



Republic of Iraq – Baghdad Mayoralty

Baghdad Water Supply and Sewerage Improvement Project (P162094)

**Environmental and Social Impact Assessment  
(ESIA)/ Environmental and Social Management  
Plan (ESMP)**

*For*

*Rehabilitation of*

**Al-Habibiya, Al-Doura, and Al-Ghazaliya  
Sewerage Subprojects**



World Bank Group

ESIA and ESMP Report – August, 2017

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## *List of Acronyms and Abbreviations*

°C	Degree Celsius	MDB	Main Distribution Boards
a.s.l	above sea level	MIGA	Multilateral Investment Guarantee Agency
ACGIH	American Conference of Governmental Industrial Hygienists	min	Minute
Ag	Silver	MIS	Management Information System
Al	Aluminum	mm	Millimeter
APHA	American Public Health Association	Mn	Manganese
ARAP	Abbreviated Resettlement Action Plan	MOB	Mayorality of Baghdad
As	Arsenic	MOE	Ministry of Environment
AWWA	American Water Works Association	MPN	Most Probable Number
B	Boron	MTR	mid-term review
Ba	Barium	MWth	Megawatt thermal
BCM	Billion Cubic Meter	N/A	Not Applicable
BMP	Best Management Practices	NH4	Ammonium
BOD	Biochemical Oxygen Demand	Ni	Nickel
BOQs	Bill of Quantities	NO <sub>2</sub>	Nitrogen dioxide
Br <sub>2</sub>	Bromine	NO <sub>3</sub>	Nitrate
BSA	Baghdad Sewerage Authority	NO <sub>x</sub>	Nitrogen Oxides
BWA	Baghdad Water Authority	NRW	Non-Revenue Water
BWSIP	Baghdad Water Supply and Sewerage Improvement Project	NTU	Nephelometric Turbidity Unit
CaC	Calcium Carbide	NW	North West trunk main
Cd	Cadmium	O <sub>2</sub>	Oxygen

**ESIA and ESMP – Doura, Habibiya and Ghazaliya sub-projects**  
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CEMP	Construction Environmental Management Plan	OH	Occupational Health
CFU	Colony Forming Unit	OHS	Occupational Health and Safety
CH4	Methane	OP/BP	Operational Procedure/ Bank Policy
Cl	Chloride	PAHs	Polycyclic Aromatic Hydrocarbons
Cl2	Free Chlorine	PAPs	Project Affected Persons
CN	Cyanide	Pb	Lead
CO	Carbon monoxide	PCB	Polychlorinated biphenyl
Co	Cobalt	PCN	Project Concept Note
CO2	Carbon dioxide	PDO	Project Development Objective
COD	Chemical Oxygen Demand	PH	Public Health
CPS	Country Partnership Strategy	pH	Used to express acidity
Cr	Chromium	PIC	Project Implementation Consultant
Cu	Copper	PID	Project Information Document
dB(A)	A-weighted decibels	PLC	Programmable Logic Controllers
DDT	Dichlorophenyltrichloroethane	PM	Particulate Matter (sizes: 2.5 micrometer, 10 micrometer)
Dept.	Department	PMT	Project Management Team
DN	Nominal size	PMU	Project Management Unit
DO	Dissolve Oxygen	PO <sub>4</sub>	Phosphate
E&S	Environmental and Social	PPE	Personal Protective Equipment
E. coli	Escherichia coli	PS	Pumping Station
EA	Environmental Assessment	PS3	Pumping Station 3
EH	Environmental Health	PVC	Poly Vinyl Chloride
EHS	Environmental Health and Safety	Q/H	Flow per head
EIA	Environmental Impact Assessment	RAP	Resettlement Action Plan
EMP	Environmental Management Plan	RCP	Reinforced Concrete Pipes
ESHS	Environmental and Social Health and Safety	RES	UN Resolution
ESIA	Environmental and Social Impact Assessment	ROW	Right of Way
ESMF	Environmental and Social Management Framework	RPF	Resettlement Policy Framework
ESMM	Environmental and Social Monitoring Matrices	rpm	round per minute
ESMP	Environmental and Social Management Plan	S	Second
ESO	Environmental and Social Officer	S <sup>2-</sup>	Sulfide
F	Fluoride	SCADA	Supervisory Control And Data Acquisition
FC	Fecal Coliform	Se	Selenium
Fe	Iron	Sec	Second
FS	Fecal Streptococci	SO <sub>2</sub>	Sulfur dioxide
GDP	Gross Domestic Product	SO <sub>4</sub>	Sulfate
GH	Ghazaliya	SOP	Standard Operating Procedure
GRC	Grievance Redress Committee	SPD	Surge Protection Device
GRM	Grievance Redress Mechanism	SPD	Standard Procurement Document
GRP	Glass Reinforced Plastic	SPS	Sewerage Pumping Station
H2S	Hydrogen Sulfide	SS	Suspended solids
ha	Hectare	TDS	Total Dissolved Solids
Hg	Mercury	TLVs	Threshold Limit Values
hr	Hour	TNT	Tri-Nitro Toluene
HSE-MP	Health, Safety and Environment Management Plan	TOR	Terms of Reference
Hz	Hertz	TPC	Total Plate Count
IBA	Important Birds Area	TSP	Total Suspended Particles
ID	Iraqi Dinar	TSS	Total Suspended Solids
IDP	Internally Displaced People	UN	United Nations
IFC	International Funding Corporation	UNECE	United Nations Economic Commission for Europe
IQD	Iraqi dinar	UPS	Uninterruptible Power Supply
ISIS	Islamic State in Iraq and Syria	UPVC	Un-plasticized Poly Vinyl Chloride
JICA	Japan International Cooperation Agency	US\$	United States Dollars
Km	Kilometer	USD	United States Dollar
KPI	Key Performance Indicator	USGS	United States Geological Survey
KVA	Kilo-volt-ampere	V	Volt
kW	Kilowatt	VOCs	Volatile Organic Compounds
L	Liter	WB	World Bank
LCB	Leakage Circuit Breaker	WBG	World Bank Group

**ESIA and ESMP – Doura, Habibiya and Ghazaliya sub-projects**  
Baghdad Water Supply and Sewerage Improvement Project

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LOAEL	Lowest Observed Adverse Effect Level	WEF	Water Environment Federation
LT	Low Tension	WHO	World Health Organization
M	Meter	WRI	World Resources Institute
M&E	Monitoring and Evaluation	WTP	Water Treatment Plant
MCC	Motor Control Center	WWTP	Waste Water Treatment Plant
MCCB	Modeled Case Circuit Breakers	Zn	Zinc
MCM	Million Cubic Meter		

## **EXECUTIVE SUMMARY**

### **1.1. Preamble**

In 2013, the population of the Republic of Iraq was estimated at around 33 million, of which 66 percent lived in urban areas. Currently the country has an estimated 3.3 million internally displaced people (IDPs). About 27 percent of the total urban population in Iraq resides in Baghdad, which is by far the largest city in the country with an estimated population of 6 million, not including an estimated 289,000 of IDPs. A 2012 household survey indicates that Iraq's national poverty stood at 19 percent. The poverty rate in 2012 in Baghdad was at 12 percent; this figure is likely to have risen significantly due to the recent conflict. Unemployment is high and labor force participation remains low, especially for women and youth. Official figures from 2011 have labor force participation and youth at 11 percent although actual levels, particularly among youth, were likely much higher.

Poor public service delivery, reflected especially in significant water and electricity shortages, are binding constraints on the population's quality of life and private sector development. Safe drinking water and basic sanitation is of crucial importance to the preservation of human health, especially among children. Baghdad is one of the governorates most impacted by outbreaks of waterborne diseases. About 14 percent of diarrhea cases registered in 2011 occurred in Baghdad, which also topped the governorates in terms of number of deaths from diarrhea. Similarly, the incidents of typhoid and other waterborne diseases are higher in Baghdad compared to national averages. Contaminated water supplies and improper disposal of sewage force families to spend a significant fraction of their income to medical treatment and to purchase bottled water. This has implications for gender inequality in addition to the adverse effects on children's health, by increasing the burden of care on mothers, who are the primary caregivers of children.

The city of Baghdad and its suburbs cover 950 km<sup>2</sup> and are administered by the Mayorality of Baghdad (MOB). The city is divided into 14 municipalities. The water and wastewater services are centrally administered by the Baghdad Water Authority (BWA) and Baghdad Sewerage Authority (BSA), respectively, which are responsible for all infrastructure assets. As far as water supply and sewerage are concerned, the municipalities' role is limited to installing house connections and to maintaining neighborhood networks (pipes under 200 mm diameter). The planning and implementation of investment projects in the municipalities is the responsibility of the MOB.

The sewer system consists of a network which covers about 92 percent of the city area. Baghdad has two main wastewater treatment plants, one in Rusafa called "Rustomiya", and another one in Karkh. The efficiency with which these wastewater treatment plants and the (old) pumping stations are operated has dropped significantly (by an estimated 30 to 50 percent). The wastewater treatment plants, therefore, are not operating effectively and are under-utilized. The bulk of the city's sewage is discharged untreated and constitutes a major source of pollution to surface water and groundwater and a risk to public health.

The Baghdad Water Supply and Sewerage Improvement Project (BWSIP) will support improvements in high-priority water and wastewater services that were identified in the recent Master Plan for Baghdad to help the MOB to improve its performance in water and wastewater service delivery. The

proposed project combines institutional, technical and operational steps to be undertaken by the BWA and BSA, while ensuring that they improve their financial situations.

The Project Development Objective (PDO) is to improve the quality of drinking water supply and wastewater services in Baghdad. BWSIP consists of the following components:

**Component 1: Institutional strengthening for integrated urban water management and utility management, and creating an enabling environment for private sector engagement (US\$11.48 million):** this will include – *inter alia* – support in decision making, institutional knowledge and preparedness concerning water security, management, and resilience, and sustainability.

**Component 2: Investment in drinking water supply and wastewater infrastructure (US\$188 million):** this will include the following activities:

- a. Construction of the “R2” reservoir (US\$71 million)
- b. Rehabilitation of pumping stations including main sewerage network (US\$68 million)
- c. Non-revenue water reduction (US\$39 million)
- d. Engineering, construction supervision, and quality control (US\$10 million)

**Component 3: Project implementation, studies and M&E component (US\$10 million):** this will include financing a project implementation consultant (engineering and construction supervision and quality control). In addition to financing operational costs of the subprojects.

Al-Habibiya SPS in Rusafa side and Al-Doura SPS in Karkh side are more than 30 years old. Big quantities of untreated wastewater were discharged to Tigris River because of the aging of the mechanical and electrical components of the pumping stations, being beyond design capacity to receive from increasing populations. And because of the bad operations and maintenance performed at these pumping stations.

As for Al-Ghazaliya sewerage system, the subsidiary sewage networks were largely completed in 1985 including house connections, manholes, laterals, and ventilation columns, etc. In 1990, the great part of main sewers and associated pumping stations (Al- Khadra main pumping station and four smaller submersible ones GH1, GH2, Gh6, and GH7) were also completed. Originally, the system was designed to collect sewage conveyed from the above mentioned four pumping stations to reach the trunk main (NW) and then to the Al-Khadra pumping station, which has an approximate pumping capacity of 100,000 m<sup>3</sup>/ day.

Unfortunately, the works of installation of pumping stations and their electrical and mechanical requirements were not completed because of the Gulf War. In addition, the works of the major section of the trunk main pipe jacking, which was to be laid under the Baghdad – Amman highway, were also not completed, the matter that led to the stopping of the sewage inflow completely. Consequently, deteriorating sewer pipes are contaminating the potable water network and underground water, adding further impact to the health and environmental problems.

**The proposed project falls under the Bank’s Environmental Category "B"** due to potential adverse environmental and social impacts that are site-specific and reversible and thus easily remediable by applying appropriate mitigation measures. These potential adverse environmental impacts may include the following: air quality and noise; construction debris, including old piping and sewerage



infrastructure requiring proper disposal; employee health and safety issues; vehicular and pedestrian traffic disruptions; disruptions in water supply; and risk of water contamination in the existing system. According to the provisions of "OP/BP 4.01: Environmental Assessment", the Project is categorized "B" and requires the preparation of Environmental and Social Impact Assessment (ESIA) inclusive of an Environmental and Social Management Plan (ESMP).

The purpose of this Environmental and Social Impact Assessment/ Environmental and Social Management Plan is to:

- Emphasize negative impacts of no-project alternative on public health and environment;
- Ensure compliance of the proposed project with pertinent local and international norms;
- Investigate the area that would be directly and indirectly affected by the implementation of the proposed Project components;
- Identify significant environmental and social issues brought about by the Project locations, construction, and operation phases;
- Ensure that environmental and social considerations are integrated into the Project planning and design activities;
- Ensure that a high standard of environmental performance is planned and achieved for the whole project components;
- Ensure that environmental and social aspects and impacts are identified, assessed, and mitigated accordingly;
- Recommend measures in order to mitigate adverse effects and/or enhance beneficial effects of the proposed project;
- Develop an Environmental & Social Management Plan (ESMP) and a Monitoring Plan specific to the Project's construction and operation phases.

## **1.2. Project Description**

### **Al-Habibiya SPS:**

Al-Habibiya SPS is located in Al-Sha'ab in Rusafa side of Baghdad, and serves Al-Sha'ab, Sadr1 and Sadr2 municipalities. Habibiya SPS was built in 1984 with a design capacity of 11 m<sup>3</sup>/sec. However, current capacity is only 7 m<sup>3</sup>/s. The pumping station serves around 2.6 million people in eastern part of Baghdad and transfers sewage to the Rustomiya WWTP. The subproject of rehabilitating Al-Habibiya SPS includes the following interventions:

- Removing all old mechanical and electrical parts, including needed civil works;
- Installing new vertical shaft pumps and their associated motors (4 sets of Type A, 4 sets of Type B, and 2 sets of Type C);
- Installing the required quantities of valves, penstocks, motorized bar screens, cranes, ventilation systems, fire-fighting systems, biological odor control systems, and other secondary part replacements, like handrails, covers, meshes, frames, steel ladders;
- All electrical panels, switches, and wiring

The subproject is expected to span 18 months. The station will have partial and sequential stoppage while keeping other parts working towards the end of having all parts renovated. Working areas are to be prepared within the perimeter of the pumping station.

#### **Al-Doura 1 SPS:**

Doura 1 pumping station is located in Doura (Al-Karkh side of Baghdad). It was built in 1983, with a discharge capacity of 13m<sup>3</sup>/s. The Pump transmits sewage collected from the northern area of Tigris River to the discharge point at Al-Karkh WWTP (maximum design capacity 410,000 m<sup>3</sup>/day). Al-Doura 1 pumping station serves around 2.5 million people in western part of Baghdad. The subproject of rehabilitating Al-Doura SPS includes the following interventions:

- Removing all old mechanical and electrical parts, including needed civil works;
- Installing new vertical shaft pumps and associated motors (7 sets of type A, 4 sets of type B, and 2 sets of type C);
- Installing all associated valves, well by-pass gates, and flow control facilities;
- Installing sewage pipes from pump room to terminal point (inside station);
- Installing new electrical parts and facilities.

The subproject is expected to span 24 months. The station will have partial and sequential stoppage while keeping other parts working towards the end of having all parts renovated. Working areas are to be prepared within the perimeter of the pumping station.

#### **Al-Ghazaliya 5 SPSs and Trunk Main:**

Al- Ghazaliya subproject is located in the western part of Al- Karkh. It is bordered by the Baghdad – Amman highway from the south, Saqlawia drainage canal and Shu’la from the north, and Basrah Street from the east. The rehabilitation will restore basic sewage services for both Al-Ghazaliya and Al-Shu’la districts. The subproject will serve approximately 630,000 inhabitants and will eliminate dumping of untreated wastewater into Saqlawiya Canal and Tigris River. Key components of the Ghazaliya subprojects include the following activities and works:

- The rehabilitation works in Al-Khadra, GH1, GH2, GH6, and GH7 pumping stations, including installation of Dry Well 19 Motor Pumps, Main Distribution Boards, Control Panels and all necessary civil, electrical and mechanical works;
- The replacement of collapsed sections in the sewer trunk main (dia. 2,000 – 2,200mm) of about 1,450m length including construction of manholes (NW16 – NW23);
- Cleaning, rehabilitating and flushing the sewer line and manholes from all dirt and sewage from manhole (NW11A) to Al- Khadra Pump Station. Also exposing of manhole covers from Pumping Station GH1 to manhole (NW15);
- Construction of trenchless trunk main, which is of diameter 2.2 meters of about 725 meters and a depth of 5 to 7 meters, as part of the trunk main under the international Baghdad-Amman HW, by using a jacking techniques, in order to avoid Highway closure or interruption of traffic;

The subprojects of Ghazaliya are expected to span 24 months. All subprojects' lands are owned by MOB (Incl. trunk mains and manholes, which lie within the Right of Way of Basrah st.). Work areas will be established within the perimeter of the stations. For rehabilitation work of trunk main and manholes, it is expected that the contractor(s) will use a mobile working caravans for personnel and equipment. However, areas to be used for mobile caravans are not known at this stage, and they are to be chosen and approved by the MOB as agreed with the winning contractor(s) upon signing the agreement. Land to host working caravans will be state-owned, including options of using Right of Way alongside the main trunk line. Therefore no private land acquisition is expected.

### **1.3. Environmental and Social Settings**

The climate of Baghdad is arid, subtropical, and continental. The mean maximum temperature in July and August is about 43°C, which could reach up to 49°C in hot seasons. Dust storms are common in summer and the winter is chilly. The mean annual rainfall ranges from about 120 mm in the south to about 160 mm in the northeast. Prevailing wind direction is Northwestern. And an exceptional flood is expected every 30 years. Floods in general take many days to drain from streets. Baghdad city is severely impacted by air pollutants, mostly emitted by mobile sources, industrial activities, and private generators, as well as poor quality of fuel. Measurements show that noise level could reach 92 dB(A) three meters from the traffic lane at all hospitals during daily hours.

Baghdad is part of a geological formation called the Mesopotamian Plain Region. The land is considered highly flat with no clear natural drainage pattern. This type of topography brings the area at risk of floods, especially in rainy seasons. Baghdad has a Calcaric Fluvisols soil type with about 20% of lime. Organic matter content is low and the carbon nitrogen ration is narrow.

Tigris is the only water source for drinking water in Baghdad. It is fed by a number of tributaries. Udhaim is the most immediate to Baghdad. The next, and last, downstream tributary to the south of Baghdad, is the Diyala River with a mean daily flow of 182 m<sup>3</sup>/s at the confluence with Tigris. Water quality of the Tigris is poor due to the return flows from irrigation projects. Tigris receives more damage by discharges of sewage at a rate of 500,000 m<sup>3</sup>/day or more. Dams and groundwater are also another source of water in Baghdad. Water tables could be found at shallow levels, which are contained in relatively permeable layers, thus, increasing possibility of cross-contamination by activities above the ground surface.

The Project area is heavily urbanized, leaving behind very sparse natural habitats. Some wild flora species could still be found, like deciduous flowering trees and shrub. There is an Important Birds Area (IBA) on the Tigris River, which comprises one stop of international flyways between Africa and Eurasia. The area also includes a wide range of invertebrates and vertebrates. However, the Project area does not include a significant wildlife.

Access to improved water supply and sanitation is relatively high, but the quality of service is often low. Conflicts in Iraq have further damaged sanitation infrastructure, leading to more decline in service quality.

As for land use, Baghdad governorate, in general, has a fragmented and inefficient land use, with very limited areas for future expansion.

## **1.4. Legal and procedural framework**

Locally, the Project is governed by the Iraqi legislative regime, and overarched by two main laws: Public Health Law no. 89 – 1981, and Protection and Improvement of the Environment Law no. 27 – 2009. Other regulations and guidelines are also formulated towards protecting the environment and monitoring against breaching of limits. A full account was given for all local and international legal, regulatory, and technical guiding frameworks pertinent to the Project in the Main report. Additionally, a special focus was made on the applicable WB's environmental and social safeguards. And how both Iraqi's and WB's environmental assessment requirements can match and contradict. However, the following is a quick overview of the legal framework:

### **Iraqi's framework:**

- Public Health Law no. 89 – 1981;
- Protection and Improvement of the Environment Law no. 27 – 2009;
- Establishing the Ministry of Environment Law No. 37 – 2008;
- Protection of Wild Animals and Birds Law no. 21 – 1997;
- Forest Law no. 30 – 2009;
- Noise Prevention Law no. 21 – 1966;
- Labor Law no. 71 – 1987;
- Decision Concerning the Cutting of Trees no. 1 – 1991;
- Preservation of Water Resources Regulation no. 2 – 2001;
- Protection of Ambient Air Quality Regulation no. 4 – 2012;
- The new determinants for the Prevention of Pollution of Rivers and Public Water – Regulation, no. 25 – 1967;
- National Air Emissions Standards, instructions no. 3 – 2012;
- Noise – Instructions no. 2 – 1993;
- Vibration – Instructions no. 4 – 1993;
- Safe storage and handling of chemicals – Instructions no. 4 – 1989;
- Environmental Criteria for Carrying out Projects and Monitoring Appropriateness of Implementation Instructions no. 3 – 2011;

### **World Bank's framework:**

#### Environmental Assessment OP/BP 4.01

According to OP/BP 4.01, the Project is categorized “B” due to potential adverse environmental and social impacts that are site-specific and reversible and thus easily remediable by applying appropriate mitigation measures. OP/BP 4.01 requires the preparation of Environmental and Social Impact Assessment (ESIA) inclusive of an Environmental and Social Management Plan (ESMP).

#### Involuntary Resettlement OP/BP 4.12

The subprojects of rehabilitating Habibiya, Doura and Ghazaliya SPSs will not involve loss of land. Rehabilitation will be applied on existing locations and structures (incl. state-owned land). However, Involuntary Resettlement OP/BP 4.12 is triggered as a precautionary measure should implementing

the project results in minor loss of livelihood and/or socio-economic disturbance within project land proximity. Therefore, a Resettlement Policy Framework (RPF) has been prepared for the entirety of BWSIP. This RPF would establish a reference for addressing socio-economic impacts, and provide a suitable Grievance Redress Mechanism (GRM) information for Project Affected Persons (PAPs) throughout the project lifecycle.

#### Projects on International Waterways – OP/BP 7.50

The World Bank recognizes the issues involving projects on international waterways and attaches importance to the riparian countries making appropriate agreements or arrangements for the entire waterway, or parts thereof. In the absence of such agreements or arrangements, the Bank requires, as a general rule, that the prospective borrower notify the other riparian countries of the project. The Policy lays down detailed procedures for the notification requirement, including the role of the Bank in affecting the notification, period of reply and the procedures in case there is an objection by one of the riparian countries to the project.

Note: The project area is located on the Tigris which is an international waterway. However, the project involves rehabilitation of existing pumping stations, construction of potable water reservoir, and non-revenue water including replacement of old drinking water distribution network. The project does not involve works and activities that would exceed the original capacity of the pumping stations and will not increase water off-take from the Tigris. Therefore, the project falls within the exception to the notification requirements of OP 7.50, set forth in paragraph 7(a) of OP 7.50.

Other applicable regulations include the Environmental, Health and Safety (EHS) Guidelines, of the World Bank Group (WBG)/ International Finance Corporation (IFC) 2008<sup>1</sup>, as the project will involve a range of risks related to occupational health and safety during construction and operation.

