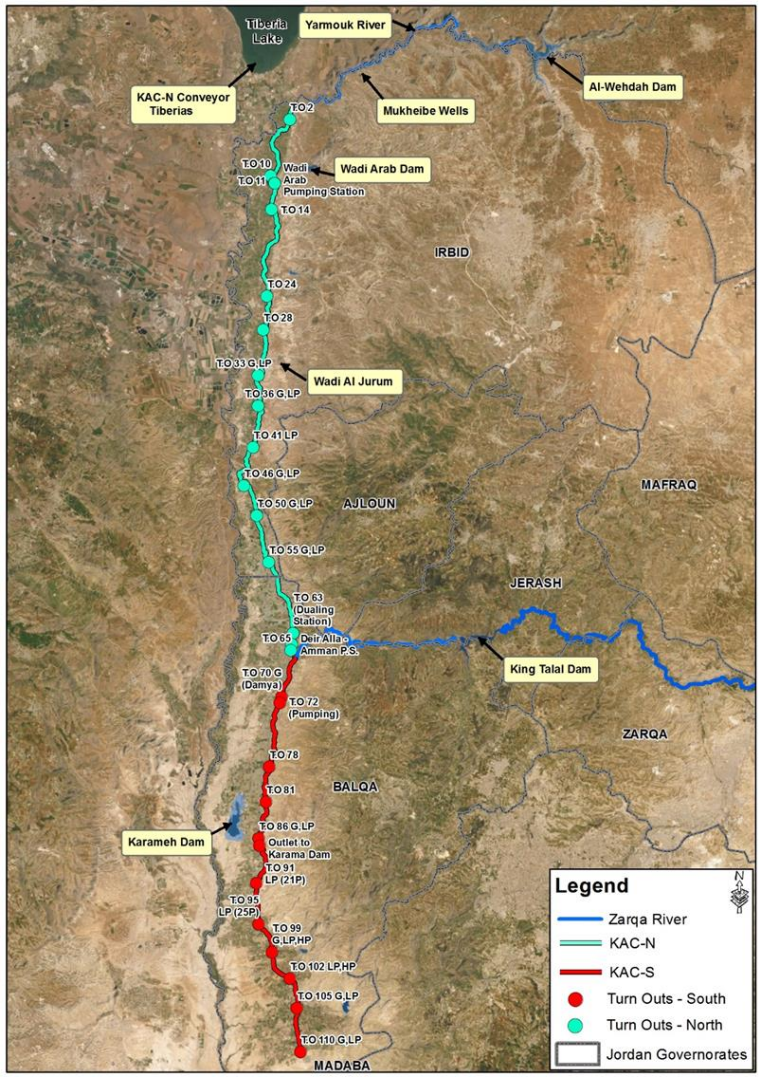
Consultation Session
جلسة تشاورية

05 September 2021

محتوى العرض

1. خلفية المشروع وموقعه
2. أهداف دراسة تقييم الأثر البيئي
3. الإطار التنظيمي والتشريعي
4. البدائل
5. وصف فني للمشروع ومكوناته
6. أهم القضايا البيئية

خلفية عن المشروع



- يهدف المشروع إلى تحسين كفاءة تزويد مياه الري في وادي الأردن من خلال بناء ناقل مياه مغلق ليحل محل جزء من قناة **الملك عبد الله الجنوبية.**
- **الممول:** بنك الاستثمار الاوروبي.
- **المستفيد:** وزارة المياه والري / سلطة وادي الأردن.
- **الدراسة:**
  - تحضير دراسة جدوى اقتصادية
  - تقييم الأثر البيئي والاجتماعي
  - إعداد التصاميم النهائية ووثائق العطاء
- **الوضع القائم**
  - يصل فاقد المياه في القناة حاليا الى 38%

أهداف دراسة تقييم الأثر البيئي

- تحديد الإطار القانوني والتنظيمي البيئي والاجتماعي الذي يحكم تنفيذ المشروع
- وصف مكونات المشروع والبدائل التي تم النظر فيها
- تحديد الظروف البيئية والاجتماعية الأساسية داخل منطقة تأثير المشروع
- تحديد وتقييم الآثار البيئية والاجتماعية المحتملة المرتبطة بجميع مكونات المشروع واقتراح الاجراءات التخفيفية الممكنة
- وضع خطة إدارة بيئية واجتماعية لكافة مراحل المشروع.