#### **Other references:**

- WHO Air Quality Guidelines – 2006;
- WHO Drinking Water Quality, 4th ed – 2011;
- WHO Guidelines for Community Noise – 1999;
- UN Framework Convention on Climate Change and Kyoto Protocol; and
- Convention on Biological Diversity.

#### **WB's and Iraqi's EIA Procedure:**

The Project proponent is required by the two aforementioned Iraqi and WB frameworks to follow the following procedures in order to get the final approval on this ESIA/ESMP study (called the Environmental Compliance Certificate).

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<sup>1</sup> WBG EHS General Guidelines is available on: <http://www.ifc.org/wps/wcm/connect/554e8d80488658e4b76af76a6515bb18/Final%2B-%2BGeneral%2BEHS%2BGuidelines.pdf?MOD=AJPERES>

WBG EHS for Water and Sanitation is available on:  
<http://www.ifc.org/wps/wcm/connect/e22c050048855ae0875cd76a6515bb18/Final%2B-%2BWater%2Band%2BSanitation.pdf?MOD=AJPERES>

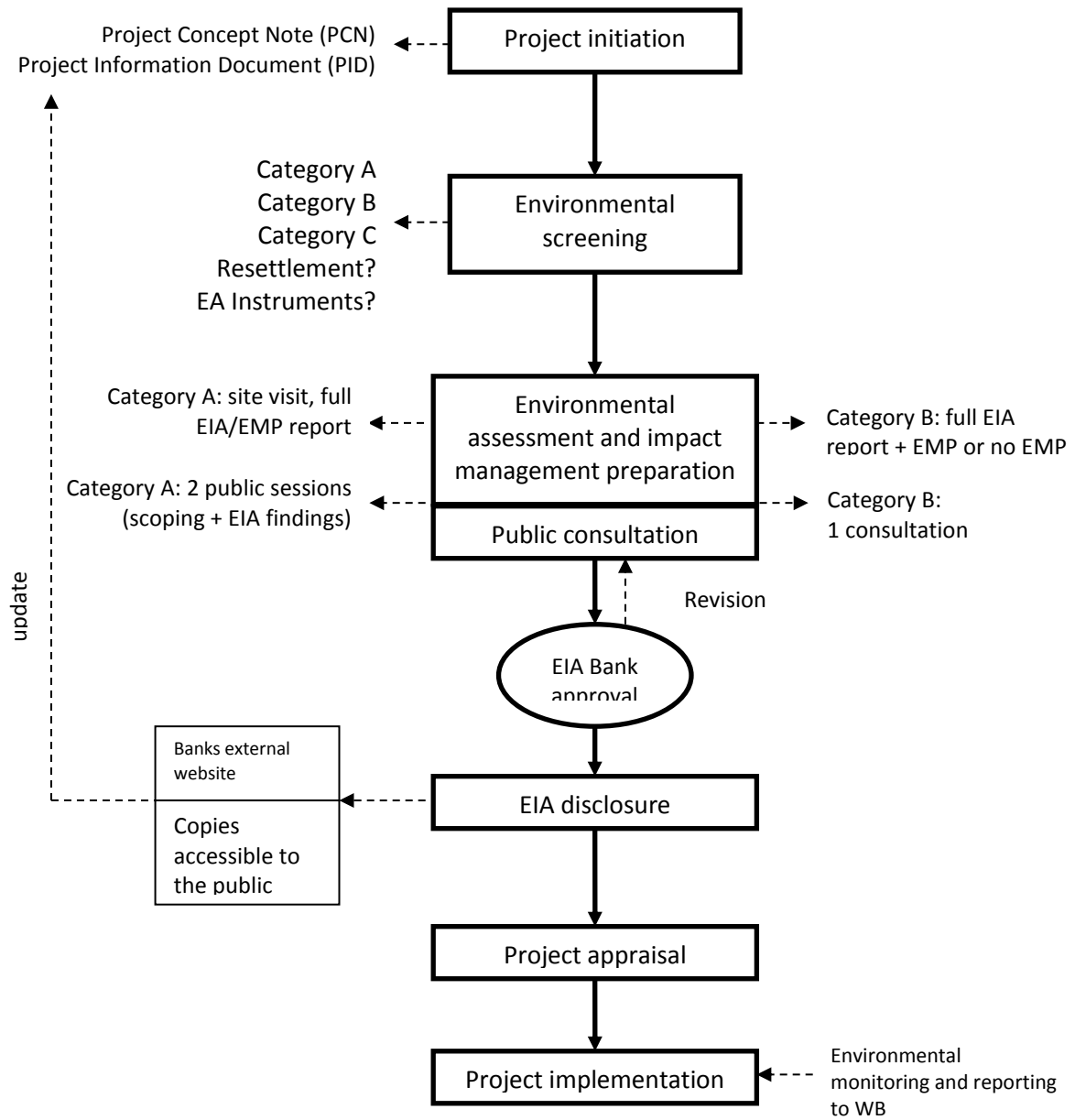


Figure A. Simplified EIA process diagram according to the World Bank Operations Manual

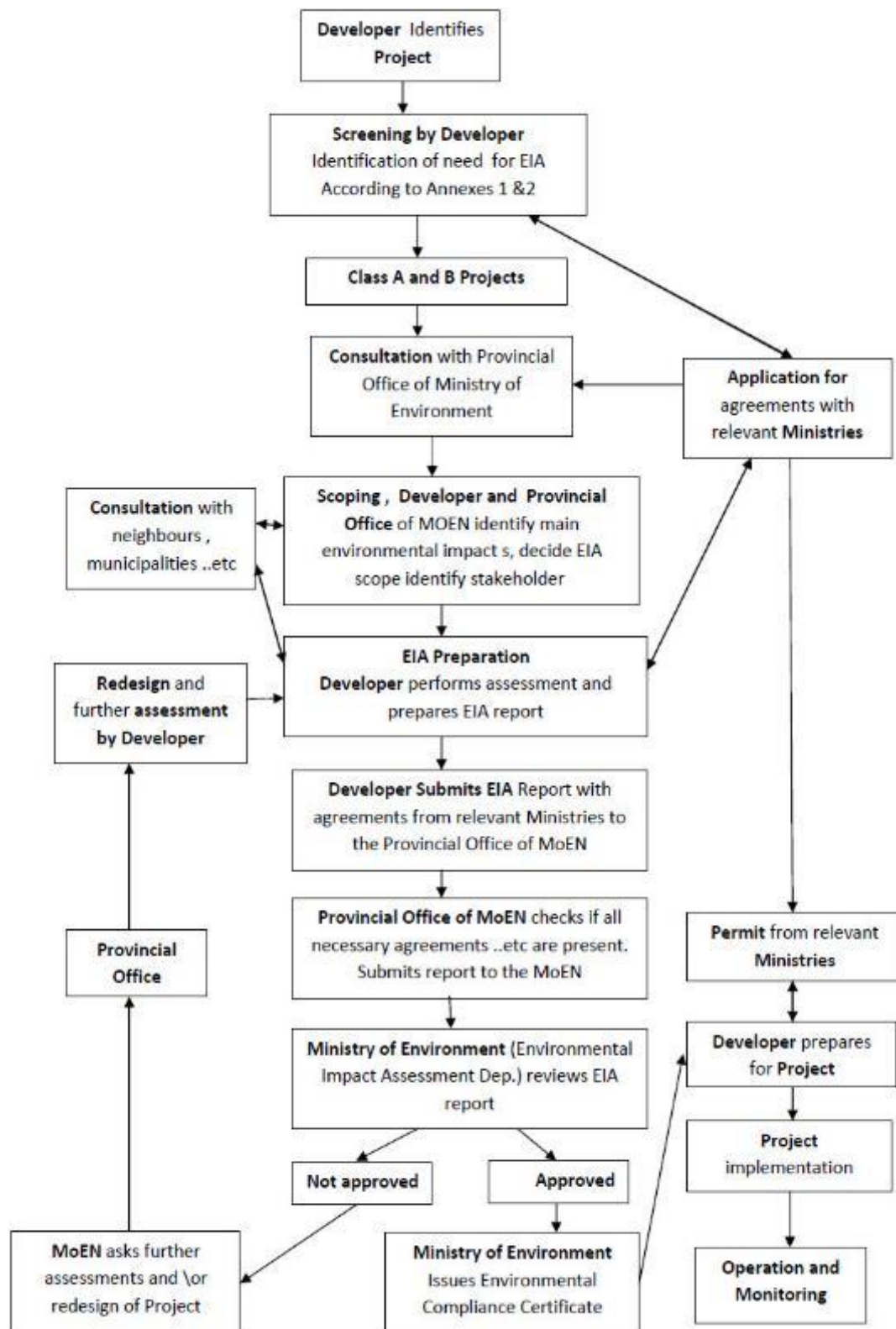


Figure B. Simplified EIA process diagram for Iraq – categories A and B

### 1.5. Public Consultation

## Public Meetings

Public meetings were held at the premises of pumping stations of Al-Habibiya, Al-Doura, and Al-Ghazaliya on 15 November 2015, 16 December 2015, and 30 January 2017, respectively. The meetings aimed at introducing the project components in details, construction timeline, activities, potential impacts and benefits brought about by the project, and concerns and views of possible effects (including socio-economic effects).

**Table A: Number of participants and distribution according to gender**

<b>Habibiya SPS – 15 November 2015</b>
Total participants: 26 Gender: Male: 18 (69%), Female: 8 (31%)
<b>Doura SPS – 16 December 2015</b>
Total participants: 26 Gender: Male: 20 (77%), Female: 6 (23%)
<b>Ghazaliya SPS – 30 January 2017</b>
Total participants: 23 Gender: Male: 17 (74%), Female: 6 (26%)

A pre-designed questionnaire was prepared for participants, which concentrated on environmental impacts and issues related to public health, and were directed to people working and/or living in the vicinity of the Project area. Annex VIII of main report provided a copy of the questionnaire and attendees' sheets. Participants had the chance to express expectations of the Project and suggestions for improvement. The following answers were collected:

**Table B: Feedback collected from public meetings – Al-Habibiya, Al-Doura 1 & Al-Ghazaliya SPSs**

#	Question	Answer		
		Yes	No	No answer
1	Are you impacted by noise when operating pumps, motors, and other parts of the SPS?	50 (66.7%)	25 (33.3%)	0
2	Are you impacted by odors and fumes generating from the SPS?	65 (86.7%)	10 (13.3%)	0
3	Do you have any health problems linked to emissions from the Sewerage Pumping Station?	39 (52.0%)	35 (46.7%)	1 (1.3%)
4	Do you expect that rehabilitation work will provide job opportunities in your neighborhood?	49 (94.2%)	2 (3.8%)	1 (2.0%)
5	Do you think installing fumes and odor scrubbers in the SPS will help reduce risk of harmful emissions?	70 (93.3%)	3 (4.0%)	2 (2.7%)

Participants have also provided the following expectations of the new Project:

- More investment in the wastewater sector to enhance services and connect more users;
- Enhancing air quality through reducing bad smells and air pollutants generating from the pumping stations;
- Reducing flooding incidents;
- Reducing communicable diseases and enjoying a healthier and more hygienic life,



- Avoiding/ Reducing flooding incidents by developing operational procedures pertinent to overflows and diversions;
- Providing job opportunities for the local community;
- Positive impacts on the surrounding environment, increasing green areas, and reducing environmental pollution;
- Avoiding incidents of clogging the piping system and decreasing overflows in Al-Karkh, Abu-Disher and Al-Ghazaliya areas; and
- Relocating pumping stations outside populated areas.

According to participants, areas for improvement could be best described as follows:

- Providing an enclosed design to help avoid emissions to outer environment,
- Providing proper ventilation systems to get rid of air emissions in a modernized way,
- Setting pumping stations in as far away as possible from populated areas, in order to reduce noise and contamination,
- Providing a better landscape to the area and planting trees to avoid topsoil erosion,
- Targeting local people for jobs,
- Fulfilling the neighborhood's needs of power supply,
- Rehabilitating pumping station by the team of the BSA and through selecting competent international companies,
- Flushing sewerage pipelines and mains,
- Fixing damages in main lines.

### **Grievance Redress Mechanism**

A Grievance Redress Mechanism (GRM) is required to enable Project Affected Persons (PAPs) to address their grievance as a result of the project. GRM should be managed and maintained at the MOB level, and made available at the project level. This mechanism could also be integrated into the already existing complaining system at MOB. However, the community should be reached out to explain the complaining system. The GRM should also facilitate lodging a complaint easily and anonymously. However, the form of the GRM should be posted at each subproject site in Arabic Language with the contact information of the person in charge. Information to be deposited in the complaining system, include contact information, a full description of the issue, and attaching to it all necessary material. GRM should be accessible to all PAPs (by writing, phone, email, official portals) and should be able to receive grievances and complaints at any time of the Project lifecycle. Personnel responsible for processing complaints have to inform complainers on the legal time period for responding to the grievance/ complaint in final. Responses to complainers should be returned in no more than 14 calendar days, and before starting project activities.

The complainers will have the right to appeal their case at a tribunal should the offered compensation(s) deemed unsatisfactory. The GRC should continuously report updates to the MOB higher management and to the World Bank Group.

## **1.6. Assessment and Alternatives**

The Project is expected to interact with 4 main categories: the local community, the biotic and abiotic environments, as well as the personnel responsible for operation, maintenance and supervision. Impacts during construction were mainly studied on Occupational Health and Safety (OHS) related issues, with additional attention to the issues on the physiochemical environment (water, air, noise, vibration, and waste mismanagement). However, in operation phase, impacts were mostly linked to daily operations and maintenance (again OHS issues).

Impacts were assessed by studying pertinent, laws, regulations, and safeguards (mainly those of the Iraqi Government and World Bank); by comparing effects to the baseline data; by reviewing useful literature; and by applying practical experience in the field of Environmental Assessment and Management. Useful references were visited, like those of the WB (EHS guidelines<sup>2</sup>) and those of the World Health Organization (Drinking water, noise, and ambient air guides). Of special importance is the feedback collected from consultation meetings with Affected Project Persons (PAPs).

Risks associated with operational activities should be diligently evaluated by the operator. The study has already presented a useful reference for rating risks according to their occurrence and severity.

**Table C: Risk assessment matrix – EHS Guideline of IFC**

Likelihood	Consequences				
	Insignificant 1	Minor 2	Moderate 3	Major 4	Catastrophic 5
A. Almost certain	L	M	E	E	E
B. Likely	L	M	H	E	E
C. Moderate	L	M	H	E	E
D. Unlikely	L	L	M	H	E
E. Rare	L	L	M	H	H

*Legend*  
 E: extreme risk; immediate action required  
 H: high risk; senior management attention needed  
 M: Moderate risk; management responsibility should be specified  
 L: low risk; manage by routine procedures

The environmental assessment has taken into consideration impacts on the following main aspects:

- Physiochemical aspects: land, soil, water, air, etc.
- Biological aspects: habitats, flora, fauna, etc.
- Socio-economic aspects: public health and safety, infrastructural services, etc.

Impacts were ranked according to their level of significance (H: High, M: Moderate, L: Low, Negligible and None). Only two alternatives were evaluated through this study. They are the "No-Project" alternative and the "Project" alternative. A full discussion was given to the negative impacts by having "No-Project", and they are summarized as follows:

**Table D: Impact assessment of "No-Project" alternative**

<sup>2</sup> WBG EHS General Guidelines is available on: <http://www.ifc.org/wps/wcm/connect/554e8d80488658e4b76af76a6515bb18/Final%2B-%2BGeneral%2BEHS%2BGuidelines.pdf?MOD=AJPERES>

WBG EHS for Water and Sanitation is available on:  
<http://www.ifc.org/wps/wcm/connect/e22c050048855ae0875cd76a6515bb18/Final%2B-%2BWater%2Band%2BSanitation.pdf?MOD=AJPERES>

Area of concern	Impact	Sensitive receptor	Level of significance
Abiotic environment (Cross-media interaction)	Land and soil contamination due to accidental discharges	Land and soil at discharge point	H
	River water contamination due to flooding, and emergency discharges,	Receiving river bed (Diyala, Tigris)	H
	Aquifer water contamination due to infiltration and water influx with river	Receiving aquifer basin (under-ground resources that could coexist)	H
Biotic environment (flora and fauna species)	Biological life poisoning due to high loads of chemical and microbial constituents	<ul style="list-style-type: none"> <li>- Endangered and not threatened flora at discharge point,</li> <li>- Endangered and not threatened fauna at the discharge point,</li> <li>- Aqua life (Diyala and Tigris)</li> </ul>	H
Occupational Health and Safety (OHS)	Suffocation and/or death due to inhalation of hazardous air emissions (H2S, CH4, VOCs, etc) for prolonged times.	<ul style="list-style-type: none"> <li>- On-site operators,</li> <li>- Maintenance staff,</li> <li>- Supervisors,</li> <li>- The station guards.</li> </ul>	H
	Hearing nuisance due to exposure to excessive noise levels for prolonged times.	<ul style="list-style-type: none"> <li>- On-site operators,</li> <li>- Maintenance staff,</li> <li>- Supervisors,</li> <li>- The station guards.</li> </ul>	H
	Vibration nuisance due to contact with unstiffened floors and vibrating parts (motors, pumps) for prolonged times.	<ul style="list-style-type: none"> <li>- Operators,</li> <li>- Maintenance staff</li> </ul>	M
	Electrical shock due to uncovered wiring and misused/unmaintained switches and control panels	<ul style="list-style-type: none"> <li>- Operators,</li> <li>- Maintenance staff</li> </ul>	M
Community Health & Safety	Various health issues due to direct and indirect contact with waterborne pathogens (sanitary and emergency discharges to canals and rivers),	Populations in close proximity to raw sewage outlets, including commercial and residential areas	H
	Noise and odor nuisances	Populations living or staying shortly in the vicinity of the pumping station and trunk lines and manholes.	M

### ***1.7. Environmental and Social Impact Assessment/ Environmental and Social Management Plan***

**The "Project" Alternative:**

The Project will have a range of positive impacts on the quality of Tigris River water through minimizing emergency discharges due to blockage and overflow events. There would be also indirect positive impacts on soil, land, and groundwater in the long term.

Although Project locations do not intersect with biologically sensitive areas, decreasing discharges to the surrounding environment would prevent further degradations of the ecological life indirectly and in the long term.

Occupational health and safety of workers will certainly be improved, due to introducing more reliable mechanical and electrical parts and facilitating needed maintenance works. The Project will also involve workers in capacity building activities, including participation in educational workshops on best management practices and working with hazards and contingencies.

The Local community will enjoy safer and more developed sanitation services, thus, improving environment and preventing diseases altogether. All businesses located alongside the trunk main and manholes will enjoy more hygienic working conditions, which will also improve working conditions and consequently will boost local economy. However, MOB will be more encouraged to improve environmental conditions in the area where the rehabilitated lines pass through, or at least within the Right of Way. The project is also expected to utilize workforce for the local market, which will create more job opportunities.

#### **Expected Negative Impacts and Proposed Management Plan**

The table below presents expected impacts during construction and operation phases, their proposed mitigation measures, responsible parties, requirements, and time for implementation.

**Table E: Environmental and Social Impact Assessment/ Environmental and Social Management Plan – Construction**

#	Area	Impact	Ranking	Mitigation	Roles & Responsibilities	Requirements	Time/frequency
1	<b>Occupational Health and Safety</b>	Health issues related to over-exertion and ergonomic injuries and illnesses	M	<ul style="list-style-type: none"> <li>Prevent and control through training of workers in lifting and material handling techniques,</li> <li>Plan work site layout to minimize the need for manual transfer of heavy loads,</li> <li>Select tools and design work stations that reduce force requirements and holding times,</li> <li>Implement administrative controls into work processes</li> </ul>	<ul style="list-style-type: none"> <li>Contractor to implement,</li> <li>Supervision contract,</li> <li>BSA to follow up</li> </ul>	<ul style="list-style-type: none"> <li>Training on OHS,</li> <li>Site layout,</li> <li>The best design of work station,</li> <li>Personnel rotation system,</li> <li>First aid.</li> </ul>	<ul style="list-style-type: none"> <li>Prior to construction for training and work station,</li> <li>Weekly for rotation,</li> <li>Daily for others</li> </ul>
2		Health issues related to accidental slips and falls	H	<ul style="list-style-type: none"> <li>Implement good house-keeping practices,</li> <li>Clean up excessive waste debris and liquid spills regularly,</li> <li>Locate electrical cords and ropes in common areas and marked corridors,</li> <li>Use slip retardant footwear.</li> </ul>	<ul style="list-style-type: none"> <li>Contractor to implement,</li> <li>Supervision contract,</li> <li>BSA to follow up</li> </ul>	<ul style="list-style-type: none"> <li>Housekeeping practices,</li> <li>Cleanup kits,</li> <li>First aid,</li> <li>PPE,</li> <li>Site layout</li> </ul>	On daily basis
3		Health issues related to working in heights	H	<ul style="list-style-type: none"> <li>Train and use temporary fall prevention devices,</li> <li>Train and use personal fall arrest systems,</li> <li>Use control zones and safety monitoring systems</li> </ul>	<ul style="list-style-type: none"> <li>Contractor to implement,</li> <li>Supervision contract,</li> <li>BSA to follow up</li> </ul>	<ul style="list-style-type: none"> <li>Education,</li> <li>Acquisition of right expertise,</li> <li>Provision of safety devices,</li> <li>Provision of safety monitoring systems,</li> <li>PPE,</li> <li>First aid,</li> <li>Site layout</li> </ul>	<ul style="list-style-type: none"> <li>Prior to construction for Education and right expertise,</li> <li>Daily for other provisions</li> </ul>
4		Health issues related to getting struck by objects	H	<ul style="list-style-type: none"> <li>Use a designated and restricted waste drop or discharge zones,</li> <li>Conduct sawing, cutting, grinding, sanding, chipping or chiseling with proper guards and anchoring as applicable,</li> <li>Maintain clear traffic ways,</li> <li>Use temporary fall protection measures,</li> <li>Wear appropriate PPE.</li> </ul>	<ul style="list-style-type: none"> <li>Contractor to implement,</li> <li>Supervision contract,</li> <li>BSA to follow up</li> </ul>	<ul style="list-style-type: none"> <li>Education,</li> <li>Acquisition of right expertise,</li> <li>Provision of safety devices,</li> <li>First aid,</li> <li>PPE</li> </ul>	<ul style="list-style-type: none"> <li>Prior to construction for Education and right expertise,</li> <li>Daily for other provisions</li> </ul>
5		Health and accidental issues related to exposing to	M	<ul style="list-style-type: none"> <li>Ensure the visibility of personnel through their use of high-visibility vests,</li> </ul>	<ul style="list-style-type: none"> <li>Contractor to implement,</li> </ul>	<ul style="list-style-type: none"> <li>Provision of safety devices,</li> </ul>	<ul style="list-style-type: none"> <li>Prior to construction for</li> </ul>

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#	Area	Impact	Ranking	Mitigation	Roles & Responsibilities	Requirements	Time/frequency
		moving machinery		<ul style="list-style-type: none"> <li>• Ensure moving equipment is outfitted with audible back-up alarms,</li> <li>• Use inspected and well-maintained lifting devices.</li> </ul>	<ul style="list-style-type: none"> <li>• Supervision contract,</li> <li>• BSA to follow up</li> </ul>	<ul style="list-style-type: none"> <li>• Provision of safety monitoring systems,</li> <li>• Provision of suitable equipment,</li> <li>• First aid,</li> <li>• PPE.</li> </ul>	<ul style="list-style-type: none"> <li>• devices and systems,</li> <li>• Daily for other provisions</li> </ul>
6		Health issues related to working with exposed electrical parts	H	<ul style="list-style-type: none"> <li>• Conduct detailed identification and marking of all buried electrical wiring,</li> <li>• Lock out and tag-out devices during dismantling and maintenance,</li> <li>• Check all electrical cords, cables, and hand power tools for frayed or exposed cords,</li> <li>• Ensure circuit breaking before starting work,</li> <li>• Use electricity-specific PPE,</li> <li>• Use specially trained personnel.</li> </ul>	<ul style="list-style-type: none"> <li>• Contractor to implement,</li> <li>• Supervision contract,</li> <li>• BSA to follow up</li> </ul>	<ul style="list-style-type: none"> <li>• Education,</li> <li>• Acquisition of right expertise</li> <li>• Provision of safety devices,</li> <li>• PPE,</li> <li>• First aid,</li> <li>• Site layout</li> </ul>	<ul style="list-style-type: none"> <li>• Prior to construction for education and right expertise,</li> <li>• Daily for safety devices and PPE</li> </ul>
7		health issues related to respiratory hazards mismanagement	H	<ul style="list-style-type: none"> <li>• Minimize dust from material handling sources,</li> <li>• Minimize dust from open area sources (storage piles),</li> <li>• Remove potential hazardous air pollutants such as asbestos, from existing infrastructures,</li> <li>• Use PPE, such as dust masks, where dust levels are excessive,</li> <li>• Avoid burning of solid wastes.</li> </ul>	<ul style="list-style-type: none"> <li>• Contractor to implement,</li> <li>• Supervision contract,</li> <li>• BSA to follow up</li> </ul>	<ul style="list-style-type: none"> <li>• Provision of respiratory controls,</li> <li>• PPE,</li> <li>• Best management practices.</li> </ul>	<ul style="list-style-type: none"> <li>• Daily for controls,</li> <li>• Weekly for local communication</li> </ul>
8		Health issues related to working in confined places	H	<ul style="list-style-type: none"> <li>• Provide safe means of access and egress from confined places,</li> <li>• Avoid operating combustion equipment for prolonged periods,</li> <li>• Use special PPE.</li> </ul>	<ul style="list-style-type: none"> <li>• Contractor to implement,</li> <li>• Supervision contract,</li> <li>• BSA to follow up</li> </ul>	<ul style="list-style-type: none"> <li>• Education,</li> <li>• Provision of safety devices,</li> <li>• Ventilation system,</li> </ul>	<ul style="list-style-type: none"> <li>• Prior to construction for education,</li> <li>• Daily for safety devices,</li> </ul>

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#	Area	Impact	Ranking	Mitigation	Roles & Responsibilities	Requirements	Time/frequency
9		hazardous solid and liquid materials mismanagement	H	<ul style="list-style-type: none"> <li>• Provide adequate secondary containment for lubricating oils and hydraulic fluids,</li> <li>• Provide adequate ventilation,</li> <li>• Use impervious surfaces for refueling areas,</li> <li>• Train workers on the correct transfer and handling of fuels and chemicals and the required response to spills,</li> <li>• Provide portable spill containment and cleanup equipment,</li> <li>• Assess the contents of the hazardous materials and petroleum-based products in building systems and process equipment,</li> <li>• Provide awareness to workers on EHS related risks,</li> <li>• Remove contents of hazardous materials prior to construction,</li> <li>• Identify types and quantities of hazardous waste expected,</li> <li>• Identify available collection and treatment programs and infrastructure,</li> <li>• Put procedures and operational controls for on-site storage.</li> </ul>	<ul style="list-style-type: none"> <li>• Contractor to implement,</li> <li>• Supervision contract,</li> <li>• BSA to follow up,</li> <li>• MOB to approve final treatment.</li> </ul>	<ul style="list-style-type: none"> <li>• PPE,</li> <li>• First aid.</li> <li>• Education,</li> <li>• Secondary containment,</li> <li>• Ventilation,</li> <li>• Refueling areas,</li> <li>• Spill and cleanup,</li> <li>• Waste management plan,</li> <li>• Material storage plan</li> </ul>	<ul style="list-style-type: none"> <li>• ventilation, and PPE</li> <li>• Prior to construction for education,</li> <li>• Daily for management</li> </ul>
10		health issues related to noise and vibration mismanagement	H	<ul style="list-style-type: none"> <li>• Use noise control devices, such as exhaust muffling devices for combustion engines,</li> <li>• Use vibration protecting gear, like gloves and clothing,</li> <li>• Install vibration damping pads or devices, and minimize exposure duration.</li> </ul>	<ul style="list-style-type: none"> <li>• Contractor to implement,</li> <li>• Supervision contract,</li> <li>• BSA to follow up</li> </ul>	<ul style="list-style-type: none"> <li>• Education to workers,</li> <li>• Preventive and corrective Maintenance,</li> <li>• PPE,</li> </ul>	<ul style="list-style-type: none"> <li>• Prior to construction for education,</li> <li>• Daily for management</li> </ul>
11		<b>Public health and &amp; safety</b>	public issues related to spread of pests and communicable diseases	M	<ul style="list-style-type: none"> <li>• Provide surveillance and active screening and treatment of workers,</li> <li>• Prevent illness among workers in local communities,</li> <li>• Train health workers in disease treatment,</li> </ul>	<ul style="list-style-type: none"> <li>• Contractor to implement,</li> <li>• Supervision contract,</li> <li>• Health centers to immunize,</li> <li>• Municipalities to apply</li> </ul>	<ul style="list-style-type: none"> <li>• Immunization programs,</li> <li>• Municipalities to apply pest control programs</li> </ul>

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#	Area	Impact	Ranking	Mitigation	Roles & Responsibilities	Requirements	Time/frequency
				<ul style="list-style-type: none"> <li>• Conduct immunization programs,</li> <li>• Provide treatment on-site or in community health care facilities, <i>vector-borne diseases</i></li> <li>• Eliminate unusable impounded water,</li> <li>• Consider application of residual insecticide to dormitory walls,</li> <li>• Implement integrated vector control programs,</li> <li>• Promote use of personal protective means and barriers,</li> <li>• Communicate with public health officials,</li> <li>• Educate project personnel and area residents on risks, prevention, and available treatment,</li> <li>• Monitor communities during high-risk seasons,</li> <li>• Follow safety guidelines for the storage, transport, and distribution of pesticides.</li> </ul>	controls (in liaison with the environmental dept of MOB), <ul style="list-style-type: none"> <li>• BSA to follow up,</li> </ul>		
12		Public health and safety issues due to excavation	M	<ul style="list-style-type: none"> <li>• Plan activities in consultation with local communities (during the days with least disturbance);</li> <li>• Use dust suppression techniques (like watering);</li> <li>• Coordinate with utility service providers (power lines, water lines, gas etc.);</li> <li>• Post warning signs and warning lights near the residential areas. And use safety fences;</li> <li>• Avoid piling excavation soil or debris as well as building materials and water pipes on the narrow roads in high densely populated areas.</li> </ul>	<ul style="list-style-type: none"> <li>• Contractor to implement and coordinate,</li> <li>• Supervision contract,</li> <li>• BSA to follow up</li> </ul>	<ul style="list-style-type: none"> <li>• Public outreach</li> <li>• Warning signage</li> </ul>	<ul style="list-style-type: none"> <li>• Daily during construction</li> </ul>
13		public safety issues due to unauthorized access to working sites	M	<ul style="list-style-type: none"> <li>• Restrict access to the working site, (institutional and administrative controls, fencing, signage, and communication of risks),</li> <li>• Remove hazardous conditions on</li> </ul>	<ul style="list-style-type: none"> <li>• Contractor to implement,</li> <li>• BSA to follow up,</li> </ul>	<ul style="list-style-type: none"> <li>• Education,</li> <li>• Acquisition of right expertise,</li> <li>• Collection and disposal plan,</li> </ul>	<ul style="list-style-type: none"> <li>• Prior to construction for education and right expertise,</li> <li>• Daily for other</li> </ul>



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#	Area	Impact	Ranking	Mitigation	Roles & Responsibilities	Requirements	Time/frequency
				construction sites that cannot be controlled by restricting access, such as covering opening to small confined spaces, and ensuring means of escape, like in case of locked storage of hazardous materials.		<ul style="list-style-type: none"> <li>• Provision of safety devices,</li> <li>• PPE,</li> <li>• First aid,</li> <li>• Site layout,</li> <li>• Site security.</li> </ul>	provisions
14		Traffic safety	M	<ul style="list-style-type: none"> <li>• Emphasize safety aspects among drivers,</li> <li>• Avoid or minimize driving through community areas and dangerous routes and times of day,</li> <li>• Alert drivers on local speed limits, and monitor implementation,</li> <li>• Apply regular maintenance of vehicles,</li> <li>• Collaborate with local communities and responsible authorities to improve signage and visibility,</li> <li>• Minimize traffic by purchasing from the local markets.</li> </ul>	<ul style="list-style-type: none"> <li>• Contractor to implement,</li> <li>• Supervision contract,</li> <li>• BSA to follow up,</li> <li>• Traffic department to advise,</li> <li>• Local representatives to get in touch</li> </ul>	<ul style="list-style-type: none"> <li>• Education,</li> <li>• Provisions of suitable means of transportation,</li> <li>• Best management practices,</li> <li>• Provision of regular maintenance,</li> <li>• Provisions of traffic safety measures,</li> <li>• Considering local market</li> </ul>	<ul style="list-style-type: none"> <li>• Daily for education,</li> <li>• Weekly for traffic communication,</li> <li>• Weekly for local communication,</li> <li>• Periodically for local market inclusion.</li> </ul>
15	<b>Waste Management</b>	solid waste mismanagement	M	<ul style="list-style-type: none"> <li>• Identify types and estimate quantities of waste;</li> <li>• Identify available collection and treatment programs and;</li> <li>• Establish collection and treatment priorities;</li> <li>• Identify opportunities for reduce, reuse, and recycle;</li> <li>• Put procedures and operational controls for on-site storage.</li> </ul>	<ul style="list-style-type: none"> <li>• Contractor to implement,</li> <li>• Supervision contract,</li> <li>• BSA to follow up,</li> <li>• MOB to approve dumpsite.</li> </ul>	<ul style="list-style-type: none"> <li>• Waste management plan,</li> <li>• Material storage plan</li> </ul>	<ul style="list-style-type: none"> <li>• Prior to construction for plans,</li> <li>• Daily for management</li> </ul>

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#	Area	Impact	Ranking	Mitigation	Roles & Responsibilities	Requirements	Time/frequency
16		domestic wastewater mismanagement	H	<ul style="list-style-type: none"> <li>Identify types and estimate quantities of wastewater,</li> <li>Segregate wastewater streams,</li> <li>Segregate and pre-treat oil and grease containing effluents,</li> <li>Discharge to sanitary network only after confirming compliance,</li> <li>Contain in septic tanks if discharge to sanitary sewer network is not possible,</li> <li>Avoid direct contact with wastewater through applying an enclosed system for collection, containment, and disposal.</li> <li>Monitor groundwater quality that could exist close to the working areas to ensure compliance.</li> </ul>	<ul style="list-style-type: none"> <li>Contractor to implement,</li> <li>Supervision contract,</li> <li>BSA to follow up,</li> <li>MOB to approve dumpsite.</li> </ul>	<ul style="list-style-type: none"> <li>Waste management plan,</li> <li>Storage plan,</li> <li>Quality testing for groundwater resources</li> <li>Provisions for on-site treatment</li> </ul>	<ul style="list-style-type: none"> <li>Prior to construction for plans,</li> <li>Daily for management</li> <li>Quarterly for water quality monitoring</li> </ul>
17	<b>Physical environment</b>	contamination of land	H	<ul style="list-style-type: none"> <li>Manage contaminated land (to protect safety and health of the occupants of the site, the community, and the environment),</li> <li>Understand the historical use of the land with regard to the potential presence of hazardous materials or oil,</li> <li>Prepare a management plan to manage contaminated land remaining,</li> <li>Transfer contaminated land remaining to a legal dumpsite,</li> <li>Avoid direct contact to the extent applicable.</li> </ul>	<ul style="list-style-type: none"> <li>Contractor to implement,</li> <li>Supervision contract,</li> <li>BSA to follow up,</li> <li>MOB to designate and approve dumpsite.</li> </ul>	<ul style="list-style-type: none"> <li>Waste management plan,</li> <li>Best management practices,</li> </ul>	Upon earth work

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#	Area	Impact	Ranking	Mitigation	Roles & Responsibilities	Requirements	Time/frequency
18		soil erosion and sediment mobilization	M	<ul style="list-style-type: none"> <li>• Schedule to avoid heavy rainfall periods,</li> <li>• Minimize steepness of slopes,</li> <li>• Re-vegetate if applicable,</li> <li>• Design channels and ditches for expected flows,</li> <li>• Reduce or prevent off-site sediment transport,</li> <li>• Modify/ suspend activities during extreme rainfall and high winds,</li> <li>• Segregate or divert clean runoffs from water containing high solids content,</li> <li>• Provide adequate drainage system onsite.</li> <li>• Monitor groundwater quality that could exist close to the working areas to ensure compliance.</li> </ul>	<ul style="list-style-type: none"> <li>• Contractor to implement,</li> <li>• Supervision contract,</li> <li>• BSA to follow up,</li> <li>• Meteorological department for weather forecast</li> </ul>	<ul style="list-style-type: none"> <li>• Best management practices,</li> <li>• Provision of drainage/ segregation systems,</li> <li>• Weather forecast</li> <li>• Quality testing for groundwater resources</li> </ul>	<ul style="list-style-type: none"> <li>• Daily for best practices,</li> <li>• Seasonally for rainfall seasons</li> <li>• Quarterly for water quality monitoring</li> </ul>
19	<b>Biotic environment</b>	altering/ endangering biological life	L	<ul style="list-style-type: none"> <li>• Ensure full adherence to the zero-discharge criterion,</li> <li>• Oblige by available and approved routes, and avoid driving off-roads, or through naturally valued areas,</li> <li>• Oblige by legal transportation and dumping of materials in their pre-designated and approved dumpsites,</li> <li>• Stay in constant contact with the concerned authorities should any emergent spillage occurs, and apply prompt and approved site cleanup procedures,</li> <li>• Raise awareness on the importance of natural life.</li> </ul>	<ul style="list-style-type: none"> <li>• Contractor to implement,</li> <li>• Supervision contract,</li> <li>• BSA to follow up,</li> <li>• MOB to designate and approve dumpsite,</li> <li>• Environment department to advise,</li> </ul>	<ul style="list-style-type: none"> <li>• Best management practices,</li> <li>• Provisions of off-site cleanup,</li> <li>• Waste and spill management plan,</li> <li>• Flora and fauna mapping,</li> <li>• Awareness on natural life</li> </ul>	<ul style="list-style-type: none"> <li>• Prior to construction for flora and fauna mapping,</li> <li>• Daily for zero-discharge, driving routes,</li> <li>• Weekly for awareness,</li> <li>• Continuously for contact with environment dept.</li> </ul>

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#	Area	Impact	Ranking	Mitigation	Roles & Responsibilities	Requirements	Time/frequency
20	<b>Cultural heritage and chance finds</b>	Possible damage to objects of historical/ cultural value	H	<ul style="list-style-type: none"> <li>Educate site workers on possibilities of unearthing objects,</li> <li>Make workers aware of the significance and legal liabilities,</li> <li>Put simple and clear instructions for workers in response chance finds,</li> <li>Liaise with responsible authorities,</li> <li>Suspend excavation work and promptly communicate any chance finds to the responsible authorities.</li> </ul>	<ul style="list-style-type: none"> <li>Contractor to implement,</li> <li>Supervision contract,</li> <li>BSA to follow up,</li> <li>Dept. of antiquities to approve chance finds procedures,</li> </ul>	<ul style="list-style-type: none"> <li>Education &amp; awareness,</li> <li>Procedures for chance finds,</li> <li>Well-defined communication channels,</li> </ul>	<ul style="list-style-type: none"> <li>Prior to excavation for "education",</li> <li>Prior to excavation for "chance finds procedures",</li> <li>On daily basis during excavation works</li> </ul>
21	<b>Socio-economic</b>	temporary loss of livelihoods and interruption of social and economic activities if relocation is deemed necessary	M	<ul style="list-style-type: none"> <li>Prepare and apply a RAP/ARAP in case some business owners alongside trunk main has to be relocated.</li> </ul>	<ul style="list-style-type: none"> <li>BSA</li> <li>PIC's Environmental and Social Safeguards Specialist</li> </ul>	RPF/RAP/ARAP	Prior to construction

**Table F: Environmental and Social Impact Assessment/ Environmental and Social Management Plan – Operation**

#	Area	Impact	Ranking	Mitigation	Responsibility	Requirement	Frequency
1	<b>Public health and safety</b>	public health issues and contamination of environment due to mismanagement of overflows	L	<ul style="list-style-type: none"> <li>Develop and implement appropriate protocols to reduce risks to safety, public health, and environment,</li> <li>Develop a contingency plan (site-specific),</li> <li>Respond to overflows by preventing, containing, minimizing, the overflow,</li> <li>Protect SPS's components from flood damage (i.e. protecting components from rising flood water),</li> <li>Notify responsible parties (BSA).</li> </ul>	<ul style="list-style-type: none"> <li>Working personnel to implement,</li> <li>BSA to monitor,</li> <li>Environment dept to advise,</li> <li>Local representatives,</li> </ul>	<ul style="list-style-type: none"> <li>Contingency plan,</li> <li>Public health standards,</li> <li>Maintenance plans,</li> <li>Community outreach</li> </ul>	<ul style="list-style-type: none"> <li>Daily for contingency, and maintenance,</li> <li>Seasonally for community outreach</li> </ul>
2		Odor and noise nuisance to adjacent sensitive receptors	L	<ul style="list-style-type: none"> <li>Apply preventive and corrective maintenance procedures on odor and noise generating equipment and facilities,</li> <li>Apply preventive and corrective maintenance on odor control units,</li> <li>Establish a Standard Operating</li> </ul>	<ul style="list-style-type: none"> <li>Working personnel to implement,</li> <li>BSA to monitor,</li> <li>Environment dept to advise,</li> <li>Local representatives,</li> </ul>	<ul style="list-style-type: none"> <li>Provision of noise and odor controls,</li> <li>Maintenance plans and procedures,</li> <li>Monitoring plans,</li> <li>Community</li> </ul>	<ul style="list-style-type: none"> <li>Daily for management and maintenance plans,</li> <li>Weekly for monitoring,</li> <li>Seasonally for community outreach</li> </ul>

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#	Area	Impact	Ranking	Mitigation	Responsibility	Requirement	Frequency
				Procedure (SOP) to include requirements for maintenance, monitoring, and personnel training, <ul style="list-style-type: none"> <li>• Monitor outdoor odor and noise levels within pumping station boundary,</li> <li>• Create retrofitting noise controls where practical, like fencing and enclosures,</li> <li>• Keep records of the maintenance logs, local complaints, and analyze trends.</li> </ul>		outreach	
3		Pest spreading issues	L	<ul style="list-style-type: none"> <li>• Use of pesticides that are compatible with “Recommended Classification of Pesticides by Hazard and Guidelines to Classifications” of the WHO</li> </ul>	<ul style="list-style-type: none"> <li>• Working personnel to implement,</li> <li>• BSA to monitor,</li> <li>• Environment dept to advise,</li> </ul>	<ul style="list-style-type: none"> <li>• Pesticides compatible with WHO guidance</li> </ul>	Monthly

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#	Area	Impact	Ranking	Mitigation	Responsibility	Requirement	Frequency
4		public health issues and contamination of environment due to mismanagement of hazardous waste and materials	H	<ul style="list-style-type: none"> <li>• Train operators on release prevention, including drills specific to hazardous materials,</li> <li>• Implement inspection programs to maintain the mechanical integrity and operability of parts and systems,</li> <li>• Prepare written Standard Operating Procedures (SOPs) for filling containers or equipment and for transfer operations,</li> <li>• Apply SOPs for the management of secondary containment structures,</li> <li>• Identify locations of hazardous materials and associated activities,</li> <li>• Transport and dump waste residues from screens in legal and approved dumpsites,</li> <li>• Make available specific PPE and training needed to respond to an emergency,</li> <li>• Make available spill response equipment sufficient to handle at least initial stages of a spill,</li> <li>• Train and educate operational personnel on response activities in the event of spill, release, or chemical emergency.</li> <li>• Provide quality monitoring tests for groundwater resources adjacent to subproject locations</li> </ul>	<ul style="list-style-type: none"> <li>• Working personnel to implement,</li> <li>• BSA to monitor,</li> <li>• Environment dept to advise,</li> <li>• Local representatives,</li> </ul>	<ul style="list-style-type: none"> <li>• Capacity building,</li> <li>• Inspection programs,</li> <li>• Documented procedures,</li> <li>• Best management practices,</li> <li>• Legal and approved dumpsite,</li> <li>• Provision of PPE,</li> <li>• Provision of spill equipment.</li> <li>• Provision of water quality monitoring</li> </ul>	<ul style="list-style-type: none"> <li>• On daily basis</li> <li>• Semiannual for water quality monitoring</li> </ul>
5	OHS	Health issues related to over-exertion and ergonomic injuries and illnesses	M	<ul style="list-style-type: none"> <li>• Prevent and control by training workers on lifting and material handling techniques, including placing of weight limits above which mechanical assists or two-person lifts are necessary,</li> <li>• Plan work site layout to minimize the need for manual transfer of heavy loads,</li> <li>• Select tools and design work stations that reduce force requirements and holding times,</li> </ul>	<ul style="list-style-type: none"> <li>• Working personnel to implement,</li> <li>• BSA to provide medical insurance, monitor implementation, and provide training.</li> </ul>	<ul style="list-style-type: none"> <li>• Capacity building,</li> <li>• Best practices,</li> <li>• Personnel rotation system,</li> <li>• First aid and medical insurance.</li> </ul>	<ul style="list-style-type: none"> <li>• Daily for best practices and medical care,</li> <li>• Periodically for capacity building and job rotation,</li> </ul>