الاطار التنظيمي والتشريعي

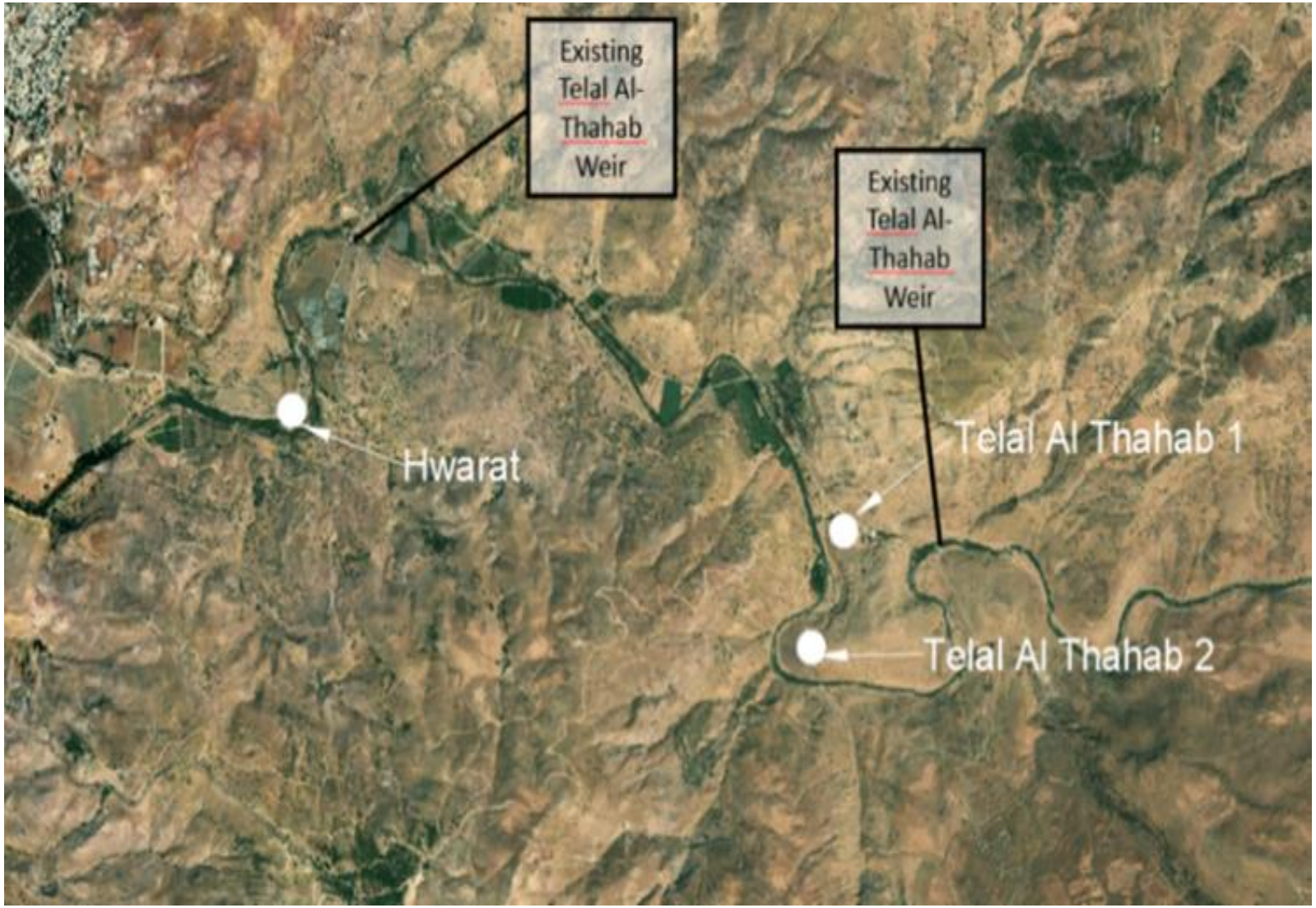
الجهات ذات الصلة

- وزارة المياه والري / سلطة وادي الاردن
- جمعية مستخدمي المياه
- وزارة البيئة
- وزارة التخطيط والتعاون الدولي
- وزارة الزراعة
- وزارة الداخلية
- وزارة السياحة والاثار
- وزارة الصحة
- وزارة الاشغال العامة والاسكان
- وزارة النقل
- وزارة الادارة المحلية
- وزارة العمل

القوانين ذات الصلة

- قانون حماية البيئة رقم 6 لسنة 2017
- قانون الزراعة رقم 13 لسنة 2015
- قانون الآثار رقم 23 لسنة 2004
- قانون البلديات رقم 41 لسنة 2015
- قانون تطوير وادي الأردن رقم 19 لسنة 1988 وتعديلاته بالقانون 30 لسنة 2001
- قانون الصحة العامة رقم 47 لسنة 2008
- قانون العمل رقم 8 لسنة 1996 وتعديلاته
- قانون الضمان الاجتماعي رقم 1 لسنة 2014
- قانون منع الإتجار بالبشر رقم 9 لسنة 2009
- قانون المرور رقم 49 لسنة 2008
- قانون حماية التراث والمواقع التراثية رقم 5 لسنة 2005
- قانون استملاك الاراضي رقم 12 لسنة 1987 وتعديلاته

البدائل



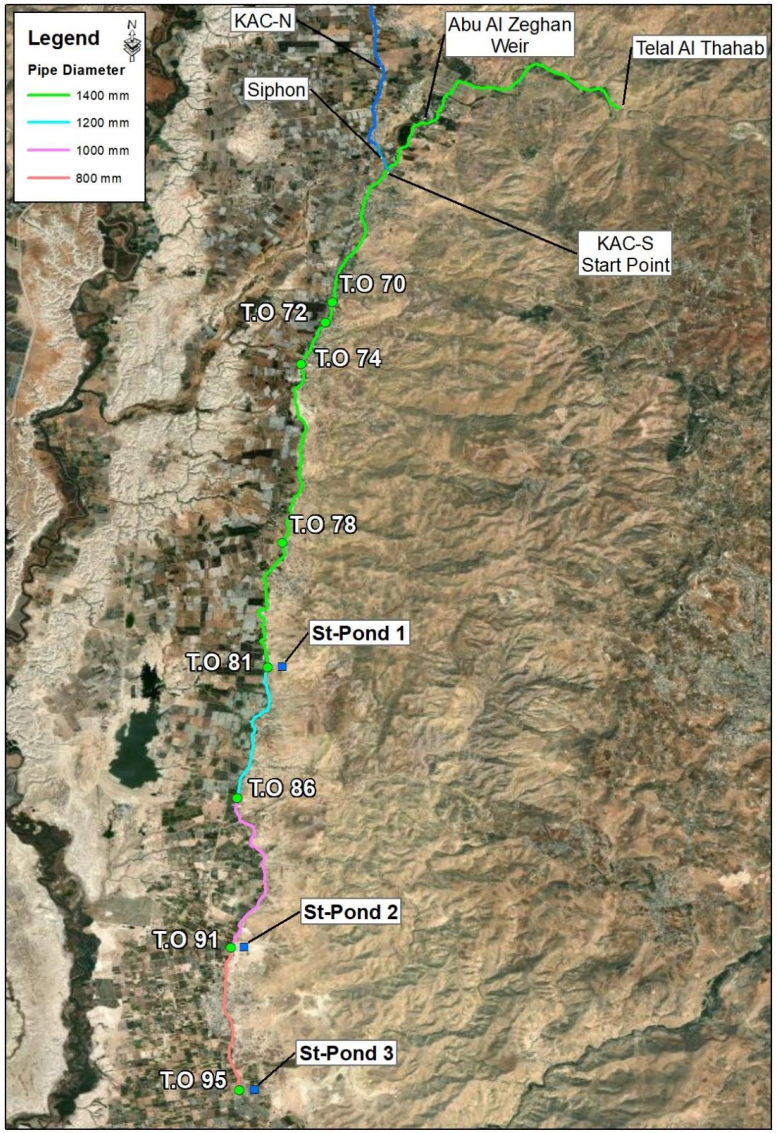
البدائل الخاصة بمواقع احواض الترسيب:

- تلال الذهب 1
- تلال الذهب 2
- الحوارات

البدائل الخاصة بالناقل:

- مابين تلال الذهب وأبو الزيغان (حوالي 6.5 كم)
- مابين ابو الزيغان وقناة الملك عبدالله الجنوبية
- بمحاذاة قناة الملك عبدالله الجنوبية وبطول حوالي 30 كم.

وصف فني للمشروع ومكوناته



الخيار المفضل

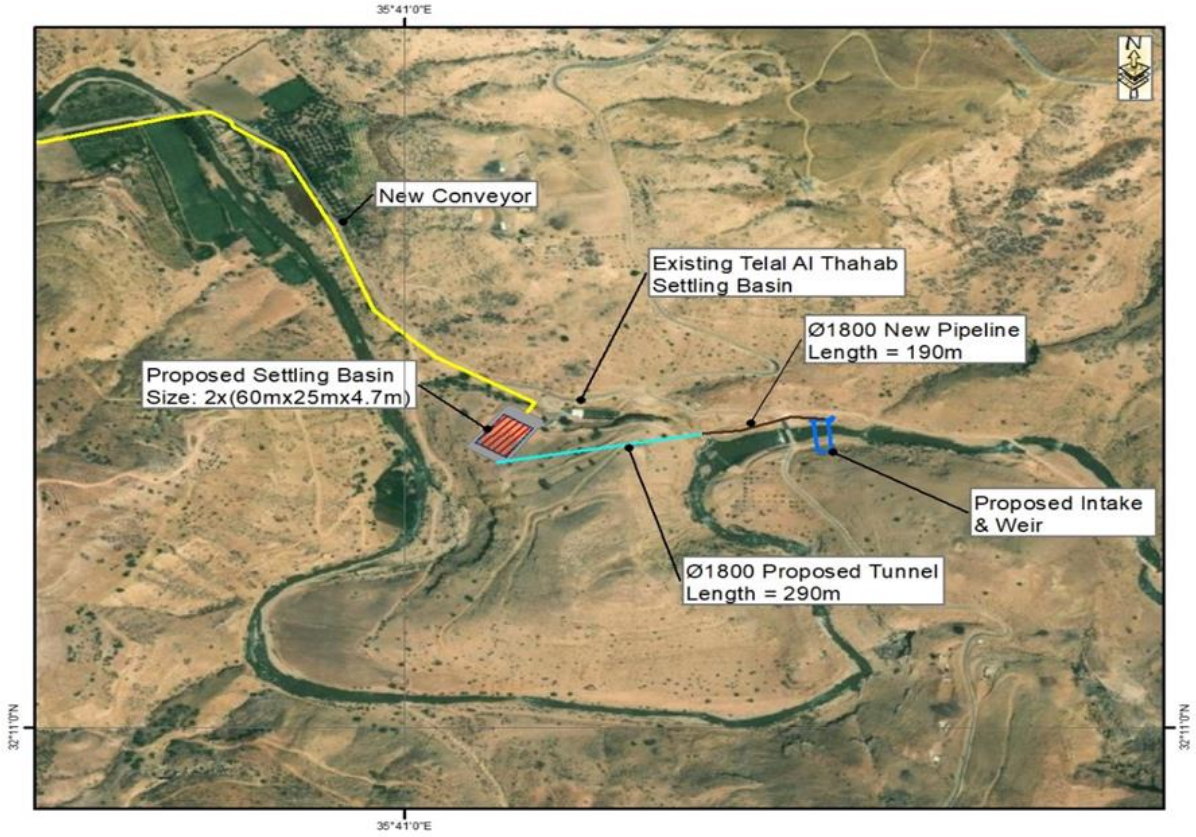
بعد دراسات الخيارات المختلفة من مختلف النواحي، تم الأخذ بعين الاعتبار الخيار الذي يعمل على أساس تحويل 211.000 متر مكعب/يوم من تلال الذهب (11.200 متر مكعب/ساعة لمدة 12 ساعة للمزارع التي يتم تزويدها حاليا عن طريق الضخ ولمدة 7 ساعات للمزارع التي يتم تزويدها حاليا انسيابيا) والذي يتكون من:

- مأخذ وأحواض الترسيب في تلال الذهب
- خط ناقل من تلال الذهب الى مأخذ رقم 95 بمحاذاة قناة الملك عبدالله الجنوبية
- ثلاث برك تجميع للمياه