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#	Area	Impact	Ranking	Mitigation	Responsibility	Requirement	Frequency
				<ul style="list-style-type: none"> <li>Implement administrative controls into work processes.</li> </ul>			
6		Health issues related to accidental slips and falls	H	<ul style="list-style-type: none"> <li>Implement good house-keeping practices,</li> <li>Clean up excessive waste debris and liquid spills regularly,</li> <li>Locate electrical cords and ropes in common areas and marked corridors,</li> <li>Use slip retardant footwear.</li> </ul>	<ul style="list-style-type: none"> <li>Working personnel to implement,</li> <li>BSA to provide medical insurance, monitor implementation, and provide training.</li> </ul>	<ul style="list-style-type: none"> <li>Capacity building,</li> <li>Best practices,</li> <li>Cleanup kits,</li> <li>First aid and medical insurance,</li> <li>PPE,</li> </ul>	<ul style="list-style-type: none"> <li>Daily for best practices, medical care, and PPE,</li> <li>Periodically for capacity building and job rotation,</li> </ul>
7		Health issues related to working in heights	H	<ul style="list-style-type: none"> <li>Train and use temporary fall prevention devices,</li> <li>Train and use personal fall arrest systems,</li> <li>Use control zones and safety monitoring systems</li> </ul>	<ul style="list-style-type: none"> <li>Working personnel to implement,</li> <li>BSA to provide medical insurance, monitor implementation, and provide training.</li> </ul>	<ul style="list-style-type: none"> <li>Capacity building,</li> <li>Best practices,</li> <li>Provision of safety devices,</li> <li>Provision of monitoring systems,</li> <li>First aid and medical insurance,</li> <li>PPE,</li> </ul>	<ul style="list-style-type: none"> <li>Daily for best practices, medical care, safety devices, monitoring systems PPE,</li> <li>Periodically for capacity building,</li> </ul>
8		Health issues related to working with electrical equipment and control panels	H	<ul style="list-style-type: none"> <li>Conduct detailed identification and marking of all buried electrical wiring,</li> <li>Lock out and tag-out devices during dismantling and maintenance,</li> <li>Ensure circuit breaking before starting work,</li> <li>Use electricity-specific PPE,</li> <li>Use specially trained personnel.</li> </ul>	<ul style="list-style-type: none"> <li>Working personnel to implement,</li> <li>BSA to provide medical insurance, monitor implementation, and provide training.</li> </ul>	<ul style="list-style-type: none"> <li>Capacity building,</li> <li>Best practices,</li> <li>Acquisition of right expertise,</li> <li>Provision of safety devices,</li> <li>Provision of monitoring systems,</li> <li>First aid and medical insurance,</li> <li>PPE,</li> </ul>	<ul style="list-style-type: none"> <li>Daily for best practices, medical care, safety devices, monitoring systems PPE,</li> <li>Periodically for capacity building and employing right expertise</li> </ul>
9		Health issues related to working in confined places	H	<ul style="list-style-type: none"> <li>Provide safe means of access and egress from confined places,</li> <li>Avoid operating combustion equipment for prolonged periods,</li> <li>Use special PPE.</li> <li>Minimize exposure period to the extent</li> </ul>	<ul style="list-style-type: none"> <li>Working personnel to implement,</li> <li>BSA to provide medical insurance, monitor implementation, and provide training.</li> </ul>	<ul style="list-style-type: none"> <li>Education,</li> <li>Provision of safety devices,</li> <li>Ventilation system,</li> <li>PPE,</li> </ul>	<ul style="list-style-type: none"> <li>Daily for best practices, medical care, safety devices, PPE,</li> <li>Periodically for capacity building</li> </ul>

#	Area	Impact	Ranking	Mitigation	Responsibility	Requirement	Frequency
10		health and stress issues due to noise and vibration in work environment	L	<p>possible.</p> <ul style="list-style-type: none"> <li>Effectively isolating control room against noise and vibration,</li> <li>Avoid prolonged exposure periods beyond permissible times,</li> <li>Avoid exposure to excessive levels beyond permissible limits,</li> <li>Monitor noise and vibration levels,</li> <li>Use noise hearing protection gear and vibration resistant boots, gloves, and clothing,</li> <li>Keep records of breaching incidents, and report to the higher management.</li> </ul>	<ul style="list-style-type: none"> <li>Working personnel to implement,</li> <li>BSA to provide medical insurance, monitor implementation, and provide training.</li> </ul>	<ul style="list-style-type: none"> <li>First aid.</li> <li>Education,</li> <li>Provision of isolation,</li> <li>Provision of monitoring devices and programs,</li> <li>PPE,</li> <li>Medical insurance,</li> <li>Record keeping</li> </ul>	<ul style="list-style-type: none"> <li>Daily for best practices, medical care, PPE,</li> <li>Weekly and monthly for monitoring,</li> <li>Periodically for capacity building</li> </ul>

## 1.8. Monitoring Plan

**Table G: Environmental and Social Monitoring Plan – Construction**

#	Parameter to be monitored	Target KPI/limit	Monitoring requirements	Monitoring Responsibility	Frequency	location	Cost estimate
1	Health issues linked to nature of work	<ul style="list-style-type: none"> <li>Zero medical complaint/ assistance,</li> <li>100% clear inspection report</li> </ul>	<ul style="list-style-type: none"> <li>Contractors' incident records</li> <li>Keeping records at medical care centers</li> </ul>	<ul style="list-style-type: none"> <li>Resident engineer of PIC</li> <li>Resident engineer of BSA</li> <li>ESO- BSA</li> </ul>	Monthly, Annual review	Construction site	<ul style="list-style-type: none"> <li>PIC's budget.</li> <li>BSA's resident engineer daily rate (approx. 50 USD/day)</li> <li>ESO-BSA's daily rate (approx. 50 USD/day)</li> </ul>
2	Training effectiveness	<ul style="list-style-type: none"> <li>Zero incident reports related to training,</li> <li>100% clear inspection report</li> </ul>	<ul style="list-style-type: none"> <li>Contractor's incident reports</li> </ul>	<ul style="list-style-type: none"> <li>Resident engineer of PIC</li> <li>Resident engineer of BSA</li> <li>ESO- BSA</li> </ul>	Monthly, Annual review	Construction site	<ul style="list-style-type: none"> <li>PIC's budget.</li> <li>BSA's resident engineer daily rate (approx.. 50 USD/day)</li> <li>ESO-BSA's daily rate (approx. 50 USD/day)</li> </ul>
3	Housekeeping in-situ	<ul style="list-style-type: none"> <li>Zero incident reports,</li> <li>Zero complaints,</li> <li>100% clear inspection report</li> </ul>	<ul style="list-style-type: none"> <li>Contractor's incident records,</li> <li>Contractor's complaining system,</li> <li>Site engineer's reporting</li> </ul>	<ul style="list-style-type: none"> <li>Resident engineer of PIC</li> <li>Resident engineer of BSA</li> </ul>	Bi-weekly, Monthly, Annual review	Construction site	<ul style="list-style-type: none"> <li>PIC's budget.</li> <li>BSA's resident engineer daily rate (approx. 50 USD/day)</li> <li>ESO-BSA's daily rate (approx. 50 USD/day)</li> </ul>



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#	Parameter to be monitored	Target KPI/limit	Monitoring requirements	Monitoring Responsibility	Frequency	location	Cost estimate
4	Right expertise	<ul style="list-style-type: none"> <li>• Zero incident reports related to failure testing,</li> <li>• 100% clear inspection report</li> </ul>	Mechanical and electrical testing records, Site engineer's reporting	<ul style="list-style-type: none"> <li>• Contractor,</li> <li>• Contractor's environmental engineer</li> </ul>	Quarterly	Construction site	<ul style="list-style-type: none"> <li>• Costs of record keeping included in the Contract price (estimate: 2,000 USD/quarter)</li> <li>• Costs incurred by Contractor's environmental engineer included in Contract budget (estimate: 100 USD/day)</li> </ul>
5	PPE effective usage	<ul style="list-style-type: none"> <li>• Zero incident reports related to misusing PPE,</li> <li>• 100% clear inspection report,</li> <li>• 100% clear OH report</li> </ul>	<ul style="list-style-type: none"> <li>• Contractor's incident records,</li> <li>• Contractor's complaining system,</li> <li>• Site engineer's reporting,</li> <li>• OH inspection system</li> </ul>	<ul style="list-style-type: none"> <li>• Contractor</li> <li>• Resident engineer of PIC</li> <li>• Resident engineer of BSA</li> </ul>	Monthly	Construction site	<ul style="list-style-type: none"> <li>• Contractor's budget</li> <li>• PIC's budget.</li> <li>• BSA's resident engineer daily rate (approx. 50 USD/day)</li> </ul>
6	Site hygiene	<ul style="list-style-type: none"> <li>• Zero incident reports related to waste mismanagement,</li> <li>• 100% clear inspection report,</li> <li>• 100% clear PH report</li> </ul>	<ul style="list-style-type: none"> <li>• Contractor's incident records,</li> <li>• Contractor's complaining system,</li> <li>• Site engineer's reporting,</li> <li>• PH inspection system</li> </ul>	<ul style="list-style-type: none"> <li>• Contractor</li> <li>• Resident engineer of PIC</li> <li>• Resident engineer of BSA</li> </ul>	Monthly, Quarterly, Annual review.	Construction site	<ul style="list-style-type: none"> <li>• Contractor's budget</li> <li>• PIC's budget.</li> <li>• BSA's resident engineer daily rate (approx. 50 USD/day)</li> </ul>
7	Off-site hygiene	<ul style="list-style-type: none"> <li>• Zero complaints related to illegal dumping off-site,</li> <li>• 100% clear PH report</li> </ul>	<ul style="list-style-type: none"> <li>• BSA's complaining system,</li> <li>• PH inspection system</li> </ul>	<ul style="list-style-type: none"> <li>• Resident engineer of PIC</li> <li>• MOB</li> </ul>	Monthly, Quarterly, Annual review	Transporting routes	<ul style="list-style-type: none"> <li>• PIC's budget.</li> <li>• MOB budget (daily rates of field inspectors approx. 50 USD/day)</li> </ul>
8	Ambient air quality and noise	<ul style="list-style-type: none"> <li>• Zero complaints related to air and noise nuisance,</li> <li>• 100% clear Environmental Health (EH) report,</li> <li>• Thresholds are fully complied with.</li> </ul>	<ul style="list-style-type: none"> <li>• BSA's complaining system,</li> <li>• EH. inspection system,</li> <li>• Air and noise monitoring equipment, measurements and analyses.</li> </ul>	<ul style="list-style-type: none"> <li>• Resident engineer of PIC</li> <li>• Resident engineer of BSA</li> <li>• ESO- BSA</li> </ul>	Quarterly, Annual review.	Site vicinity	<ul style="list-style-type: none"> <li>• PIC's budget (monitoring cost estimated at 10,000 USD quarterly).</li> <li>• BSA's resident engineer daily rate (approx. 50 USD/day)</li> <li>• ESO-BSA's daily rate (approx. 50 USD/day)</li> </ul>
9	Surface and groundwater quality	<ul style="list-style-type: none"> <li>• Physical, chemical, and bacteriological parameters are within national limits</li> </ul>	<ul style="list-style-type: none"> <li>• Water quality monitoring services</li> </ul>	<ul style="list-style-type: none"> <li>• Resident engineer of PIC</li> <li>• ESO-BSA for final</li> </ul>	Quarterly	<ul style="list-style-type: none"> <li>• Intake points from Tigris,</li> <li>• Discharge points of</li> </ul>	<ul style="list-style-type: none"> <li>• 6,100 USD per each round of testing from 4 locations</li> <li>• ESO-BSA's daily rate (approx.</li> </ul>

**ESIA and ESMP – Doura, Habibiya and Ghazaliya sub-projects**  
 Baghdad Water Supply and Sewerage Improvement Project

#	Parameter to be monitored	Target KPI/limit	Monitoring requirements	Monitoring Responsibility	Frequency	location	Cost estimate
				reporting		untreated sewage, <ul style="list-style-type: none"> <li>• Groundwater wells within 1km of point of discharge into Tigris, and</li> <li>• Groundwater wells within 1 km distance along open canals of untreated sewage.</li> </ul>	50 USD/day)
10	Public health	<ul style="list-style-type: none"> <li>• Zero complaints related to vector nuisance and communicable diseases,</li> <li>• Zero incidents of Project related infections/diseases.</li> </ul>	<ul style="list-style-type: none"> <li>• Immunization program,</li> <li>• Records of BSA's complaining system,</li> <li>• Records of Health inspection system,</li> <li>• Records of Health care systems.</li> </ul>	<ul style="list-style-type: none"> <li>• Health care provider</li> <li>• Resident engineer of PIC</li> <li>• MOB</li> <li>• ESO-BSA for final reporting</li> </ul>	Monthly, Annual review.	On-site, localities	<ul style="list-style-type: none"> <li>• Cost of health care program included in the contractor's budget (estimate: 200 USD/worker/year),</li> <li>• Cost of MOB's complaining system included in MOB's budget,</li> <li>• PIC's budget</li> <li>• ESO-BSA's daily rate (approx. 50 USD/day)</li> </ul>
11	Traffic safety	<ul style="list-style-type: none"> <li>• Zero traffic accident reports related to the Project,</li> <li>• Zero complaints of project related traffic accidents</li> </ul>	<ul style="list-style-type: none"> <li>• Traffic dept records,</li> <li>• Records of BSA's complaining system,</li> <li>• Contractor's record.</li> </ul>	<ul style="list-style-type: none"> <li>• Traffic dept,</li> <li>• MOB</li> <li>• Resident engineer of PIC for reporting</li> <li>• ESO-BSA for final reporting</li> </ul>	Monthly, Annual review	Public road network	<ul style="list-style-type: none"> <li>• Costs of accidents recording included in Traffic Department's budget,</li> <li>• Cost of MOB's complaining system included in MOB's budget,</li> <li>• PIC's budget</li> <li>• ESO-BSA's daily rate (approx. 50 USD/day)</li> </ul>
12	Natural life (flora & fauna)	<ul style="list-style-type: none"> <li>• Zero incident reports related to altering/ endangering natural life</li> </ul>	<ul style="list-style-type: none"> <li>• Environmental inspection system,</li> <li>• Incident records.</li> </ul>	<ul style="list-style-type: none"> <li>• Environmental dept at MOB</li> <li>• Resident engineer of PIC for reporting</li> <li>• ESO-BSA for final reporting</li> </ul>	Monthly, Annual review	Natural life in vicinity and downstream	<ul style="list-style-type: none"> <li>• Costs of environmental monitoring included in environmental dept's budget,</li> <li>• PIC's budget</li> <li>• ESO-BSA's daily rate (approx. 50 USD/day)</li> </ul>
13	Cultural heritage and chance finds	<ul style="list-style-type: none"> <li>• Incident reports of chance finds are fully addressed to responsible authorities</li> </ul>	<ul style="list-style-type: none"> <li>• Incident reports,</li> <li>• Site surveillance during work</li> </ul>	<ul style="list-style-type: none"> <li>• Antiquities dept.</li> <li>• Resident engineer of PIC</li> </ul>	Daily, quarterly review	Alongside roads that will have excavations	<ul style="list-style-type: none"> <li>• Antiquities Department monitoring budget,</li> <li>• PIC's budget</li> </ul>

**ESIA and ESMP – Doura, Habibiya and Ghazaliya sub-projects**  
 Baghdad Water Supply and Sewerage Improvement Project

#	Parameter to be monitored	Target KPI/limit	Monitoring requirements	Monitoring Responsibility	Frequency	location	Cost estimate
		<ul style="list-style-type: none"> <li>No activity has resulted in any archaeological/cultural heritage damage during construction</li> </ul>	<ul style="list-style-type: none"> <li>Open reporting channels with responsible authorities (dept. of antiquities and MOB)</li> </ul>	for reporting <ul style="list-style-type: none"> <li>ESO-BSA for final reporting</li> </ul>			<ul style="list-style-type: none"> <li>ESO-BSA's daily rate (approx. 50 USD/day)</li> </ul>

**Table H: Environmental and Social Monitoring Plan – Operation**

#	Parameter to be monitored	Target KPI/limit	Monitoring requirements	Monitoring Responsibility	Frequency	location	Cost estimate
1	Water quality	<ul style="list-style-type: none"> <li>River water quality within thresholds,</li> <li>Zero complaints related to overflows</li> </ul>	<ul style="list-style-type: none"> <li>Water quality monitoring services</li> </ul>	<ul style="list-style-type: none"> <li>MOB for complaining</li> <li>BWA's central labs</li> <li>ESO-BSA</li> </ul>	Semiannual	<ul style="list-style-type: none"> <li>Intake points from Tigris,</li> <li>Discharge points of untreated sewage,</li> <li>Groundwater wells within 1km of point of discharge into Tigris, and</li> <li>Groundwater wells within 1 km distance along open canals of untreated sewage.</li> </ul>	<ul style="list-style-type: none"> <li>MOB's budget for running complaining system,</li> <li>6,100 USD per each round of testing from 4 locations</li> <li>ESO-BSA's daily rate (approx. 50 USD/day)</li> </ul>
2	Land and soil quality	<ul style="list-style-type: none"> <li>Land and soil quality within thresholds,</li> <li>Zero complaints related to overflows</li> </ul>	<ul style="list-style-type: none"> <li>MOB/BSA's complaining system,</li> <li>Land and soil monitoring equipment, measurements, and analyses.</li> </ul>	<ul style="list-style-type: none"> <li>MOB's Environmental Health dept.</li> <li>ESO-BSA</li> </ul>	Monthly, Annually.	SPS vicinity, Downstream	<ul style="list-style-type: none"> <li>MOB/BSA's budget for running complaining and inspection,</li> <li>MOB/BSA's budget for running soil monitoring</li> <li>ESO-BSA's daily rate (approx. 50 USD/day)</li> </ul>
3	Ambient air quality and noise	<ul style="list-style-type: none"> <li>Zero complaints related to air and noise nuisance,</li> <li>100% clear EH report,</li> <li>Thresholds not exceeded.</li> </ul>	<ul style="list-style-type: none"> <li>MOB/BSA's complaining system,</li> <li>Air and noise monitoring measurements and analyses</li> </ul>	<ul style="list-style-type: none"> <li>MOB</li> <li>ESO-BSA</li> </ul>	Monthly, Annually.	SPS vicinity	<ul style="list-style-type: none"> <li>MOB/BSA's budget for running complaining and inspection,</li> <li>MOB/BSA's budget for running air and noise monitoring</li> <li>ESO-BSA's daily rate (approx. 50 USD/day)</li> </ul>
4	Public health related to	<ul style="list-style-type: none"> <li>Zero complaints of operation-related public</li> </ul>	<ul style="list-style-type: none"> <li>Records of BSA's complaining system,</li> </ul>	<ul style="list-style-type: none"> <li>MOB</li> <li>ESO-BSA</li> </ul>	Monthly, Annual	localities	<ul style="list-style-type: none"> <li>MOB/BSA's budget for running complaining and inspection,</li> </ul>

**ESIA and ESMP – Doura, Habibiya and Ghazaliya sub-projects**  
 Baghdad Water Supply and Sewerage Improvement Project

#	Parameter to be monitored	Target KPI/limit	Monitoring requirements	Monitoring Responsibility	Frequency	location	Cost estimate
	overflows	health, <ul style="list-style-type: none"> <li>Zero incidents of Project related infections/diseases.</li> </ul>	<ul style="list-style-type: none"> <li>Records of Health inspection system,</li> <li>Records of Health care systems.</li> </ul>		review.		<ul style="list-style-type: none"> <li>ESO-BSA's daily rate (approx. 50 USD/day)</li> </ul>
5	Health issues linked to nature of work	<ul style="list-style-type: none"> <li>Zero medical complaint/assistance,</li> <li>Zero incident reports</li> </ul>	<ul style="list-style-type: none"> <li>Incidents records,</li> <li>Records at medical care centers</li> </ul>	<ul style="list-style-type: none"> <li>SPS operator,</li> <li>BSA</li> <li>ESO-BSA</li> </ul>	Monthly, Annual review	SPSs	<ul style="list-style-type: none"> <li>Costs of medical care included in BSA's budget (estimate: 200 USD/personnel/month)</li> <li>ESO-BSA's daily rate (approx. 50 USD/day)</li> </ul>
6	Capacity building	<ul style="list-style-type: none"> <li>Zero incident reports related to operational and maintenance activities,</li> <li>Staff evaluation (highest score)</li> </ul>	Human resources system	<ul style="list-style-type: none"> <li>HR at MOB/BSA</li> <li>ESO-BSA</li> </ul>	Semi-annual Annual review	SPSs	<ul style="list-style-type: none"> <li>Costs of capacity building and training included in MOB/BSA's budget (estimate: 1,000 USD/worker/year)</li> <li>Costs of staff evaluation included in MOB/BSA's HR budget.</li> </ul>
7	Housekeeping in-situ	Zero incident reports related to operational and maintenance activities,	Site inspection system and records	<ul style="list-style-type: none"> <li>SPS operator,</li> <li>ESO-BSA</li> </ul>	Bi-weekly, Monthly, Annual review	SPSs	<ul style="list-style-type: none"> <li>Costs of inspection and incidents record keeping included in the SPS's and MOB/BSA's budget (estimate: 2,000 USD/year)</li> <li>ESO-BSA's daily rate (approx. 50 USD/day)</li> </ul>
8	PPE effective usage	Zero incident reports related to misusing PPE,	Site inspection system and records	<ul style="list-style-type: none"> <li>SPS operator,</li> <li>ESO-BSA</li> </ul>	Monthly	SPSs	<ul style="list-style-type: none"> <li>Costs of inspection and incidents record keeping included in the SPS's and MOB/BSA's budget (estimate: 2,000 USD/year)</li> <li>ESO-BSA's daily rate (approx. 50 USD/day)</li> </ul>
9	Site hygiene	Zero incident reports related to waste mismanagement.	Site inspection system and records	<ul style="list-style-type: none"> <li>SPS operator,</li> <li>ESO-BSA</li> </ul>	Monthly, Quarterly, Annual review.	SPSs	<ul style="list-style-type: none"> <li>Costs of inspection and incidents record keeping included in the SPS's and MOB/BSA's budget (estimate: 2,000 USD/year)</li> <li>ESO-BSA's daily rate (approx. 50 USD/day)</li> </ul>

## Site visits and reporting

**Table 1: Site visits and reporting requirements for monitoring plan**

#	Type of reporting	Timing	Reporting (from whom to whom)	Description
1	Monitoring Project site before starting civil work	Once before start of civil works	<b>From</b> Representatives of BSA, Al-Doura, Al-Sha'ab, Al-Ghazaliya, and Al-Shu'la municipalities, and Contractor's environmental engineer <b>To</b> the higher management of BSA, MOB, and WB	This stems from BSA's responsibility to ensure preparedness of the Project site to receive the new interventions (environmentally, socially, etc.). This site report is a descriptive one, and should contain expert observations and feedback from surrounding people.
2	Monitoring Contractor's obligation towards EMP	Once upon starting the Project	<b>From</b> Representatives of BSA, Al-Doura, Al-Sha'ab, Al-Ghazaliya, and Al-Shu'la municipalities, and Contractor's environmental engineer <b>To</b> the higher management of BSA and MOB Then <b>From</b> BSA <b>To</b> Contractor for action	This stems from BSA's responsibility to ensure Contractor's full compliance to EMP. This visit report is a qualitative and quantitative one on the Contractor's environmental and social provisions (for example. Handheld monitoring devices, spill containment, workforce training records, etc.)
3	Monitoring safeguards	On daily basis	<b>From</b> the Contractor's environmental engineer <b>To</b> the BSA 's supervision team, Then <b>From</b> BSA <b>To</b> Contractor for action (through supervision contractor)	This is to ensure full compliance to environmental and social safeguards by the Contractor throughout Project construction. This report is essentially technical in heart, which should include figures and trend analyses for key environmental and social parameters.
4	Monitoring safeguards	Quarterly progress reporting	<b>From</b> the Contractor's environmental engineer <b>To</b> the BSA 's supervision team, <b>To</b> the higher management at BSA / MOB and WB Then <b>From</b> BSA <b>To</b> the Contractor for action (through supervision contractor)	Aims to engage higher management in monitoring progress, and to ensure their buy-in. This report should include summary information on parameters above limits and how they were rectified, and other issues and challenges and responses thereto.
5	Monitoring complaints/concerns of local community	Quarterly from starting constructions	<b>From</b> Representatives of BSA, Al-Doura, Al-Sha'ab, Al-Ghazaliya, and Al-Shu'la municipalities, and Contractor's environmental engineer <b>To</b> the higher management of BSA and MOB, Then <b>From</b> BSA <b>To</b> Contractor for action (through supervision contractor)	Aims to rectify proceedings of the Project for healthier environmental and social aspects during construction, in addition to measure local community's satisfaction/ concerns. This reporting could be integrated within the same quarterly report (as in # 4).

## Training Requirements

*Table J: Training requirements for MOB's working staff*

Target Group	Workshop/ Training Sessions	Training Provider	Costs (USD)
Coordinators and Project Officers (MOB, BSA)	- Training session on planning and design of ESIA/ESMPs.	BSA's E&S Safeguards Specialist	7,000
Project Beneficiaries and Stakeholders	- Consultation sessions on potential environmental and social impacts of the Project.	Project Unit with assistance from the E&S Safeguards Specialist	10,000
Project Proponent (BSA), Site personnel, OHS dept.	- Training session on planning and design of ESIA/ESMPs. - The design and implementation of mitigation measures. - Occupational health and safety guidelines.	Project Unit with assistance from the E&S Safeguards Specialist, External training provider for OHS	18,000
<b>Specialized training</b>			
BSA operational staff	- Contingency planning	Department of civil defense	5,000
Technical staff at the site	- Water and Wastewater monitoring and testing	Central laboratories	10,000
<b>Sub Total (USD)</b>			<b>50,000</b>
<b>Environmental and Social Officer's salary*</b>			<b>40,000</b>
<b>Total (USD)</b>			<b>90,000</b>

## 1.9. Conclusions and Additional Information

In conclusion, the Project if implemented as planned will have great positive impacts on the sanitation services and on the surrounding environments (including public health in particular). Adverse impacts brought about by the Project in construction and operation phases can be mitigated, managed, and monitored to the levels required by pertinent safeguards. Responsibilities must be defined in early stages of the Project and just before commencing work. Building institutional capacities is also of high importance to ensure full compliance and for the sake of handling further monitoring activities. More details could be found in the main report, along with its associated annexes.

**Annex I: Contingency Plan Template – emergency discharge**

**Annex II: Sample checklist for construction phase ESMP**

**Annex III: Terms of Reference – BSA's Environmental & Social Officer**

**Annex IV: Environmental Requirements for Contractors**

**Annex V: Environmental and Social Liabilities of BWSIP Contractors**

**Annex VI: Pesticides Use and Management**

***Annex VII: Sample Grievance Registration Form***

***Annex VIII: Public Consultation – Attendees’ Lists & Questionnaire Template***

## 1. INTRODUCTION

In 2013, the population of the Republic of Iraq was estimated at around 33 million, of which 66 percent lived in urban areas. Currently the country has an estimated 3.3 million internally displaced people (IDPs). About 27 percent of the total urban population in Iraq resides in Baghdad, which is by far the largest city in the country with an estimated population of 6 million, not including an estimated 289,000 of IDPs. A 2012 household survey indicates that Iraq's national poverty stood at 19 percent and that 20 percent of the population lived on less than US\$2 a day, and 70 percent on less than US\$4 a day. The poverty rate in 2012 in Baghdad was at 12 percent; this figure is likely to have risen significantly due to the recent conflict. Unemployment is high and labor force participation remains low, especially for women and youth. Official figures from 2011 have labor force participation and youth at 11 percent although actual levels, particularly among youth, were likely much higher.

Poor public service delivery, reflected especially in significant water and electricity shortages, are binding constraints on the population's quality of life and private sector development. Safe drinking water and basic sanitation is of crucial importance to the preservation of human health, especially among children. Baghdad is one of the governorates most impacted by outbreaks of waterborne diseases. About 14 percent of diarrhea cases registered in 2011 occurred in Baghdad, which also topped the governorates in terms of number of deaths from diarrhea. Similarly, the incidents of typhoid and other waterborne diseases are higher in Baghdad compared to national averages. Contaminated water supplies and improper disposal of sewage force families to spend a significant fraction of their income to medical treatment and to purchase bottled water. This has implications for gender inequality in addition to the adverse effects on children's health, by increasing the burden of care on mothers, who are the primary caregivers of children.

The city of Baghdad and its suburbs cover 950 km<sup>2</sup> and are administered by the Mayorality of Baghdad (MOB). The city is divided into 14 municipalities. The water and wastewater services are centrally administered by the Baghdad Water Authority (BWA) and Baghdad Sewerage Authority (BSA), respectively, which are responsible for all infrastructure assets. As far as water supply and sewerage are concerned, the municipalities' role is limited to installing house connections and to maintaining neighborhood networks (pipes under 200 mm diameter). The planning and implementation of investment projects in the municipalities is the responsibility of the MOB.

The sewer system consists of a network which covers about 92 percent of the city area. Baghdad has two main wastewater treatment plants, one in Rusafa called "Rustomiya", and another one in Karkh. The efficiency with which these wastewater treatment plants and the (old) pumping stations are operated has dropped significantly (by an estimated 30 to 50 percent). The wastewater treatment plants, therefore, are not operating effectively and are under-utilized. The bulk of the city's sewage is discharged untreated and constitutes a major source of pollution to surface water and groundwater and a risk to public health.



## 1.1. The Baghdad Water Supply and Sewerage Improvement Project (BWSIP)

The proposed project will support improvements in high-priority water and wastewater services that were identified in the recent Master Plan for Baghdad to help the MOB to improve its performance in water and wastewater service delivery. The proposed project combines institutional, technical and operational steps to be undertaken by the BWA and BSA, while ensuring that they improve their financial situations. In addition, this project aims to identify (and selectively address) key challenges and opportunities in the decentralized institutional framework in Baghdad in order to support decentralization in other parts of the country. **The Project Development Objective (PDO)** is to improve the quality of drinking water supply and wastewater services in Baghdad, BWSIP consists of the following main components:

***Component 1: Institutional strengthening for integrated urban water management and utility management, and creating an enabling environment for private sector engagement (US\$11.48 million):***

This component will support the MOB in operational and strategic decision making with regard to the city's water security and water conservation. The focus will be on improving the institutional knowledge and preparedness with regard to all aspects of water security and urban water management, including resilience (climate change adaptation measures), sustainability of water use, the potential use of groundwater, the use of non-conventional water (reuse of wastewater), and storm water management

This component will support the BWA and the BSA in strengthening their revenue administration and financial management. This component aims to strengthen BWA and BSA revenue management through two main schemes: i) strengthening BWA and BSA's revenue administration through preparation of a revenue administration manual, business process re-engineering and training of staff, and ii) digitization of consumer records and computerization of billing and collection practices. At the same time, this component will be supporting BWA and BSA in strengthening their financial management by improving their accounting and financial reporting, improving cost accounting of service delivery, and computerizing the asset register and adoption of modern asset management practices.

This component will also explore innovative private financing models, and conduct capacity building for structuring bankable projects and managing contracts. Capacity in the areas of innovative financing, PPP procurement and contract management will be strengthened through a series of training courses and South-South Knowledge Exchanges in the form of study tours. Training courses will include private sector participation in service delivery; performance based contracts; financing options and risk-sharing instruments. Other aspects of institutional strengthening such as variability in budget allocations by the GoI to the MoB and the coordination issues across central ministries and between the central ministries and the MoB, will be studied and addressed during implementation.

***Component 2: Investment in drinking water supply and wastewater infrastructure (US\$188 million):*** This will cover:

**(a) Construction of the “R2” reservoir (US\$71 million).** The main works will comprise: a twin-compartment concrete ground-level reservoir with a total capacity of 135,000 cubic meters; inlet and outlet works, reservoir overflow systems; pumps, piping system; and chlorination station. The reservoir will ensure improved quality and reliability of the water supply services in the area served by it, which is in the Shaab municipality and has a population of more than 550,000. The construction of the reservoir will help the city to manage its water supply better in case of climate-induced droughts.

**(b) Rehabilitation of pumping stations including main sewerage network (US\$68 million).** This will include rehabilitation of 29 sewerage pumping stations by replacing old pumps and associated electro-mechanical works. This will also include rehabilitation of the main trunk sewer system and manholes. The untreated wastewater is currently flowing out of sewers into the streets and the Tigris. The project will make sure this untreated wastewater reaches the underutilized waste water treatment plants, thus reducing the public health effects of untreated wastewater exposure in the event of Tigris flooding induced by climate change.

**(c) Non-revenue water reduction (US\$39 million).** This will include the creation of district metering areas and a Non-Revenue Water (NRW) management system and the reduction of physical losses by replacing about 13 km of water supply distribution network in Rasheed and Shaab municipalities. The distribution networks to be rehabilitated include trunk, primary and secondary pipes ranging from 100mm to 700mm in diameter which are old and are exhibiting frequent breaks with high leakage resulting in intermittent supplies of poor quality water. A Supervisory Control And Data Acquisition (SCADA) system will be established. This will provide BWA with the means to monitor and control the water supply system and to improve operational performance. Reducing non-revenue water will have energy efficiency gains. Reduced leakages will also improve the city’s ability to handle any future climate-related water shortages.

**(d) Engineering, construction supervision, and quality control (US\$10 million).** A multi-disciplinary engineering and management consulting firm will assist the PMU with the overall implementation of the project. Consultants support to the PMU will include support to engineering, construction supervision, quality control, procurement, non-revenue water, environment and assistance with the monitoring of the physical and financial progress.

***Component 3: Project management, studies and M&E component (US\$10 million):***

This component will support the operation of the Project Management Unit in the MoB. The PMU has been well established and comprises staff from the BWA, BSA and MoB. The PMU will coordinate the overall planning, coordination, implementation and supervision of project activities including central procurement and management of funds.

The component will provide funding for: citizen engagement including the establishment and operation of a grievance redress mechanism, communication and water conservation awareness; environmental and social management plan; monitoring and evaluation (M&E), including carrying out a detailed baseline study, periodic monitoring during implementation, beneficiary satisfaction surveys; Mid-term review (MTR) in collaboration with International Finance Corporation (IFC) and Multilateral Investment Guarantee Agency (MIGA) and completion report. The component will also provide funding for preparation of four feasibility studies for the water treatment plant and the

three sewerage systems. Finally, this component will finance capacity building activities targeted to female technical and managerial, staff in the MoB, BSA and BWA.

Al-Habibiya SPS in Rusafa side and Al-Doura SPS in Karkh side are more than 30 years old. During this long life, big quantities of untreated wastewater were discharged to Tigris River. This is so because of a number of reasons. First, because of the aging of the mechanical and electrical components of the pumping stations, being beyond design capacity to receive from increasing populations. And second, because of the bad operations and maintenance performed at these pumping stations.

As for Al-Ghazaliya sewerage system, the subsidiary sewage networks were largely completed in 1985 including house connections, manholes, laterals, and ventilation columns, etc. In 1990, the great part of main sewers and associated pumping stations (Al- Khadra main pumping station and four smaller submersible ones GH1, GH2, Gh6, and GH7) were also completed. Originally, the system was designed to collect sewage conveyed from the above mentioned four pumping stations to reach the trunk main (NW) and then to the Al-Khadra pumping station, which has an approximate pumping capacity of 100,000 m<sup>3</sup>/ day.

Unfortunately, and as a result of the Gulf War in 1990 and international sanctions, the works of installation of pumping stations and their electrical and mechanical requirements were not completed at that time. In addition, the works of the major section of the trunk main pipe jacking, which was to be laid under the Baghdad – Amman highway, were also not completed, the matter that led to the stopping of the sewage inflow completely. Consequently, deteriorating sewer pipes are contaminating the potable water network and underground water, adding further impact to the health and environmental problems.

**The proposed project falls under the Bank’s Environmental Category "B"** due to potential adverse environmental and social impacts that are site-specific and reversible and thus easily remediable by applying appropriate mitigation measures. These potential adverse environmental impacts may include the following: air quality and noise; construction debris, including old piping and sewerage infrastructure requiring proper disposal; employee health and safety issues; vehicular and pedestrian traffic disruptions; disruptions in water supply; and risk of water contamination in the existing system. According to the provisions of "OP/BP 4.01: Environmental Assessment", the Project is categorized "B" and requires the preparation of Environmental and Social Impact Assessment (ESIA) inclusive of an Environmental and Social Management Plan (ESMP), (see the regulatory framework in Chapter 5).

## 1.1. ESIA Objectives

The Project activities could create adverse impact to the natural and social environment on the surrounding areas caused by carrying out the works if not properly planned, managed, and implemented. Current situation indicated that untreated wastewater is dumped in Tigris River basin. Consequently, the water of Tigris River has been confirmed to decline in quantity and quality. Many serious environmental problems will continue to arise in the river basin, if current situation is kept unchanged.

The purpose of this Environmental and Social Impact Assessment/ Environmental and Social Management Plan is to:

- Emphasize negative impacts of no-project alternative on public health and environment;
- Ensure compliance of the proposed project with pertinent local and international norms;
- Investigate the area that would be directly and indirectly affected by the implementation of the proposed Project components;
- Identify significant environmental and social issues brought about by the Project locations, construction, and operation phases;
- Ensure that environmental and social considerations are integrated into the Project planning and design activities;
- Ensure that a high standard of environmental performance is planned and achieved for the whole project components;
- Ensure that environmental and social aspects and impacts are identified, assessed, and mitigated accordingly;
- Recommend measures in order to mitigate adverse effects and/or enhance beneficial effects of the proposed project;
- Develop an Environmental & Social Management Plan (ESMP) and a Monitoring Plan specific to the Project's construction and operation phases.

## 1.2. Institutional Arrangements in Mayorality of Baghdad

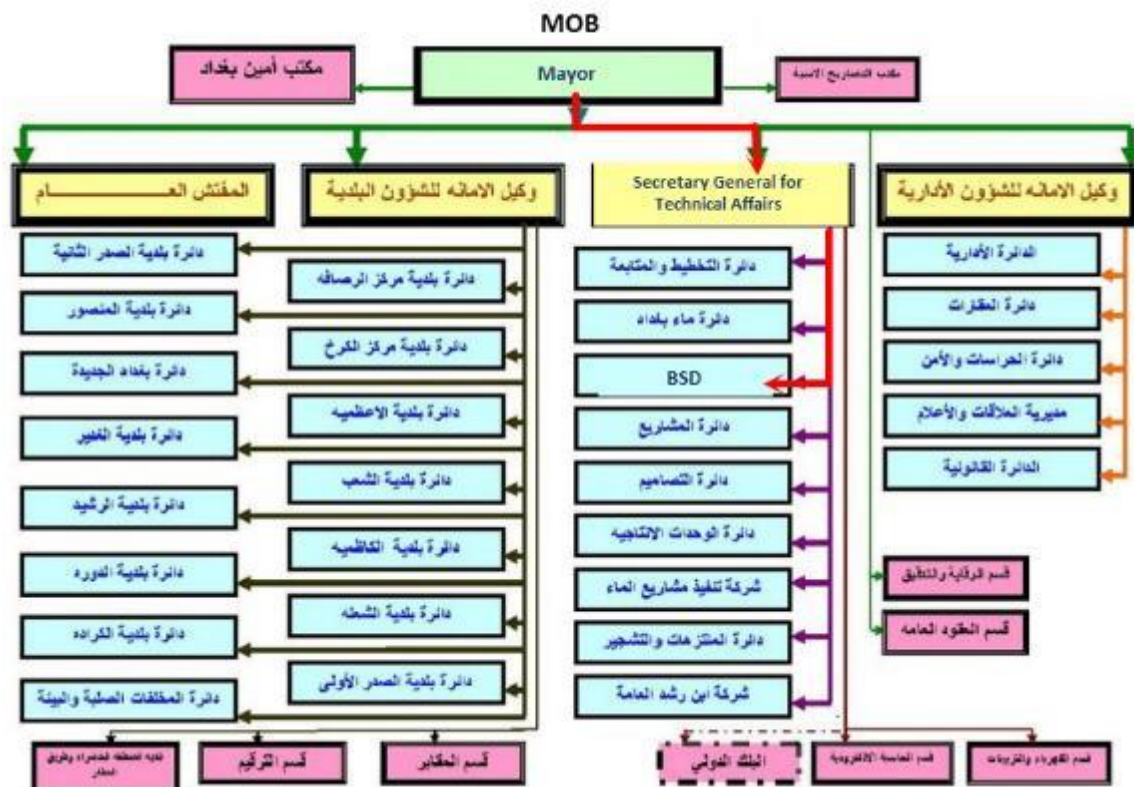


Figure 1: MOB organizational chart

Baghdad Sewerage Authority is one department of MOB, which takes responsibilities of sewerage services in Baghdad. The Following Figure 2 shows organizational structure of BSA.



## 2. BACKGROUND INFORMATION

All pumping/lifting stations of this project (including Habibiya, Doura, GH1, GH2, GH6, GH7 for Al-Ghazaliya) include above and under-ground structures and facilities. Above-ground structures include receiving and conveying networks; screens/ grit removal chambers; control room (including motors and electrical switch panels); and air ventilation systems. While, under-ground structures include storage pits (wet wells); submersible pumps (end-suction-centrifugal pumps with open impellers); vertical shafts connecting pumps with their relevant motors above the ground level; and force main with gravity manhole. The following is a detailed description per location.

### 2.1. Al-Habibiya Sewerage Pumping Station

Al-Habibiya sewerage pumping station is located in Al-Sha'ab area in the east-northern part of Rusafa side of Baghdad, and serves Al-Sha'ab, Sadr1 and Sadr2 municipalities. The pumping station was built in 1984 and is located about 11km to the north of Al-Rustomiya 1&2 WWTPs, which are the receiving sewage treatment facilities in Rusafa side.

Al-Rustomiya 1 WWTP is one of the biggest treatment plants in Baghdad, with a design capacity of 175,000 m<sup>3</sup>/day, while Al-Rustomiya 2 WWTP is relatively a newer treatment plant that has a design capacity of 300,000 m<sup>3</sup>/day. See Figure 3 for locations.



Figure 3: Location of Al-Habibiya SPS relative to Al-Rustomiya WWTPs

During the 5-year period (2010 – 2015) the physical and chemical characteristics of influent and effluent are shown in the following table.

Table 1: 5-year Average physical and chemical characteristics of treated and untreated wastewater in Al-Rustomiya WWTP (2010 – 2015)

#	Parameter	Influent	Effluent	Threshold (influent)	Threshold (effluent)
1	Biological Oxygen Demand (BOD)	200 – 400	17	350 – 400	<20
2	Chemical Oxygen Demand (COD)	300 – 600	39	300 – 750	<50
3	pH	7.15 – 7.20	7.36	6 – 9.50	6 – 9.50
4	Temperature	<30	<30	<30	<30
5	Suspended solids (SS)	200 – 500	30	200 – 500	<30
6	Ammonium (NH <sub>4</sub> )	15 – 20	...	15 – 30	<10
7	Chloride (Cl)	300 – 400	234	300 – 400	<250
8	Sulfate (SO <sub>4</sub> )	500 – 650	400 – 550	550 – 650	400 – 550
9	Nitrate (NO <sub>3</sub> )	15 – 20	8 – 10	15 – 20	<15
10	Phosphate (PO <sub>4</sub> )	3 – 7	2 – 2.5	3 – 7	<3
11	Phenol	0.5 – 0.1	...	0.5 – 0.1	<0.05 – 0.01
12	Hydrocarbons	5	...	5	...
13	Heavy metals (Pb, Cd, Ni)	0.5	0.05	0.5	<0.05
14	Oil and grease	10 – 50	1 – 3	50 – 75	<10
15	Cyanide (CN)	0.08 – 0.06	0.003 – 0.005	0.08 – 0.06	<0.05

Source: Baghdad Sewerage Authority – Central labs – 2017

Al-Habibiya SPS was built in 1984 with a design capacity of 11 m<sup>3</sup>/sec. However, current capacity is only 7 m<sup>3</sup>/s. The pumping station serves a population of around 2.6 million in eastern part of Baghdad and transfers the sewage to the Rustomiya wastewater treatment plant. Al-Habibiya Pumping Station comprises the following above and under-ground facilities and parts:

#### Above-ground facilities and parts:

- Station main entrance:
- Office and toilet rooms,
- Left and right main pump motor rooms: ten sets of 3-phase induction motors, four main servicing openings, ten servicing openings for the ten underground pumps, main electrical control panel, flow recording panel connected to penstock and flow metering panel,
- Ventilation and odor control systems (scrubbers),
- Electrical sub-station: consisting of two transformers
- Electricity generator room,
- Maintenance hangar, and
- An old administration hanger including a storehouse.

#### Under-ground facilities and parts:

- Station inlet facilities: include the main pipe (3000 Ø) from Al-Thawra Sewer Trunk Line and inlet chamber, and flow control gate,
- Left and right screen rooms equipped with a weed screen, mechanical grab screen, one submersible pump each for by-pass, pipe network (1000Ø) for by-pass, and a grit chamber each,
- Left and right sump rooms: equipped with level metering,
- Left and right pump rooms: the two main rooms consist of the following pump types and quantities (with the same quantity of vertical shafts):
  - Type A pump (DN 700), capacity: 4 sets of 1500 l/s volute mixing (centrifugal) pumps, 12m head,

- Type B pump (DN 500), capacity: 4 sets of 1000 l/s volute mixing (centrifugal) pumps, 12m head
- Type C pump (DN 400), capacity: 2 sets of 500 l/s volute mixing (centrifugal) pumps, 12m head
- Discharge chamber: equipped with 2 openings and flow metering
- Flow dividing channel/ Station outlet; this arrangement includes outlet main (3000Ø) to northern trunk sewer, to north east trunk sewer (for future expansion), washout pipe network, and stopping gate (penstock)

The following diagram (Figure 4) illustrates flow of sewage through main facilities and parts:

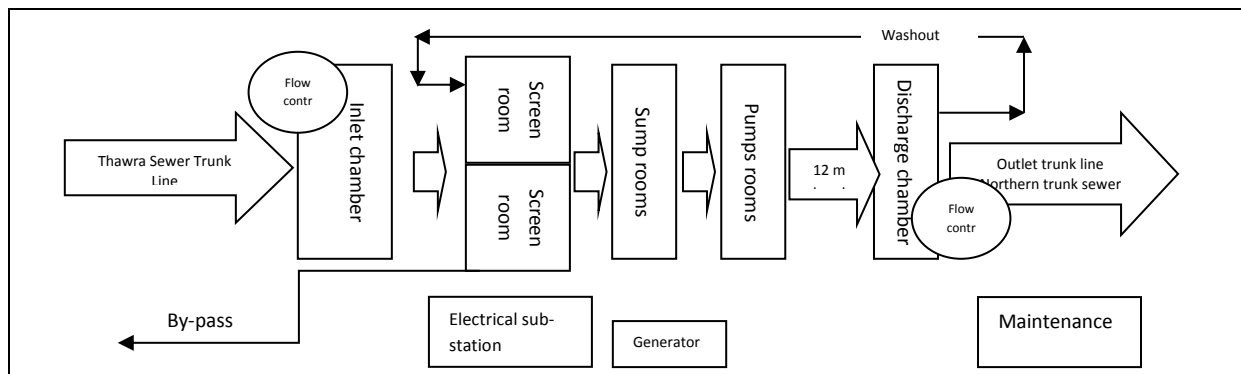


Figure 4: Current design diagram – Al-Habibiya SPS

Daily operations in Al-Habibiya pumping station include:

- Operating the pumps, and providing corrective and preventive maintenance;
- Operating the financial and technical aspects of the station;
- Liaising with other pumping stations, with respect to operations; and
- Ensuring enough fuel material at the stations, and seeking alternative energy sources to run generators.