وصف فني للمشروع ومكوناته

المأخذ وأحواض الترسيب

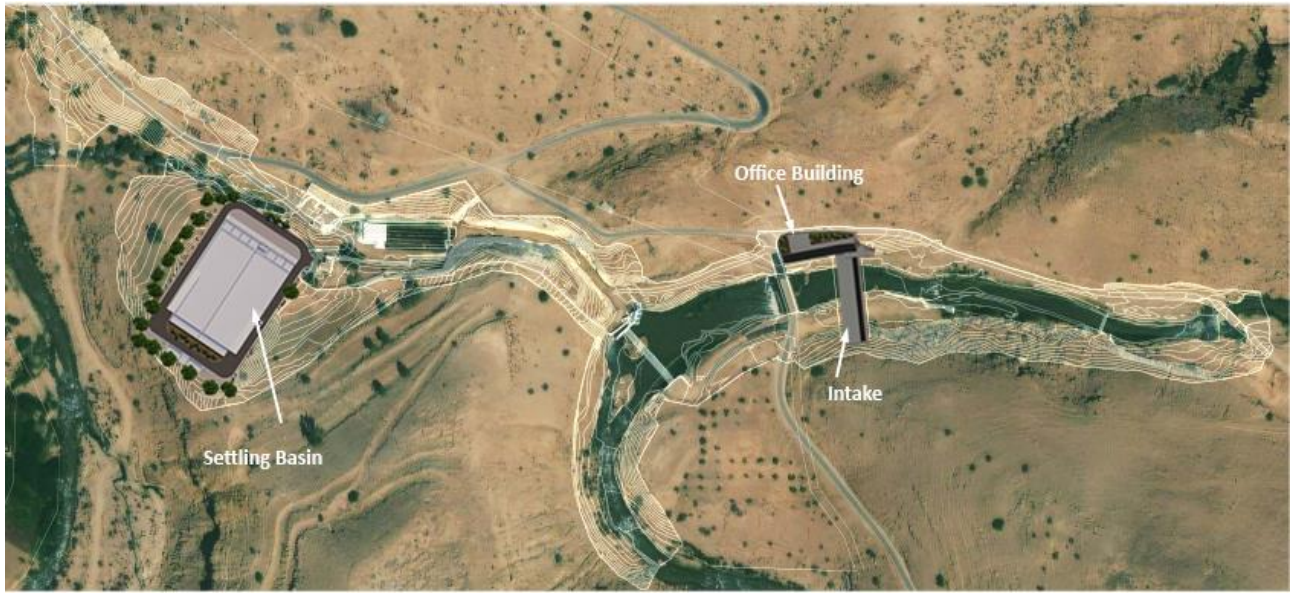
- يقع موقع تلال الذهب إلى الغرب من أحواض ترسيب تلال الذهب الموجودة بجوار مكتب سلطة وادي الاردن
- يقع موقع المأخذ على بعد حوالي 150 مترًا من weir الحالي.
- سيتم إنشاء weir، بارتفاع قمته حوالي 3.0 متر فوق سطح الماء الحالي لحجز تدفق الوادي وتحويل المياه إلى مدخل جانبي.
- في موقع المأخذ، سيتم تحويل تدفق النهر عبر مدخل جانبي إلى خط أنابيب يمتد على طول الضفة الشمالية للوادي على مسافة حوالي 190 مترًا حتى يصل بالقرب من المدخل الحالي. عند هذه النقطة هناك نفق مقترح بقطر 1.8 متر وطول 290 مترًا ، والذي سينقل التدفق إلى الجانب الغربي من التل إلى أحواض الترسيب.



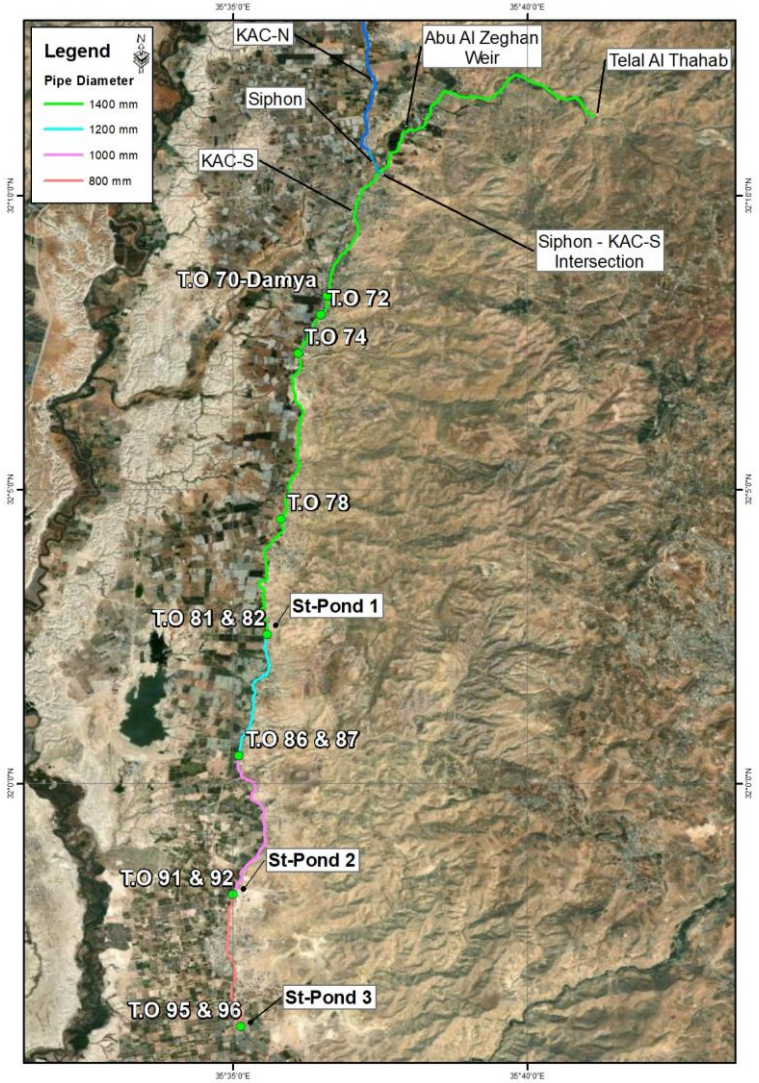
وصف فني للمشروع ومكوناته

المأخذ وأحواض الترسيب

- تم تصميم الموقع لاستيعاب حوضين ترسيب بطول 60 مترًا وعرض 25 مترًا بعمق 4.7 متر تقريبًا لتخزين الترسيب لمدة عام واحد.