Other works also include the management of almost 1.5 m<sup>3</sup> of daily solid waste being collected from the screens. These wastes are being accumulated and disposed to a sanitary landfill. Below are few photos of the pumping facility







Figure 5: Current situation at Al-Habibiya SPS

## 2.2. Al-Doura 1 Pumping Station

Al-Doura 1 pump station is located in Doura district (Al-Karkh side of Bagdad) about 3 kilometers to the northwest of Al-Karkh WWTP. See Figure 5 below.



Figure 6: Location of Al-Doura 1 SPS relative to Al-Karkh WWTP

Doura 1 pumping station was built in 1983, with a discharge capacity of  $13\text{m}^3/\text{s}$  and 22m of pump head. The Pump transmits the sewage collected from the northern area of Tigris River to the discharge point at Al-Karkh WWTP (maximum design capacity  $410,000\text{ m}^3/\text{day}$ ). Al-Doura 1 Station contains 13 vertical sewerage pumps, with a design capacity of about  $13.5\text{m}^3/\text{s}$ . Al- Doura 1 pumping station serves around 2.5 million people in western part of Baghdad. Main process at Doura 1 SPS is shown in the following flow diagram (Figure 6):

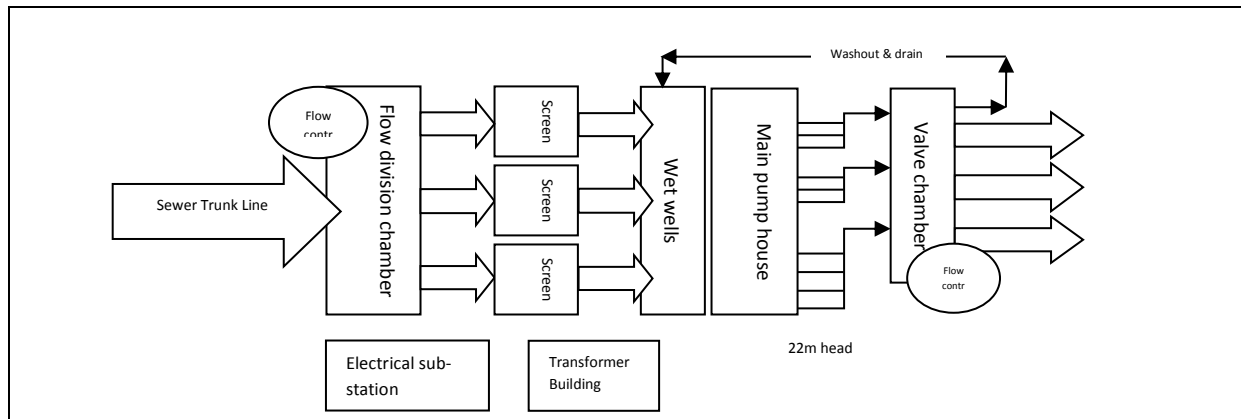


Figure 7: Current design diagram – Al-Doura 1 SPS

#### Existing flow distribution and screening facility:

- Main influent gate (3 sets),
- Screening chamber influent gate (6 sets),
- Primary screen for coarse screening (6 sets),
- Mechanical screen for fine screening (6 sets),
- Screening conveyor (3 sets).

#### Existing sewage pump facility:

- Sewage pump well by-pass gate (2 sets),
- Sewage pump (no. 1a – 1g): 7 sets of pumps, 7 sets of suction valves, 7 sets of check valves, and 7 sets of discharge valves,
- Sewage pump (no. 2a – 2d): 4 sets of pumps, 4 sets of suction valves, and 4 sets of discharge valves,
- Sewage pump (no. 3a & 3b): 2 sets of pumps, 2 sets of suction valves, 2 sets of check valves, and 2 sets of discharge valves.

The aforementioned pumps are arranged in 3 arrays, which are of the type volute mixing (330V & 400V) and connected to vertical shafts. The first array consists of 7 pumps; the second consists of 4 pumps, while the third one consists only of 2 pumps.

Existing flow control facility includes the following: 4 sets of flow control valve and 3 sets of air valve. There are 1 lot each of piping and foundations above equipment. And one 1000kVA generator. The following photos (Figure 7) provides a closer look at the interior and exterior of Al-Doura 1 SPS.



Figure 8: Current situation at Al-Doura 1 SPS

### 2.3. Al-Ghazaliya Pumping Stations (GH1, GH2, GH6, GH7, and Khadra)

Al- Ghazaliya area is located in the western part of Al- Karkh district of the capital Baghdad. It is bordered by the Baghdad – Amman highway from the south, Saqlawia drainage canal and Shu’la from the north, and Basrah Street from the east. It consists of a number of residential blocks (mahallas) that have the following ID numbers: 651, 681, 665, 653, 655, 667, 671, 673, and 679 (see figure 8.)



Figure 9: Location of Al-Ghazaliya Sewerage Pumping Stations

The five pumping stations included in the Ghazaliya subprojects can be described as following:

- GH1 pumping station: It lies at the beginning of Basrah Street near Al- Hamza mosque. Currently, the station operates with one submersible pump of capacity 200 L/ sec and connects with trunk main NW through pipe of diameter of 1000mm. This station serves Mahallas 454, 458, 460, 671, and 673 in Al-Ghazaliya and Shu'la areas.
- GH2 pumping station: Currently, it operates with one submersible pump of capacity 150 L/ sec. This station serves mahallas 667 with a capacity of 35,000m<sup>3</sup>/day. The connecting pipe between the station and the trunk main NW is of type GRP and with diameter of 1000mm. This station serves Mahallas 448, 450, 452, and 456 in Al-Ghazaliya and Shu'la areas.
- GH6 pumping station: Currently it operates with one submersible pump of capacity of 100L/ sec. This station serves mahallas 665 in Al-Ghazaliya area. The connecting pressure pipe between the station and the trunk main NW is of diameter 1000mm.
- GH7 pumping station: It lies at the end of Abu- Dulef Street (St. 35). Currently the station operates with one submersible pump of capacity 140L/ sec. This station serves mahalla 653 in Al-Ghazaliya area.
- Al-Khadra main pumping station: It lies in Abu- Ghareib – Ammeria intersection (cross road) with previous design capacity of 100,000m<sup>3</sup>/ day. Al- Khadra Main Pumping Station serves both Al-Ghazaliya and Shu'la areas. However, this station is currently not operational, as indicated by BSA representative.

In summary, the existing capacities, number of units and the previous design capacities of the pump stations are presented in the following table.

Table 2: The Existing Pumping Stations of Al-Ghazaliya subprojects

Pump station Name	No. Of units/pumps	No. of Duty pumps	No. of standby pumps	Existing Capacity (m3/d)	Head (m)	Previous Design Capacity (m3/d)	Served Area (Block No.)
GH1	2	1	1	23,880	38.1	6,800	454,458,460,671,673,
GH2	2	1	1	23,880	38.1	35,000	448,450,452,456
GH6	2	1	1	3,480	39	8,000	665
GH7	2	1	1	3,480	39	8,500	653
Al Khadra	/	/	/	/	/	100,000	Al Ghazalyya and Shu'la

The following photos give a closer look at the Ghazaliya five pumping stations (figure 9).



Figure 10: existing pumping stations in Al-Ghazaliya

Trunk Lines (see figure 10):

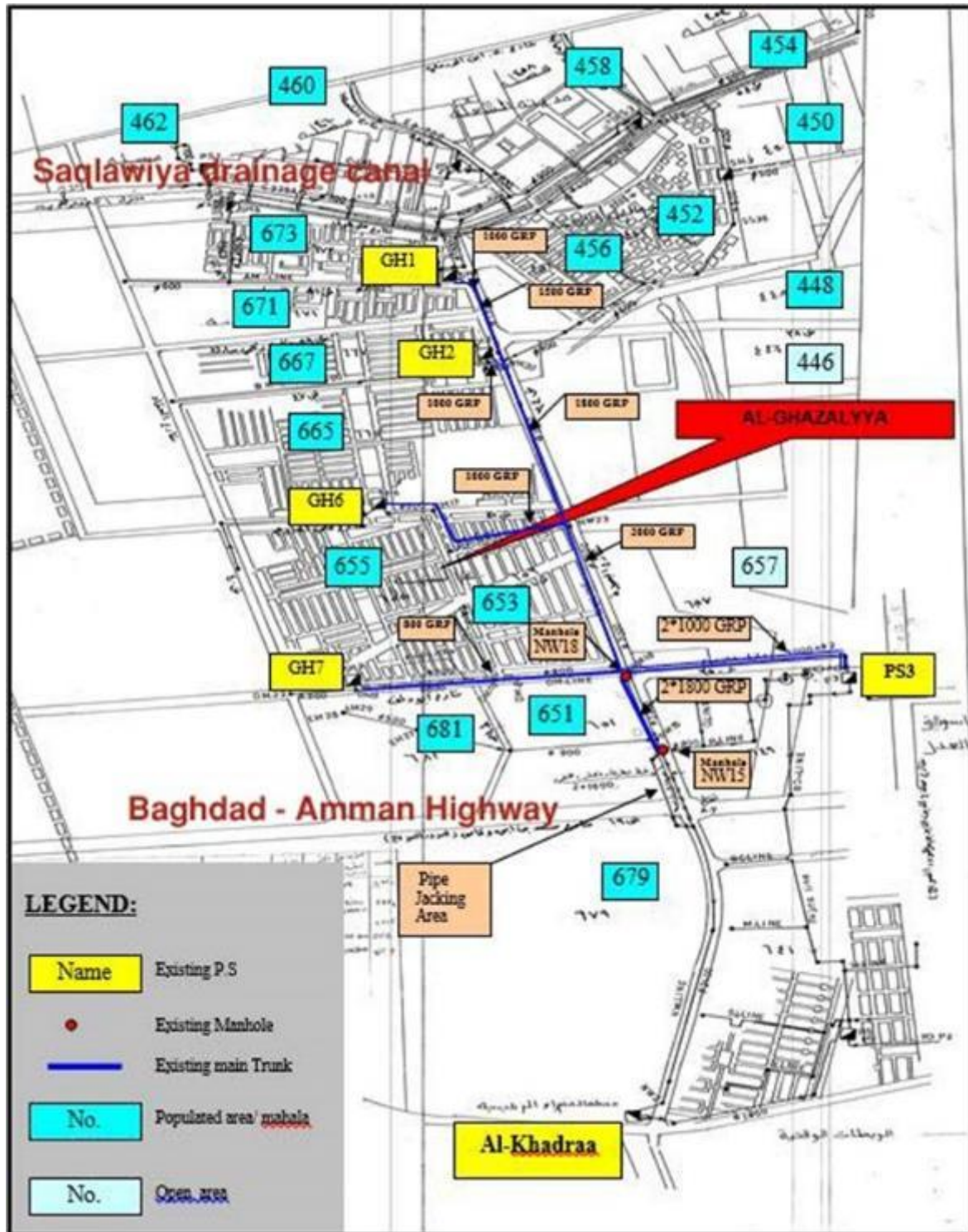


Figure 11: Project scheme of Al-Ghazaliya

1. Main Trunk line begins from Al- Hamza mosque (Near Al- Saqlawia drainage canal) along the right side of Basrah street with diameter of 1,500mm, then turns under the area between two sides of the street (the crossing point of outlet pressure line of Shu’la pumping station SH4), then turns to the left side of the street with diameter 2,000mm (near the crossing point of outlet

pressure line of pumping station GH7) reaching to the cross point of DM line of manhole (NW18) with diameter of 2,200mm.

2. The trunk main NW is a gravity line, and continues at double line diameter (2\*1800mm) until manhole (NW15) close to the Intersection. The Line NW was supposed to cross under this area at the Baghdad – Amman Highway Bridge /A7 through implementing jacking to be ended at Al-Khadra main pumping station with diameter of 2,200mm.
3. The depth of this main trunk line is ranging from 4.24m near the pumping station (GH1) (near Al-Hamza mosque) and ends at the depth of 7.61m near Al- Khadra pumping station with total length of approximately 4,850m.
4. The received inlet sewage to the trunk main (NW) is estimated much higher than that of the discharged outlet sewage. As a result, the main trunk is completely full of collected sewage and accordingly works as “Balance tank”. It receives a great amount of sewage, which is stored and then discharged gradually according to the cross section (i.e. the capacity of double line), which is finally conveyed to PS3.

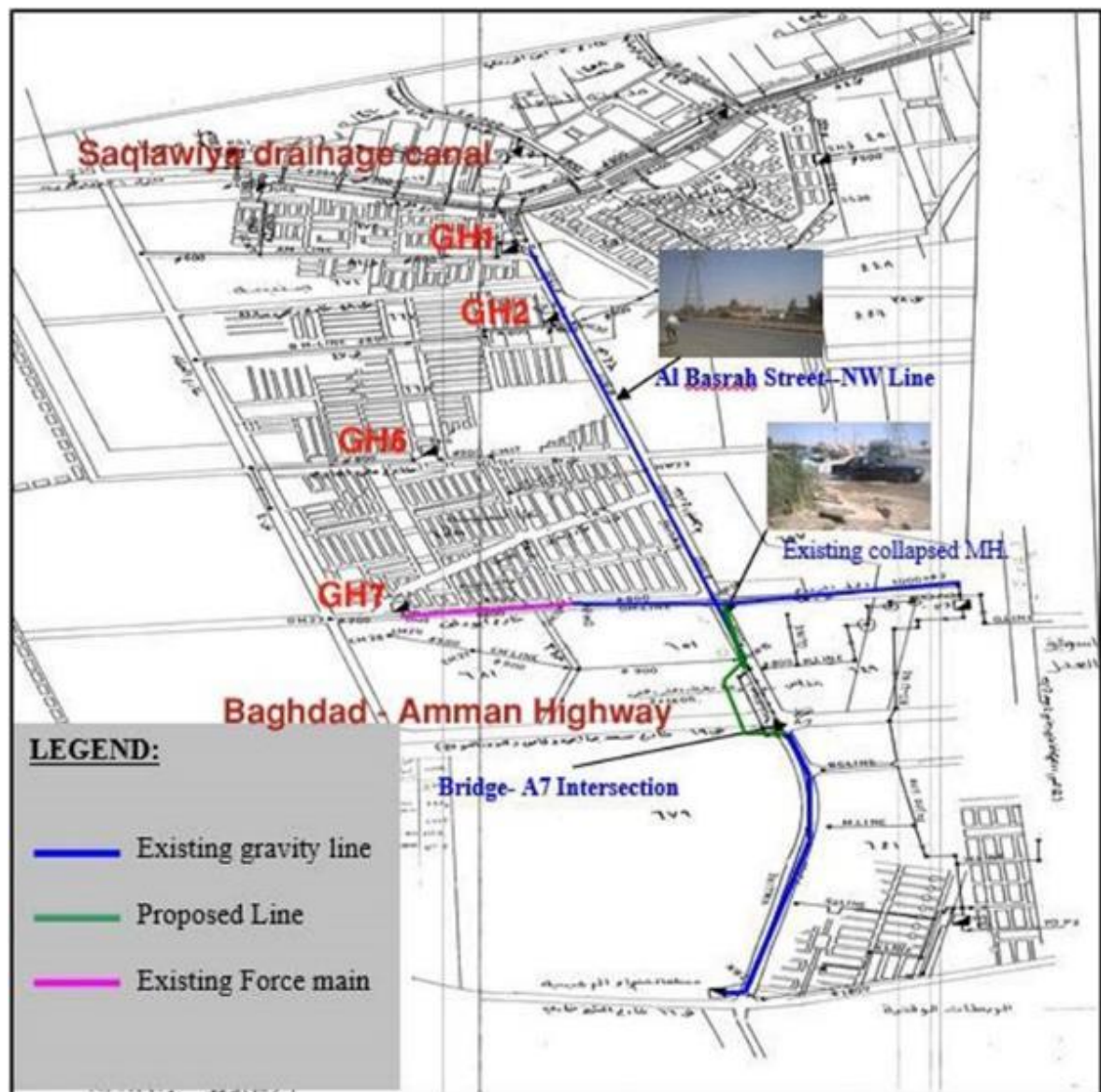


Figure 12: Existing trunk main lines and newly proposed line in Al-Ghazaliya

The Project will include rehabilitating a number of seven manholes in the trunk main NW (from NW1 to NW11). These manholes are almost 200m far from each other. Rehabilitation will only be performed in an area of not exceeding 2 sq. m, which is only the opening space of the manhole for exposing. During site surveillance alongside the NW trunk main on 26 February 2017, it was reported that some small businesses exist in the trunk main's Right of Way (RoW). A walkthrough in the area has revealed that around 150 small businesses were running alongside the manhole line. These were mainly small stores that provide grocery, meat, cold and hot refreshments, fruits and vegetables, as well as construction materials. There are 1 – 3 people in average working in these stores, and on daily basis. And they are located in a varying distance from the main (5 – 25m), and some of them have no legal right on their locations. Upon meeting with officials from BSA, Relocation is not required in these locations. However, in the very unlikely case, where relocation is needed, some moderate, socio-economic impacts may arise because of the project, like partial loss of assets, temporary interruption of social and economic daily activities, and temporary loss of income. Therefore, OP/BP is triggered for precautionary purposes. See figure below.



Figure 13: Manhole location and some nearby business structures in the RoW



### 3. PROJECT DESCRIPTION

The Bank’s Country Partnership Strategy (CPS) for Iraq FY13-17 (Report No. 73265-IQ), per the CPS Performance and Learning Review (Report No. 94767-IQ) is centered on: (i) delivering basic public services, especially in areas where the security threat has diminished, reducing poverty, and enhancing citizens’ trust in government institutions, and (ii) addressing and helping to manage the country’s critical fiscal situation, and helping to increase opportunities for private investors. The overarching project – Baghdad Water and Sanitation Improvement Project (BWSIP) – contributes to the first pillar of delivering basic public services (drinking water and sanitation). However, the project also contributes to the second pillar, by increasing efficiency, accountability and transparency in public resource use for service at the governorate level. **The Project Development Objective (PDO)** is to increase the reliability and continuity in drinking water supply services as well as to improve wastewater collection and its treatment in Baghdad.

The following subsequent sections provide a detailed description of all components and interventions of Al-Habibiya, Al-Doura, and Al-Ghazaliya sewerage projects.

#### 3.1. Project Components

The subprojects of Al-Habibiya, Al-Doura, and Al-Ghazaliya – under this ESIA/ESMP study – are parts of the biggest BWSIP. Under component 2 of the BWSIP “Investment In drinking water supply and wastewater infrastructure”, these subprojects will mainly include

- Rehabilitation of Al-Doura sewerage pumping station, and all associated civil works.
- Rehabilitation of Al-Habibiya sewerage pumping station, and all associated civil works.
- Rehabilitation Al-Ghazaliya main sewerage system, and all associated civil

Additionally, the subprojects will be able to receive support from “Institutional strengthening for water security, integrated urban water management and decentralization” under Component 1. And will benefit from Component 3, which will finance a project implementation consultant (engineering, and construction supervision and quality control) and the operational costs of the project implementation teams who will coordinate, implement, supervise and monitor the project.

The following figure represents the proposed timeline for implementing the subprojects

No.	Contract Description	Cost Estimate (US\$, Millions)	Contract Type <sup>1</sup>	Priority	Year 1		Year 2			Year 3			Year 4			Year 5			Year 6			Construction Period (Months)											
					Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1		Q2	Q3	Q4								
<b>Upgrading of Sewerage Pumping Stations:</b>																																	
1	Al Doura Sewerage Pumping Station: consist of replacement of 10 vertical sewage pumps (330 W and 400 KW) with design capacity of 0.35 m <sup>3</sup> /sec.	40.00	SM	Priority																	24												
2	Al Habibiya Sewerage Pumping Station: consist of replacement of 10 vertical sewage pumps with design capacity of 0.3 m <sup>3</sup> /sec.	20.00	SM	Priority																	18												
<b>Institutional and capacity building</b>																																	
	Trainings workshops, installation of financial systems, surveys, communication and outreach etc... activities	3.00																															
<table border="0"> <tr> <td style="background-color: #e0e0e0; width: 20px;"></td> <td>Direct Liability Period, Technical Assistance during first two years of Operation</td> <td>SM = Supply and Install</td> </tr> <tr> <td style="background-color: #ffff00; width: 20px;"></td> <td>Construction Period</td> <td></td> </tr> <tr> <td style="background-color: #90ee90; width: 20px;"></td> <td>Pre-contract period (design tender documents and bidding stages)</td> <td></td> </tr> <tr> <td style="background-color: #ffcccc; width: 20px;"></td> <td>Institutional and capacity building</td> <td></td> </tr> </table>																							Direct Liability Period, Technical Assistance during first two years of Operation	SM = Supply and Install		Construction Period			Pre-contract period (design tender documents and bidding stages)			Institutional and capacity building	
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Figure 14: A project indicative implementation timeline

### 3.2. Al-Habibiya SPS Rehabilitation Subproject

The project of rehabilitating Al-Habibiya SPS is a sub of the prime project "Baghdad Water Supply and Sewerage Improvement Project (BWSIP)" and is planned to take 18 months to be accomplished. Al-Habibiya SPS sub-project will include the following main components, parts, and activities that will be supplied, installed, and operated by the Contractor:

1. Four sets of Type (A) pumps of the following specifications: volute casing with vertical garden shafts; capacity 1,500 l/s, head 12m; speed less than 750 rpm; vertical installation. Motors 3-phase induction; indoor ambient temperature 50°C, and totally enclosed double fan cooling.
2. Four sets of Type (B) pumps of the following specifications: volute casing with vertical garden shafts; capacity 1,000 l/s, head 12m; speed less than 750 rpm; vertical installation. Motors 3-phase induction; indoor ambient temperature 50°C, and totally enclosed double fan cooling;
3. Two sets of Type (C) pumps of the following specifications: volute casing with vertical garden shafts; capacity 500 l/s; head 12m; speed less than 1000 rpm; vertical installation. Motors 3-phase induction; indoor ambient temperature 50°C, and totally enclosed double fan cooling.

*Applying By-Pass during rehabilitation of pumps:*

Supplying, installing, and operating 2 sets of submersible mixed flow column pumps, capacity 2,000 l/s, head 12m, speed less than 750 rpm, horizontal installation, with complete set of spare parts. During rehabilitation, these pumps will be installed in the wet well and will be connected after the stop log; in order to use them to pump sewage directly to the discharge channel. However, these pumps will be normally used to pump sewage to discharge chamber at a depth of 33.44m after rehabilitation is complete. Activities at this stage include all necessary civil works as well.

4. Ductile valves for all pumps of Types A, B & C mentioned above;
5. Four sets of motorized penstocks, on seated, wall mounted, of the size 2,200mm H x 2,200mm W; as well as supplying, installing, and operating one set of penstock, on seated, wall mounted, and of the size 1,000mm H x 1,000mm W;

6. Four sets of multi-rake-bar screens, bar spacing 3cm, with conveyor, washer compactor, including control panel and level sensing;
7. One set of motorized overhead cranes (20m lift height) in motor room, and two sets of motorized overhead cranes (18m lift height) in screen rooms;
8. A ventilation system consisting of eighteen sets of fans (5,080 m<sup>3</sup>/hr), and fourteen sets of fans (7,645 m<sup>3</sup>/hr);
9. Firefighting and washing systems, with all components and upon approval by MOB;
10. A biological odor control system (a trickling bio-filter) suitable for the volume of pumping station. Air pollutants will include: Hydrogen Sulfide, Methane, Methyl Mercaptans, Ammonia, Sulfur Oxides, Volatile Organic Components, and other toxic constituents and organic reduced sulfur compounds.

*Installation of the odor control system.*

The installed system will include one or multi-stage mass media, in addition to chemical media scrubbers. And will use non-circulated potable or reclaimed water for irrigating media layers, which will be collected in the bottom and discharged to a pre-designated point. Filtered air will finally be released to the outer airstream through an exhaust stack. It will also include needed electrical and water supplies for each module, and equipped with odor control blowers. The provided system will be assembled before transporting to the site to avoid possible hazards and to enable sufficient time for acclimation of bacteria. As for testing, the system will be tested for performance at a noted time, and will last for 4 hrs, through which Hydrogen Sulfide concentrations will be logged in a data-logging gas monitoring device, before treatment and after final release. The whole system will require approval from MOB prior to installation and before getting into operation.

11. Other parts like: handrails, removable covers with frames, removable meshes with frames, ladders, galvanized steel ladders in the dry well.

### **3.3. Al-Doura 1 SPS Rehabilitation Subproject**

The Project of Al-Doura 1 SPS will take 24 months to be accomplished. The Doura Project will include removal of existing mechanical and electrical equipment, procurement, transportation, installation, and operation of new equipment and trial operation for handover. The Project is comprised of the following major works:

#### **3.3.1. New mechanical facilities**

This work will involve building the following new facilities, along with their associated parts:

1. One flow distribution and screening facility: this will be supported with 3 sets of main influent gate; 6 sets each of; (1) screening chamber influent gate, (2) primary screen (coarse screen), and (3) mechanical screen (fine screen); and 3 sets screening conveyor.

2. Sewage pumping facility: this will consists of: (1) 7 sets each of Type A: sewage pumps, suction valves, check valves, and discharge valves; (2) 4 sets each of Type B: sewage pumps, suction valves, check valves, and discharge valves; (3) 2 sets of Type C: sewage pumps, suction valves, check valves, and discharge valves; and (4) 2 sets sewage pump well by-pass gate.
  - The Type A pump is a "vertical shaft volute type mixed flow pump unit". It will have a capacity of 78.0 m<sup>3</sup>/min, total head of 22m and efficiency of not less than 81%. Equipped with a vertical shaft squirrel-cage 3-phase induction motor (400 kW) and efficiency not less than 81%. In addition to all required accessories, spare parts, tools, and consumables,
  - The Type B pump is a "vertical shaft volute type mixed flow pump unit". It will have a capacity of 55.2 m<sup>3</sup>/min, total head of 22m, and efficiency of not less than 80%. Equipped with a vertical shaft squirrel-cage 3-phase induction motor (315 kW) and efficiency not less than 80%. In addition to all required accessories, spare parts, tools, and consumables,
  - The Type C pump is a "vertical shaft volute type mixed flow pump unit". It will have a capacity of 27.6 m<sup>3</sup>/min, total head of 22m, and efficiency of not less than 78%. Equipped with a vertical shaft squirrel-cage 3-phase induction motor (160 kW) and efficiency not less than 78%. In addition to all required accessories, spare parts, tools, and consumables,
  - The above 3 types is expected to exhibit low noise and low vibration levels, generate no cavitation, and allow shut-off starting. Also, the pumps will be tested for a satisfactory continuous operation after installation (5 continuous hours),
  - Shafts and shaft coupling will be structurally strong enough to endure revolution, torque, and vibration. Shafts and shaft coupling will be provided with the safety cover of fence to secure safety during maintenance.
3. One flow control facility: this will comprise of 8 sets of flow control valves and 3 sets of air valves.
4. Gates and valves will comprise the following:
  - Manual operated gates,
  - Motor driven gates,
  - Manual operated and motor driven gate valves,
  - Check valves,
  - Air valves.
  - Pipework: This is only the construction of intake pipes, from pumping rooms to terminal points within pimping stations' perimeter, and will include associated civil work, all in 1 lot.

### 3.3.2. Removal of existing facilities

This work will involve removing the following old facilities and their parts:

1. Existing flow distribution and screening facility: this will comprise removing 6 sets each of: screening chamber influent gates, primary screens, and mechanical screens; as well as 3 sets each of main influent gates and screening conveyors.

- Existing sewage pumping facility: this will comprise the removal of the following: (1) 7 sets each of (No. 1a – 1g): sewage pumps, suction valves, check valves and discharge valves; (2) 4 sets each of (No. 3a – 2d)

### 3.3.3. Electrical works

The electrical works include all components deemed necessary for the satisfactory completion and functioning of the entire work, commissioning of electrical sub-station, electrical equipment, instrumentation and control system. The Contractors obligations include designing, constructing, supplying, installing, testing, and commissioning all electrical and instrumentation works as below:

Note: the removed old electrical equipment will be transported to the site instructed by the MOB.

- 11 kV Substation/ Generator: this comprises: The 11kV metal enclosed indoor switchboard system that withstands a maximum ambient temperature of 55°C, and be dust and vermin-proof, as well as holding a proper labeling for each device; The main transformer (oil-filled self-cooling type); The capacitor; The battery, battery charger and UPS; The emergency generator, and wiring and other work.
- For the main transformer, it will have a rated output of 2,000 kVA, 3-phase, and withstands maximum ambient temperature of 55°C and variation of atmospheric conditions. Transformers will be supplied complete with transformer PCB free (naphthenic base) oil
- For the battery, it will be a sealed lead acid battery of the sealed maintenance free type
- For the emergency power generator, it will be a diesel generator suitable for indoor operation, withstands the a maximum ambient temperature of 55°C, provides 12 hours of continuous operation, and complies with local codes for safety. Specifically, the generator will comprise of:
  - Three sets of generator package with soundproof enclosure, 1,500 kVA, 400V, 50 Hz,
  - Three sets of fuel tank (20,000L for one week operation),
  - Exhaust silencer (not exceeding noise level of 65dB at the nearest property boundary, and not exceeding 70dB(A) at a distance not greater than 1.5m from the generator set room) and all related works for supplying the emergency electric power. This will be housed inside acoustic enclosure and provided with fan exhaust silencers, air intake silencers, and
  - Full set of modifying work of the existing Low Tension (LT) 1,000 kVA generator.

While the wiring and other work will include:

- Cabling and earthing,
  - Construction of cable trench/ underground pipe between generator house and pump house,
  - All necessary civil rehabilitation work for the existing substation, the transformer house, and the cable duct,
  - All removal work of existing equipment
- Pump panel, Modeled Case Circuit Breakers (MCCBs), and relay cubicle for 3 zones and common. However, wiring and other work will include:

- Cabling and earthing work for LT, MCC, Leakage Circuit Breaker (LCB) and control panels,
  - All necessary civil rehabilitation work for the pump house,
  - All necessary civil rehabilitation work for the existing lighting facilities,
  - All removal work of existing equipment.
6. Earthing and lightening protection system,
7. Lighting system,
8. Instrumentation: this will include: Indicating and metering instruments (microwave level sensors at the pump well); Cubicle (instrumentation panel with necessary Surge Protection Device (SPD) and power supply), as well as wiring and other work:
- Cabling and earthing work for instrumentation,
  - All removal work of the existing equipment.
9. Control system: this will include the system components: panel of redundant Programmable Logic Controllers (PLC); and control room furniture.

### 3.4. Al-Ghazaliya Rehabilitation Subprojects

The rehabilitation of Al-Ghazaliya sewerage mainly aims at restoring basic sewage services for the Al-Ghazaliya and Al-Shu'la districts. It will serve approximately 630,000 inhabitants and will pursue the elimination of dumping of untreated wastewater into open areas, and the completion of the sewage collection and conveyance systems within the target areas. The new project will include supply and installation of the electrical and mechanical equipment including motors, pumps with their accessories, and works of operation. It also includes providing and installation of generators ventilation columns, all electrical wirings, transformers and civil works needed to complete the work. Key components of the Ghazaliya subprojects include the following activities and works:

- The rehabilitation works in Al-Khadra, GH1, GH2, GH6, and GH7 pumping/lifting stations, including installation of Dry Well 19 Motor Pumps, Main Distribution Boards (MDB), Control Panels (CP) and all necessary civil, electrical and mechanical works. The pump Q/H ranges from ( 197m<sup>3</sup>/hr/15m to 2888m<sup>3</sup>/hr/15m) and the power ranges from ( 15KW to 202KW);
- The replacement of collapsed sections in the sewer trunk main (NW) of diameter ranges between 2,000 – 2,200mm of about 1,450m length including all the pertinent construction works and the construction of manholes (NW16 – NW23). See section 3.4.6 for more detail;
- Cleaning, rehabilitating and flushing the sewer line and manholes from all dirt and sewage including the repair works of the internal PVC sheeting and the external exposing of manholes' covers with the road level. The intended length shall be from manhole (NW11A) to Al- Khadra Pump Station. Also exposing of manhole covers from Pumping Station GH1 to manhole (NW15);
- Construction of trenchless trunk main, which is of diameter 2.2 meters of about 725 meters and a depth of 5 to 7 meters, as part of the trunk main (NW) in Al-Ghazaliya district. The new construction will include all pertinent works of soil investigation of the local geotechnical condition and position of water table, design of sheet piles, jacking shafts' construction,

characteristics of jacking plant, support of excavation sides, and construction of manholes. The new construction will take place under the international Baghdad-Amman highway.

The following timeline provides a glimpse of the expected implementation periods, which needs to be updated upon contracting (figure 14).

Work Item	Year1		Year2		Year3
	Jan. - Jun.	Jun.- Dec.	Jan. - Jun.	Jun.- Dec.	Jan. - Jun.
<b>Pump stations rehabilitation</b>	[Orange bar spanning Year 1 and Year 2]				
Removal, demolition and cleaning	[Blue bar]				
Supply and Installation of equipment		[Blue bar]			
Civil work rehabilitation		[Blue bar]			
<b>Pipe Jacking construction</b>	[Orange bar spanning Year 1 and Year 2]				
Investigation of current soil conditions	[Blue bar]				
Supply and Installation of jacking plant system and construction of pipes		[Blue bar]			
<b>Construction of new NW Main Trunk section</b>	[Orange bar spanning Year 1 and Year 2]				
<b>Rehabilitation of existing NW Main Trunk and other</b>	[Orange bar spanning Year 1 and Year 2]				

Figure 15: Indicative timeline for Al-Ghazaliya subprojects

### 3.4.1. Al-Ghazaliya pumping station 1 (GH1)

#### Mechanical work

This will include installing and commissioning all mechanical works within the site plan and inside the wet well and dry well of the pumping station building including excavation in all types of soil, backfilling and reinstatement. The station will be provided with 2 vertical dry-pit extended shaft configuration pumps with motors, 806 l/s against 11 m total head and motors, complete with flush valves and strainers. This will also include all necessary stainless steel guide rails and chains for pumps and strainers. As well as odor control units. Additionally, ductile iron pipework (including all fittings and valves) inside the station will encompass all necessary replacements and upgrades. The station will also be provided with slide gates (Φ1100 mm) and bars, fine and coarse screens, and cranes (5 tons capacity) along with all necessary civil works.

#### Electrical work

This will include (but not limited to): Ultrasonic level meter to be installed and tested inside the pump station and connected to visual and audible alarms. And equipped with float switches. The transformer room will be equipped with distribution boards, lighting points, fixtures, and sockets. And the same will also be provided for the guard room.

#### Civil work

Civil works of GH1 will include rehabilitation of all the existing civil structures inside the borders of the pump station, and will include finishing works and restructuring parts of the building deemed to be necessary for the commissioning and as directed by the project engineer. The contractor is

expected to coordinate water supply for his work with the Baghdad Water Authority. Additionally, working areas are expected to exist within the pumping stations' perimeters, and transportation of materials and workers will be liaised with the Mayorality of Baghdad at the beginning of contract (this also goes for all project components).

### 3.4.2. Al-Ghazaliya pumping station 2 (GH2)

#### Mechanical works

This will include installing and commissioning all mechanical works within the site plan and inside the wet well and dry well of the pumping station building including excavation in all types of soil, backfilling and reinstatement. The station will be provided with 2 vertical dry-pit extended shaft configuration pumps with motors, 445 l/s against 12 m total head and motors, complete with flush valves and strainers. This will also include all necessary stainless steel guide rails and chains for pumps and strainers. As well as odor control units. Additionally, ductile iron pipework (including all fittings and valves) inside the station will encompass all necessary replacements and upgrades. The station will also be provided with slide gates ( $\Phi$ 1100 mm) and bars, fine and coarse screens, and cranes (4 tons capacity) along with all necessary civil works.

#### Electrical works

This will include (but not limited to): Ultrasonic level meter to be installed and tested inside the pump station and connected to visual and audible alarms. And equipped with float switches. The transformer room will be equipped with distribution boards, lighting points, fixtures, and sockets. And the same will also be provided for the guard room.

#### Civil works

Civil works of GH2 will include rehabilitation of all the existing civil structures inside the borders of the pump station, including finishing works and restructuring parts of the building deemed to be necessary for the commissioning and as directed by the project engineer.

### 3.4.3. Al-Ghazaliya pumping station 6 (GH6)

#### Mechanical works

This will include installing and commissioning all mechanical works within the site plan and inside the wet well and dry well of the pumping station building including excavation in all types of soil, backfilling and reinstatement. The station will be provided with 2 vertical dry-pit extended shaft configuration pumps with motors, 115 l/s against 9 m total head and motors, complete with flush valves and strainers. This will also include all necessary stainless steel guide rails and chains for pumps and strainers. As well as odor control units. Additionally, ductile iron pipework (including all fittings and valves) inside the station will encompass all necessary replacements and upgrades. The station will also be provided with slide gates ( $\Phi$ 800 mm) and bars, fine and coarse screens, and cranes (3 tons capacity) along with all necessary civil works.

#### Electrical works



This will include (but not limited to): Ultrasonic level meter to be installed and tested inside the pump station and connected to visual and audible alarms. And equipped with float switches. The transformer room will be equipped with distribution boards, lighting points, fixtures, and sockets. And the same will also be provided for the guard room.

#### Civil works

Civil works of GH6 will include rehabilitation of all the existing civil structures inside the borders of the pump station, including finishing works and restructuring parts of the building deemed to be necessary for the commissioning and as directed by the project engineer.

### **3.4.4. Al-Ghazaliya pumping station 7 (GH7)**

#### Mechanical works

This will include installing and commissioning all mechanical works within the site plan and inside the wet well and dry well of the pumping station building including excavation in all types of soil, backfilling and reinstatement. The station will be provided with 2 vertical dry-pit extended shaft configuration pumps with motors, 70 l/s against 15 m total head and motors, complete with flush valves and strainers. This will also include all necessary stainless steel guide rails and chains for pumps and strainers. As well as odor control units. Additionally, ductile iron pipework (including all fittings and valves) inside the station will encompass all necessary replacements and upgrades. The station will also be provided with slide gates (Ø800 mm) and bars, fine and coarse screens, and cranes (2 tons capacity) along with all necessary civil works.

#### Electrical works

This will include (but not limited to): Ultrasonic level meter to be installed and tested inside the pump station and connected to visual and audible alarms. And equipped with float switches. The transformer room will be equipped with distribution boards, lighting points, fixtures, and sockets. And the same will also be provided for the guard room.

#### Civil works

Civil works of GH7 will include rehabilitation of all the existing civil structures inside the borders of the pump station, including finishing works and restructuring parts of the building deemed to be necessary for the commissioning and as directed by the project engineer.

### **3.4.5. Al-Khadra pumping station**

#### Mechanical works

This will include installing and commissioning all mechanical works within the site plan and inside the wet well and dry well of the pumping station building including excavation in all types of soil, backfilling and reinstatement. The station will be provided with 5 vertical dry-pit extended shaft configuration pumps with motors, 787 l/s against 13 m total head and motors, complete with flush valves and strainers. This will also include all necessary stainless steel guide rails and chains for pumps and strainers. As well as odor control units. Additionally, ductile iron pipework (including all

fittings and valves) inside the station will encompass all necessary replacements and upgrades. The station will also be provided with 2 sets of slide gates ( $\Phi 1200$  mm and  $\Phi 800$  mm) and bars, fine and coarse screens, and cranes (5 tons capacity) along with all necessary civil works.

#### Electrical works

This will include (but not limited to): Ultrasonic level meter to be installed and tested inside the pump station and connected to visual and audible alarms. And equipped with float switches. The transformer room will be equipped with distribution boards, lighting points, fixtures, and sockets. And the same will also be provided for the guard room.

#### Civil works

Civil works of Khadra will include rehabilitation of all the existing civil structures inside the borders of the pump station, including finishing works and restructuring parts of the building deemed to be necessary for the commissioning and as directed by the project engineer.

### **3.4.6. Pipework and manholes**

#### Gravity sewers

This part of the project will include cleaning and rehabilitating existing trunk main (NW) line and pertinent manholes. Pipework will include installing Reinforced Concrete Pipes (RCP) in trenches, and excavations, bending, laying, testing, embedding, backfilling, and reinstating at two different lengths and depths: 400 m of depth 6.5 – 7.5m, and 325 m of depth 7.5 – 8.5 m

#### Replacement of collapsed section

The replacement of collapsed sections in the sewer trunk main (NW) of diameter ranges between 2,000 – 2,200mm of about 1,450m length including all the pertinent construction works and the construction of 8 manholes (NW16 – NW23) – see figure below. The line passes alongside the main road of Al-Basrah st. (within right of way – MOB's ownership) and does not intersect with any private property.



Figure 16: Collapsed main and manholes (NW16 – NW23)

#### Sewers in micro-tunneling

This is basically involves jacking pipes and execution of drilling for underpass, pipes or connection with jack rig after excavation of adequate shaft for jacking equipment or excavation of proper thrust pit. Drilling will proceed by insertion into the equipment of trunks of steel or concrete pipe of or some other materials of span length between 3 and 6 m with pre-installed drilling auger. Jacked pipe trunks will be effectively connected by welding of steel or by sealing of concrete joint. Micro-tunneling will be applied to a total length of 725 m under the Baghdad – Amman Highway Interchange, and will encompass the following segments:

- 300 m of depth 6.5 – 7.5 m,
- 100 m of depth 7.5 – 8.5 m,
- 100 m of depth 8.5 – 9.5 m,
- 100 m of depth 9.5 – 10.5 m, and
- 125 m of depth 10.5 – 11.5 m.

#### Manholes

These are concrete manholes in-situ, lined, and provided with 550m-diameter clear opening, and covered with GRP sealing plates. This part will also include the provision of two sets of in-situ deep manholes at different external diameters and depths: (ext. dia. 5000m, depth 6.0 – 7.5 m), and (5000 mm, depth 7.5 – 9.5 m), as well as one special manhole (7m x 8 m and depth 9.0m).

### Gravity pipelines for connection works

These are Reinforced Concrete Pipes (RCP) provided in trenches and including excavation, bedding, laying, testing, embedding, backfilling, and reinstating for connection of existing sewer and storm water to the new trunk main (total of 400 m), at different diameters: 1,800mm, 1,400mm, 400mm, and 200mm. This part of work will also include installing Un-plasticized Poly Vinyl Chloride (UPVC) pipes in trenches including excavation, bedding, laying, testing, embedment, backfilling, reinstatement for connection of existing sewer and storm water to the new trunk main (total of 500m), at different diameters: 400mm, 350mm, 300mm, 250mm, and 200mm.

### **3.5. Common Activities in the Construction Phase**

Prior to Construction, it is expected that successful Contractors (for Al-Habibiya, Al-Doura 1, and Al-Ghazaliya subprojects) will mobilize equipment and machinery to the site. The existing pumping stations (Habibiya, Doura, and Ghazaliya) will accommodate machinery and workforce within their premises and stations' perimeter. As for Ghazaliya main trunk and manholes, Contractors will be required to use a temporary working caravan (a mobile one wherever field work is taking place) to accommodate machinery and workforce. However, areas to be used for work preparation and accommodation are not known at this stage, and they are to be chosen and approved by the MOB as agreed with the winning contractor upon signing the agreement. Working areas and spaces for mobile caravans will be established in a state-owned land, including options of using Right of Way alongside the main trunk line. Therefore no private land acquisition is expected.

Additionally the Contractor is expected to hire a number of skilled and non-skilled workers from the local market to the extent possible to undertake the work (estimated at 50 – 75 skilled and non-skilled workers per each subproject). On another hand, any of the contractors will use local road network to transport equipment and machinery shipments to the working site, as well as to transport decommissioned and waste material from the working site to the place(s) designated and approved by the MOB. These activities and alike are expected to have close coordination between the Contractors and the MOB on one hand, and between MOB and other responsible departments (for instance, the public security, and traffic) on another hand.

The rehabilitation of Al-Habibiya, Al-Doura 1, and Al-Ghazaliya SPSs will also involve carrying out civil works onsite. That would involve cut and fill works as well as transportation of excavation/building materials in and out of the site. Moreover, the contractors are expected to use large amounts of water for construction, washing, flushing, cleaning, etc. and for office purposes. The supply and discharge of these amounts of water are the responsibility of the contractors, which must be done in close coordination with BWA and BSA.

As the Doura 1 station possesses three lifting trains in normal operations. It is expected that the Contractor will shut down one train at a time and operate the other two trains in full capacity to be able to finish rehabilitation works for that train. The same will be applied to the remaining two trains. No full stoppage will be performed at the two stations as Al-Habibiya SPS has also put in place a by-pass plan during construction. Over-pumping and flow diversion are expected to take place during construction periods. This is applicable to all Habibiya, Doura, and Ghazaliya subprojects. Specifically the Ghazaliya subproject, which has the largest sewer trunk rehabilitation and

construction. Contractors are required to submit their proposals of over-pumping and temporary diversion of flows to pertinent authorities for approval. No stoppage of service is allowed. And no obstruction of access to private properties is allowed as well, if unavoidable, alternative means of access will be provided.

## 4. BASELINE INFORMATION

### 4.1. Physiochemical Environment

#### 4.1.1. Climate

The climate in Baghdad is arid subtropical continental with very hot and completely dry summers and cold winters having some rain. The mean maximum temperature in July and August is about 43°C, but during heat waves the temperature shoots up to 49°C. Dust storms are common in summer. High temperature and winds combine to cause very high evaporation, about 10 mm per day during June, July, and August. The winter is chilly with mean minimum temperature of 4.5°C in December and January but the minimum temperature drops down to -7°C during cold waves which are experienced intermittently during December and January. The mean annual rainfall ranges from about 120 mm in the south to about 160 mm in the northeast, occurring in winter and spring. The following table represents typical climatic parameters in Baghdad (2010 – 2013):

Table 3: Climatic parameters in Baghdad (2010 – 2013)

Parameter	2010	2011	2012	2013
Maximum temperature (°C)	46.6	45	46.1	43.3
Minimum temperature (°C)	6.9	3.6	3.4	5.1
Maximum relative humidity	100	100	100	100
Minimum relative humidity	4	6	5	5
Rainfall (mm)	92.5	96	184.4	296.7
Average annual dust fall (g/m <sup>2</sup> )	30	31	29	18

Source: Central Statistical Organization of Iraq – Climate

A typical year in Baghdad shows the following monthly precipitation and temperature trends.