وصف فني للمشروع ومكوناته



الخط الناقل

- سيكون قطر الناقل 1400 مم لتزويد المزارع المزودة انسيابيا وبالضخ بمقدار بمقدار 211.000 متر مكعب / يوم
- سيستمر تزويد TOs 70-78 من خلال قناة الملك عبدالله الجنوبية كما الوضع القائم
- في حين سيتم تزويد TOs 81-95 من الخط الناقل المقترح والذي يبلغ طوله حوالي 18 كم موازيا لقناة الملك عبدالله الجنوبية

وصف فني للمشروع ومكوناته

الاحتياجات المائية

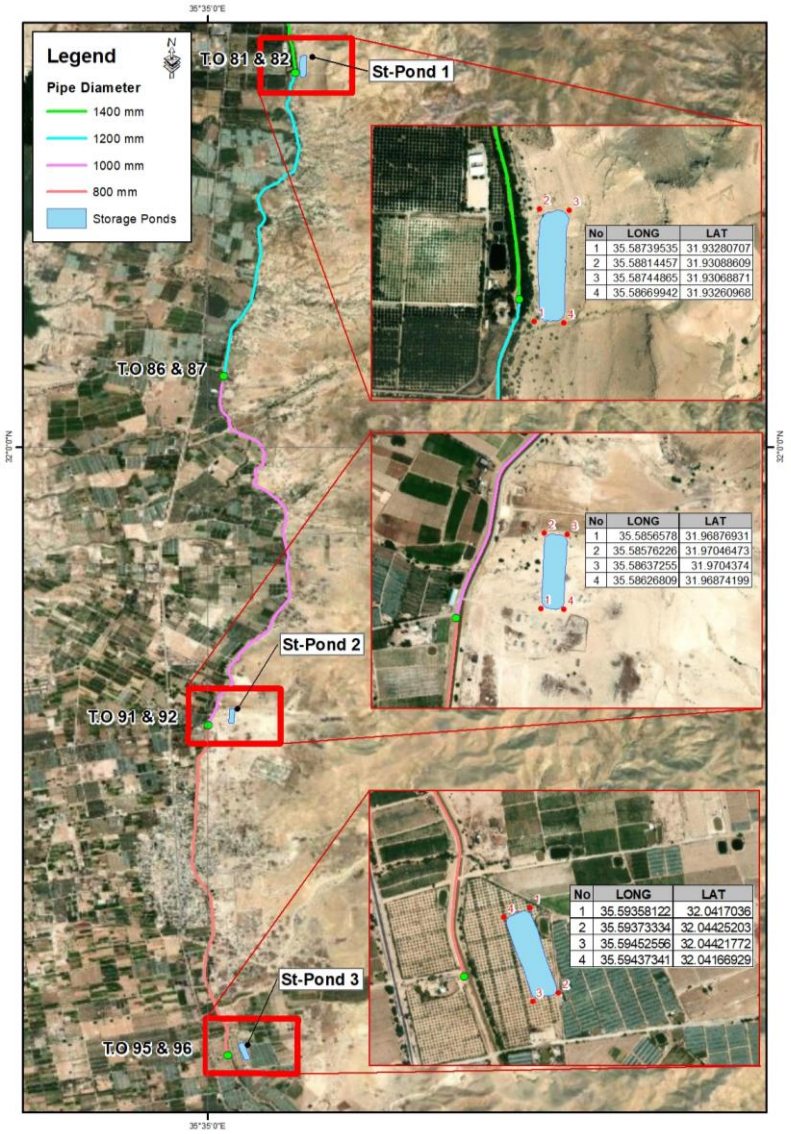
المساحة المروية دونم	طريقة التزويد	المأخذ
9,130	تزويد انسيابي	78
2,330	تزويد بالضخ	78
3,631	تزويد بالضخ	72
767	تزويد انسيابي	70 داميا
767	تزويد بالضخ	74 داميا الجديدة
3,399	تزويد انسيابي	74 داميا الجديدة
6,033	تزويد انسيابي	81
5,185	تزويد بالضخ	81
2,923	تزويد بالضخ	82
5,001	تزويد بالضخ	86
5,521	تزويد بالضخ	87
4,560	تزويد بالضخ	91
3,980	تزويد انسيابي	92
5,634	تزويد انسيابي	95
4,368	تزويد بالضخ	95
63،238	التزويد الانسيابي 45% التزويد بالضخ 55%	المجموع

وصف فني للمشروع ومكوناته

الاحتياجات المائية

المأخذ	المساحة المروية	الاحتياجات اللدونم	ذروة التزويد اليومي
	دونم	م^3 / دونم/ يوم	م^3 / يوم
70	767	4.88	3,743
72	3,631	4.88	17,719
74	4,166	4.88	20,330
78	11,460	4.88	55,925
81	11,218	4.88	54,744
82	2,923	4.88	14,264
86	5,001	4.88	24,405
87	5,521	4.88	26,942
91	4,560	4.88	22,253
92	3,980	4.88	19,422
95	10,002	4.88	48,810
	63,229		308,558

وصف فني للمشروع ومكوناته



برك التخزين

- سيتم إنشاء ثلاث برك تخزين لمدة 7 ساعات لتلبية الطلب اليومي من المزارع التي يتم تزويدها انسيابيا بين T.Os 81-95.

البركة	المساحة (دونم)	السعة (م3/يوم)
1	22.75	29,441
2	12.79	19,422
3	17.74	27,494

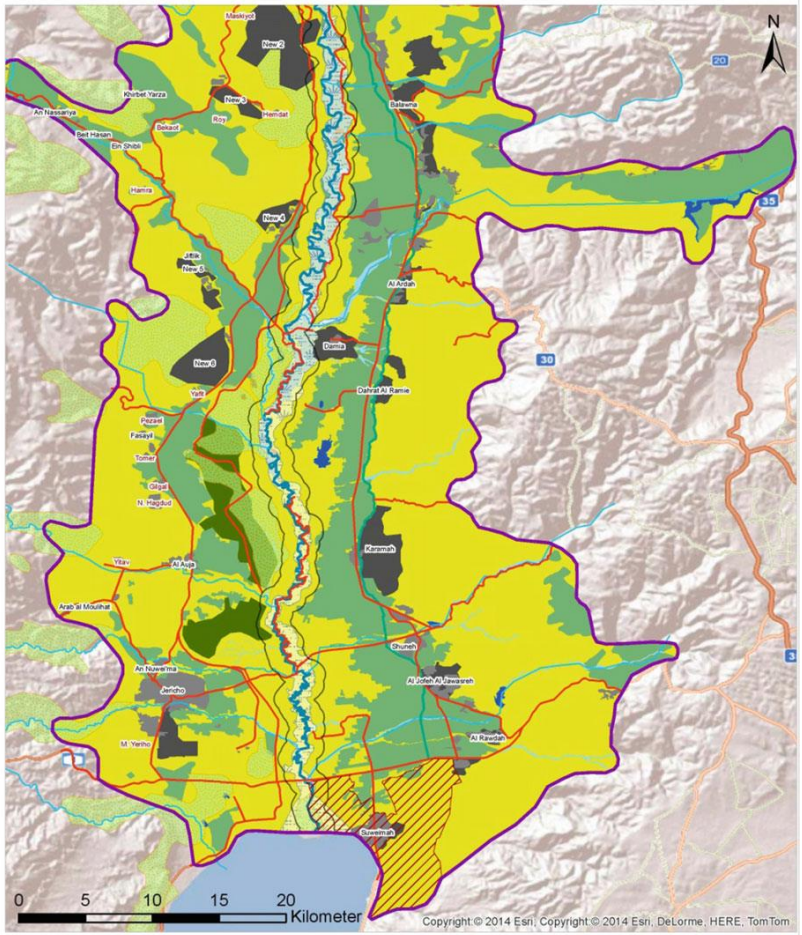
استهلاك الطاقة

- تعمل حاليا 6 محطات ضخ قائمة على مآخذ القناة الجنوبية بين TO 70-95
- سوف يقل استهلاك الطاقة نتيجة لضغط المياه الكافي الذي سيوفره الخط الناقل المقترح

توفير المياه

- سيتم توفير 15-20 مليون م3/السنة

أهم القضايا البيئية والاجتماعية



استعمالات الاراضي

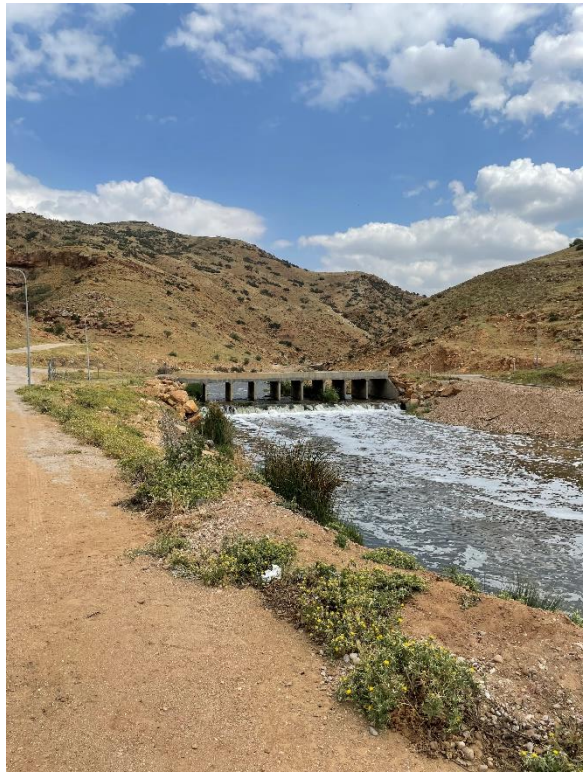
- منطقة وادي الاردن من أهم المناطق **الزراعية** في المملكة
- مناطق سكنية تحتوي على محلات تجارية
- مزارع سمك

أهم القضايا البيئية والاجتماعية

استعمالات الاراضي

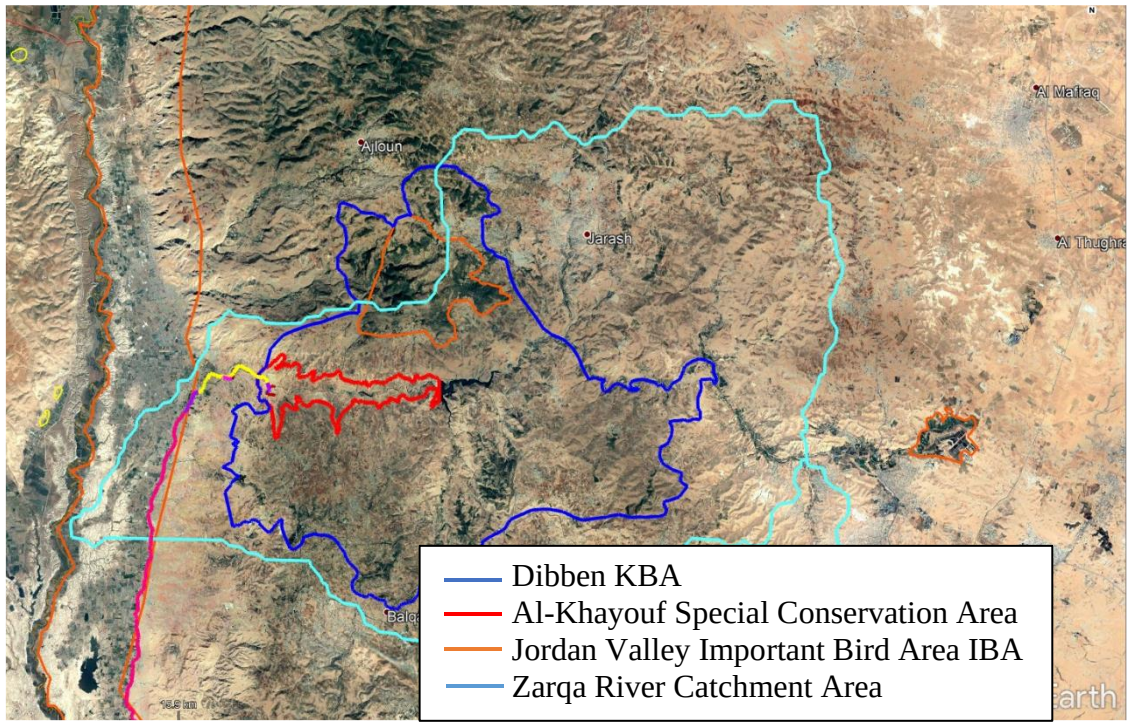
- مناطق زراعية على طول الخط الناقل

- منطقة احواض الترسيب المقترحة غير مطورة



- منطقة المأخذ الحالي بجانب موقع المأخذ المقترح

أهم القضايا البيئية والاجتماعية



البيئة البيولوجية

- يقع المشروع داخل حوض نهر الزرقاء وغرب سد الملك طلال
- يقع الجزء الشمالي من منطقة المشروع ضمن منطقتين رئيسيتين من المناطق المحمية (دبين ومنطقة الخيوف الخاصة). يقع الجزء الجنوبي الغربي من القناة في منطقة وادي الأردن المهمة للطيور.
- تم دمج غابة دبين والسلط (بما في ذلك منطقة الخيوف الخاصة المحمية) لتشكيل محمية دبين (2017).
- يعتبر سد الملك طلال منطقة انطلاق هامة لمجموعة كبيرة من الطيور المائية المهاجرة
- من غير المتوقع أن يشكل تحويل القناة من مجرى مفتوح إلى خط أنابيب أي تهديدات علر التنوع البيولوجي في المنطقة.

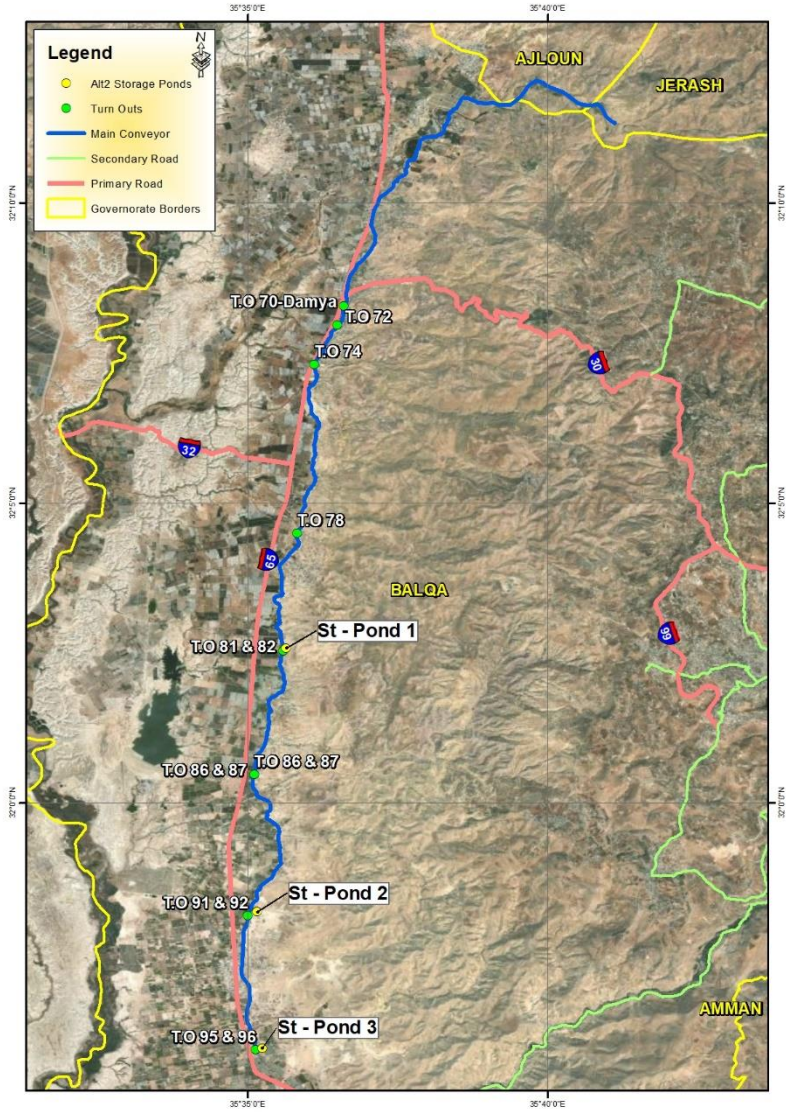
أهم القضايا البيئية والاجتماعية

الصحة والسلامة العامة

تشير احصائيات تم نشرها عبر وكالة الانباء الاردنية عام 2015 بوجود 102 حالة غرق خلال 11 عام السابقة في قناة الملك عبد الله

الطرق الرئيسية والمرور

طريق البحر الميت أو R65



Q&A

استبیان

https://engic.onl/3mxnlLd

شكرا

/

Project Title	Session Title	Venue	Date and Time
Jordan Valley Water Resources Efficiency	The consultation Session of the Environmental and Social Impact Assessment (ESIA) Study	Virtual - MS Teams	September 05, 2021, at 10:30 am

Time	Topic	الموضوع	الوقت
10:30-11:00	Participant Registration	تسجيل الحضور	11:00 – 10:30
11:00-11:15	Welcome Speech by MWI / JVA	كلمة ترحيبية من وزارة المياه / سلطة وادي الاردن	11:15 – 11:00
11:15-11:30	Introduction and Scoping Session Objectives by TTID / Engicon	مقدمة وأهداف الجلسة من شركة TTID وأنجيكون	11:30 – 11:15
11:30-12:00	Description of the project components and surrounding environment	وصف مكونات المشروع والبيئة المحيطة/ الاستشاري	12:00 – 11:30
12:00-12:30	Q&A	أسئلة وأجوبة	12:30 – 12:00
12:30-12:45	Questionnaire	استبيان	12:45 – 12:30
12:45	Wrap-up and Closing	ختام الجلسة	12:45

Please scan the QR code below or visit the link below to fill the Questionnaire:	يرجى مسح رمز الاستجابة السريعة ضوئيًا أو زيارة الرابط أدناه لملء الاستبيان:

https://engic.onl/3mxnlLd

Questionnaire of the Jordan Valley Water Resources Efficiency Project - استبيان

Please answer the questions below

الرجاء الاجابة على الاسئلة التالية

* Required

1. Please insert your full name - الرجاء ادخال الاسم من 3 مقاطع *

2. What is the agency / organization that are you representing? - ما هي الجهة / المؤسسة التي تمثلها؟ *

3. In your opinion, what is the significance of the potential environmental and social impacts/issues during the **Construction** of the main Conveyance Components?

ما هي برأيك أهمية الآثار/القضايا البيئية والاجتماعية التالية خلال مرحلة **الانشاء** لمكونات الخط الناقل الرئيس؟ *

	low - منخفض	medium - متوسط	high - عالي
Wadis, surface and ground water contamination - تلوث الاودية والمياه السطحية والجوفية	○	○	○
Disturbance from generated dust and noise - الازعاج بسبب الغبار والضجيج المتولد	○	○	○
Terrestrial habitat loss or alteration - فقدان الموائل الأرضية أو تغييرها	○	○	○
Disruption/destruction to existing infrastructure - / تعطيل تدمير البنية التحتية القائمة	○	○	○
Disruption of traffic movement - تعطيل الحركة المرورية	○	○	○
Worker and public health and safety risks - مخاطر على صحة وسلامة العمال والمواطنين	○	○	○
Disruption/loss of cultural heritage - تأثر أو فقدان التراث الثقافي	○	○	○
Permanent land acquisition - استملاك الأراضي بشكل دائم	○	○	○

	low - منخفض	medium - متوسط	high - عالي
Disruption to businesses along the route - تعطيل الأعمال التجارية الموجودة على طول مسار الخط	○	○	○
Disruption of water supply for agricultural units - تعطل تزويد المياه للوحدات الزراعية	○	○	○

4. In your opinion, what is the significance of the potential environmental and social impacts/issues during the **Operation** of the water conveyance component?

ما هي برأيك أهمية الآثار/القضايا البيئية والاجتماعية التالية خلال مرحلة **تشغيل** نظام الخط الناقل الرئيس؟
*

	low - منخفض	medium - متوسط	high - عالي
Keeping part of the canal opened - إبقاء جزء من القناة مفتوح	○	○	○
Supply hours for agricultural units - ساعات تزويد المياه للوحدات الزراعية	○	○	○
Disturbance from generated noise of the PSs - الازعاج بسبب الضجيج المتولد من تشغيل المحطات	○	○	○
Risk of drowning in the new ponds - خطر الغرق في البرك الجديدة	○	○	○

5. Please insert here additional concerns, if any- يرجى إضافة اي مخاوف اخرى ان وجدت

6. Do you support closing that part of the canal that was replaced by a conduit or keeping it open? Please justify.

هل تؤيد اغلاق ذلك الجزء من القناة الذي تم استبداله بأنبوب أم ابقائه مفتوح؟ الرجاء التفسير *

- ◯ Close it - إغلاقه
- ◯ Keeping it open - إبقاؤه مفتوح

7. Please explain, if your answer was yes or no.

* الرجاء توضيح السبب اذا كانت اجابتك إغلاقه أو إبقاءها مفتوحة

8. Please insert suggestions, if any - يرجى إضافة اقتراحاتكم ان وجدت

9. How satisfied are you with the information presented at the session?

ما هو مدى رضاكم عن المعلومات المقدمة في الجلسة؟

1: منخفض, low
2: متوسط, medium
3: عالي, high *

1 2 3