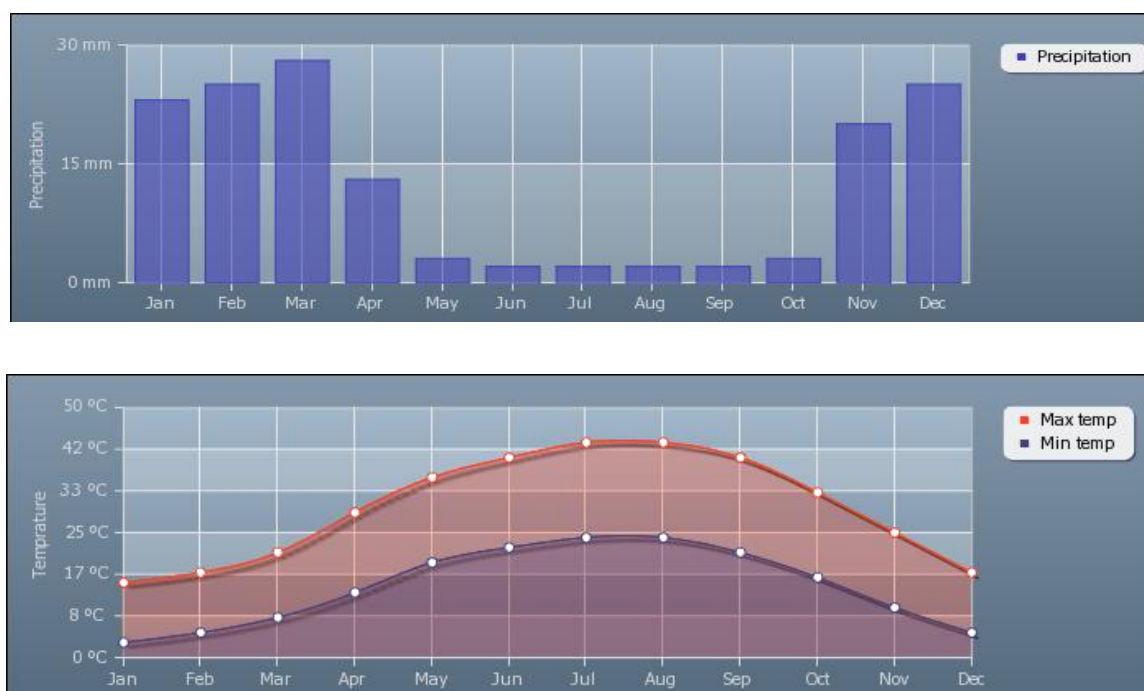


Figure 17: Typical yearly precipitation and temperature trends in Baghdad

Nevertheless, Baghdad may have exceptional flooding events almost every 30 years. In December 2012, it was recorded that 67 mm of rain fell on Baghdad in one single day, which represented nearly half average annual rainfall of that year. At that unusual event, Al-Rusafa side received more than 5 MCM in only 10 hours, which needed around 3 days to drain using available storm water networks (assuming 60% of the Rusafa area is connected to the network). While in the Karkh side, there was more than 20 MCM of rainfall in the same period, which took more than 5 days to drain (assuming also 60% connected to network). Therefore, Baghdad can have severe flooding events that can adversely impact its infrastructure.

The prevailing wind direction in Baghdad is Northwestern, and is commonly known as "Shamal". Wind blows with mostly 59 degrees to the West, while the average wind speed is about 1.35 m/sec



Figure 18: Prevailing wind direction in Baghdad

#### 4.1.2. Air quality and noise

Iraq has a persistent and severe dust and sand storms like other areas do in the region, which prevail in spring and summer months, as well as in winter/summer seasonal transition period. Dust is even more agitated by the northwesterly winds that characterize the semi-arid conditions of central Iraq. Baghdad city is severely impacted by air pollutants, mostly emitted by mobile sources, industrial activities, and private generators, as well as by using a poor quality of fuel. Total Suspended Particles (TSP) concentrations measured at Al-Sadr and Al-Doura meteorological stations in 2014 were very high and constantly pose serious concerns on the population's health. PM10 is estimated  $64 \mu\text{g}/\text{m}^3$  at 20 feet of altitude, while PM2.5 was estimated  $10,410 \mu\text{g}/\text{m}^3$  at 20 feet (Khanjer et. al, 2014). Table 4 below shows some results at the Sadr and Doura meteorological stations.

Table 4: Concentrations of major air pollutants in Baghdad (Jan – Mar 2014)

Name of station	Type of station	CO (ppm)	CO <sub>2</sub> (ppm)	TSP (µg/m <sup>3</sup> )	Wind m/s
Sadr city	Residential	42.7	315	3,246	1.3
Doura city	Residential	25.5	345	2,333.1	1.5

On another hand, road traffic is considered the most significant source of noise in Baghdad (Jaleel, 2014). Measurements were conducted in the vicinity of three hospitals in Baghdad city: Al-Wasity, Al-Elwayia, and Zayed. Results showed that noise level reached 92 dB(A) three meters away from the traffic lane at all hospital locations during daily hours (7:30AM to 2:30PM), which was beyond the permissible limit set by WHO guides.

#### 4.1.3. Topography and Soils

Baghdad – where the Project lies – is part of a geological formation called the Mesopotamian Plain Region. This is a sedimentary alluvial plain that runs along Tigris and Euphrates river beds and occupies a quarter of the country's total area. This plain is a rectangular formation that extends from Belad on the Tigris; Al-Ramadi in Tal Aswad on the Euphrates in the north; Iranian borders in the east; and desert plateau including Al-Ahwar and Buheira areas in the west. The total area of this plateau is estimated at 132,500 km<sup>2</sup>. The area where Al-Ghazaliya project is located is almost 38m a.s.l, and the area where Al-Doura SPS is located has an elevation of around 35m a.s.l., while the area where Al-Habibiya SPS is located is around 37m a.s.l. Land of Baghdad is considered highly flat with no clear natural drainage pattern. This type of topography brings the area at risk of floods, especially in rainy seasons. However, at the confluence of the two rivers in the south, land is even below the level of the river bed. Deposition of material by the rivers is in a levee basin pattern giving a distinct meso-relief in the nearly level landscape.

Baghdad has a Calcaric Fluvisols soil type. These are stratified soils of the lower Mesopotamian plain. Being formed in the alluvial material deposited by the Tigris and Euphrates rivers, these soils are strongly calcareous and have about 20 percent of lime. They are grayish brown in the Euphrates deposits but have reddish or pinkish tinges in the material of the Tigris. Almost invariably they contain gypsum because the catchment area of the Tigris and Euphrates has gypsum crusts and deposits. The organic matter content is low (ranging from 0.3 to 0.5 percent) and the Carbon/Nitrogen ratio is narrow (4 to 8). The pH is 7.5 to 8.1. And the texture ranges from silt loam to silt clay loam and silt clay.

#### 4.1.4. Hydrology and water resources

Water resources in Iraq mainly come from river waters of Tigris and Euphrates. According to Ministry of Water Resource (2010), the Tigris and Euphrates get their water from Turkey (71%), from Iran (6%), from Syria (4%) and internally from catchment areas (8%). Average annual flow of the Tigris is estimated at 21.2 BCM, and that of the Euphrates is 30 BCM when they both enter Iraq. However, the World Bank has stated that the Euphrates is 100% sourced out of Iraqi borders, while the Tigris is nearly 67% outsourced.

Tigris is fed by a number of tributaries. However the next upstream tributary to Tigris before it enters Baghdad is Udham, which drains an area of 13,000 km<sup>2</sup> and reaches 25.2 BCM of mean



annual flow. This tributary runs dry between June and November each year. The next, and last, downstream tributary to the south of Baghdad, is the Diyala River with a mean daily flow of 182 m<sup>3</sup>/s at the confluence with Tigris. In Baghdad, the mean annual flow of Tigris drops to 1,140 m<sup>3</sup>/s due to water withdrawal for irrigation. Water quality of the Tigris is poor due to the return flows from irrigation projects and continuous discharge of untreated wastewater. Some of the Tigris flood flows are diverted to Tharthar Lake through an irrigation canal (western Baghdad), which is highly saline, and then it is redirected for use in the river system with the salt washed out of the lake. For example, Total Dissolved Solids (TDS) values of the Tigris water is 280 – 275 mg/l at the Turkish Iraqi border, while it increases to more than 1,800 mg/l in Basra. Tigris water quality receives even more damage by direct discharge of raw sewage on daily basis, and at a rate of more than 500,000 m<sup>3</sup>/day.

Tigris is the only water source for drinking water in Baghdad. Many studies have been carried out to establish baseline information on the Tigris water quality. BSA performs continuous water quality monitoring at Baghdad's water and wastewater projects. Additionally, the following table shows some selected parameter that could reflect chemical characteristics at 7 water projects.

Table 5: Chemical characteristics of Tigris River – December, 2013

Water* intake project	Color	Temp (°C)	pH	Turbidity (NTU)	Sulfate (mg/l)	Nitrate (mg/l)	Nitrite (mg/l)	Ammonia (mg/l)	O-phosphate (mg/l)
Al-Karkh	<5	15	7.94	30	112	0.87	0.003	0.01	0.04
East Tigris	<5	20	7.99	27	273	0.77	0.008	0.05	0.01
Sadr	<5	16	8.07	25	189	0.50	0.014	0.11	0.01
Wathbah	<5	13	8.06	30	219	0.90	0.006	0.31	0.01
Karamah	<5	14	8.00	30	271	0.95	0.004	0.02	0.05
Qadesiyah	<5	14	7.70	22	214	0.92	0.002	0.10	0.06
Doura WTP	<5	13	8.04	28	246	0.72	0.008	0.55	0.10

\*River inlet. Source: Baghdad Water Authority

Table 6: Bacteriological characteristics of Tigris River Average limits – December, 2013

Water intake project	Plate Count (CFU/1 ml)	Total Coliform (MPN/100 ml)	E. Coli (MPN/100 ml)
Al-Karkh	588	1,210	303
East Tigris	874	5,320	4,510
Sadr	860	1,870	1,780
Wathbah	12,145	28,270	43,210
Karamah	8,230	53,727	26,420
Qadesiyah	10,020	39,050	26,420
Doura WTP	19,660	110,100	72,180

Source: Baghdad Water Authority

Groundwater resources in Iraq account for 0.9 BCM annual. And cover the needs of around 64,000ha of agricultural lands all around the country. A long time ago, the Iraqi government has drilled thousands of deep wells to cover the needs where surface water is not available. Artesian water has been widely used to supplement irrigation in winter and to irrigate vegetables in summer, in addition to supplying both urban and rural populations with potable water. Other domestic usage includes watering livestock.

Water tables in Baghdad, however, are contained in relatively permeable layers, which would therefore increase possibility of cross-contamination by activities above the ground surface. Quality

of groundwater in Baghdad, is in continuous degradation due to intensive usage of fertilizers, seepage of contaminants through soil, intensive discharge of industrial and sanitary wastewaters to land and river, illegal commissioning of cesspits, and others. The following table shows some chemical and bacteriological characteristics of water samples taken from three wells on the eastern bank of Diyala River in 2008 (Abdulla et. al, 2011). The three wells are about 14 km, and 25km to the east of Doura and Al-Ghazaliya subprojects, respectively, and about 13 km to the southeast of Habibiya SPS. These comprise of: well A: around 400m onshore, downstream of Rustomiya WWTPs; well B: around 500m onshore and close to Al-Jaish (Army) Canal; and well C: around 3km onshore in the city center (as shown in figure 17).

Table 7: Chemical and bacteriological characteristics of groundwater in Baghdad – August, 2008

Sample source	pH	Turbidity (NTU)	Sulfate (mg/l)	TDS (mg/l)	TSS (mg/l)	DO (mg/l)	BOD (mg/l)	Heavy metals			TPC (unit/ml)
								Cd (mg/l)	Pb (mg/l)	Zn (mg/l)	
A	6.99	48	1,366	3,832	40	6.1	8.5	0.089	0.048	0.98	2,600
B	7.40	55	1,490	3,980	13	6.1	9.2	0.001	0.045	0.9	2,200
C (city center)	7.45	10	540	1,852	30	6.9	5	0.003	0.044	0.43	820

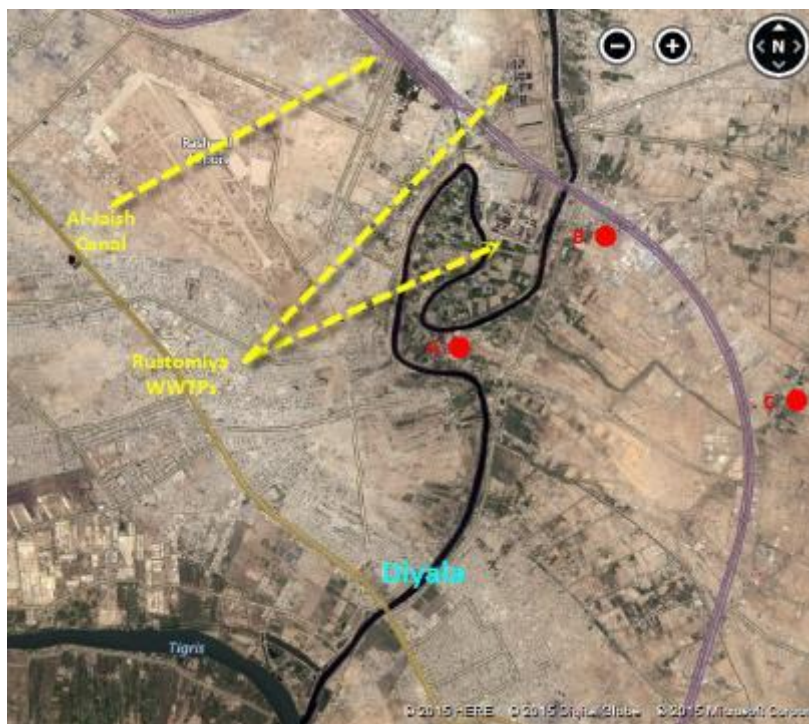


Figure 19: Locations of groundwater sampling in Baghdad – August, 2008

As can be seen from the results above, groundwater quality in Baghdad is directly proportional to discharges to canals and rivers. And it is greatly affected by agricultural activities occurring above the ground (high concentrations of pollutants, exceeding limits set by WHO and Iraqi regulations). Nevertheless, a better water quality could generally be found if going away from running and stagnant waters.

## 4.2. Biological environment

### 4.2.1. Habitats

The Project area is heavily urbanized, leaving behind very little and sparse natural habitats. However, areas of ecological features could still be found – though very limited – along the Tigris basin. Two examples are Al-Jadriya Water Park to the east of Tigris and Um Al-Khanazeer Island to the west. The western side of Al-Jadriya Park was modified to receive water from the Tigris to support eco-tourism and recreational activities during summer. Submerged vegetation in the Park usually appears after water level has become shallow, allowing for a natural accommodation for migrant waterfowl. Um Al-Khanazeer Island, on the other hand, was known in the past as a natural habitat for wild boar populations once lived in the area. To the northeastern edge of the Baghdad University campus is a zone of uncultivated arid land that supports orchards of date-palm trees. These natural habitats are also common in Doura District across the Tigris River.

### 4.2.2. Flora

In Baghdad area, some wild flora species could be found, like deciduous flowering trees and shrubs. Examples include: *Eucalyptus*, *Populus*, *Albezea*, and *Ziziphus*. Other wild species could also be found like the *Phragmites*, which are endemic to temperate and tropical regions, along with *Typha*, which is a perennial herbaceous plant endemic to wetland and marshes. People in Baghdad grow a range of palm-date trees and fruit trees, like, lemon, orange, grape, fig, pear, apple, and apricot.

### 4.2.3. Avifauna and fauna

According to literature, Baghdad includes an Important Birds Area (IBA) on the Tigris River, which comprises one stop of international flyways used by huge numbers of birds moving between Africa and Eurasia every year. On another hand, Baghdad includes habitats for endemic bird species of conservatory concern like the water birds *Marmaronett Angustir ostris*, *Larus Genei*, *Vanellus*, *Hypocolius ampelinus* and *Tachybaptus Ruficollis*, of which the latter two species being classified as restricted-range species. With regard to fish, the World Resources Institute (WRI) has stated that the combined Euphrates and Tigris watershed supports 71 native fish species (plus a further 21 introduced species) of which 28 are endemic to the basin.

The area also includes a wide range of invertebrates and vertebrates. For instance, invertebrates include snails, slugs, insects of various orders and families, and spiders and scorpions. While vertebrates include, for instance, lizards, snakes, turtles, long-eared hedgehogs, red foxes, golden jackals, rats and rodents. The Project area does not include a significant wildlife, since the Project is to be implemented within boundaries of the existing pumping stations.

### 4.3. Socioeconomic environment

#### 4.3.1. Demographic characteristics

About 27 percent of the total urban population in Iraq resides in Baghdad, which is by far the largest city in the country with an estimated population of 6 million. A 2012 household survey indicates that Iraq's national poverty stood at 18.9 percent in that year and that a fifth of the population lived on less than US\$2 a day, and 70 percent on less than US\$4 a day. The poverty rate in 2012 in Baghdad was at 12 percent. The recent conflict will have exacerbated poverty levels. Progress made in poverty reduction between 2012 and 2014 has been reversed. Unemployment is high and labor force participation remains low, especially for women and youth. It was officially estimated at 11 percent in 2011, although actual levels, particularly among youth, were significantly higher.

Baghdad has four major universities including: The University of Baghdad (established in 1957); Al-Mustansiriya University (established in 1963); University of Technology (established in 1974); and Nahrain University. In addition, Baghdad has a much bigger number of private universities and colleges.

Also, there are more than 1,000 primary schools, hundreds of intermediate and secondary schools, several vocational, commercial and Islamic academies, many technical institutes and teachers' training institutes.

#### 4.3.2. Economic characteristics

The Iraqi economy is facing severe and pressing challenges. The decline in oil prices and the financing needs associated with the ISIS insurgency have contributed to a sharp deterioration of economic activity, public finances and the balance of payments. Macroeconomic risks remain elevated due to Iraq's continued exposure to a volatile oil market. The government is facing the challenge of maintaining macroeconomic stability, undertaking structural reforms to improve the delivery of public services, and reconstructing core physical infrastructure amid ever-present risk of conflict relapse (World Bank, 2015).

#### 4.3.3. Water and Sanitation

Conflict-related damages to water and sanitation services have further impacted service quality. During the Iraqi war in 2003, trunk mains and network pipelines were attacked. Lots of essential equipment was looted from pumping stations and treatment plants. Actual cost of sanitation service per cubic meter per capita is estimated at 155 ID (operational and maintenance). However, this cost is largely subsidized, so that the subscriber is only required to pay 7 ID per each 1 cubic meter of wastewater.

Al-Habibiya Sewerage Pumping Station is receiving wastewater from around 2,500,000 people, while Al-Doura 1 Sewerage Pumping Station is receiving wastewater from nearly 2,600,000 people. However, in 2015, it was estimated that Al-Ghazaliya subproject (GH1, GH2, GH6, GH7, and Khadra)

received wastewater from around 369,577 people (comprising all Mahallas of Ghazaliya and Shu'la districts)<sup>3</sup>.

#### 4.3.4. Land use

In general, Baghdad governorate has a fragmented and inefficient land use, with very limited areas left for future expansions (see figure 18 below). Current land use is best described as:

- Wide urbanization without enough planning, especially by the housing sector,
- Rapid exploitation of land available for future development,
- Increased encroachment on the greenbelt,
- Scattered and disorganized industrial sector, and
- Centralized commercial and other services sectors.

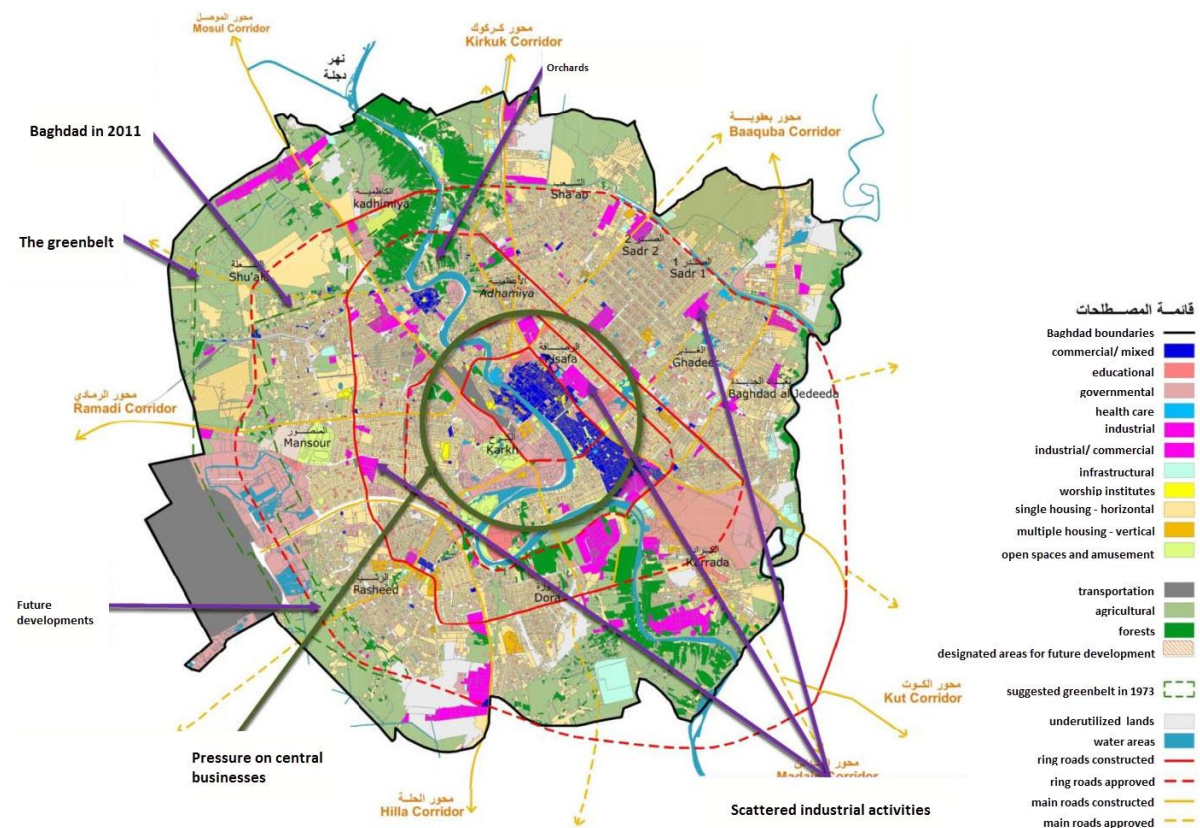


Figure 20: Land use in Baghdad, 2011

1. Baghdad in 2004: around 60% of the total area was urban areas
2. Baghdad in 2011: around 80% of the total area was urbanized.
3. The greenbelt: so far, the greenbelt was fragmented by fast-pace and disorganized urbanization, what already has been left is only some scattered areas, useless and unable of meeting their objectives.
4. Future developments: some future developments like the construction of a ring-road and a railway will increase fragmentation of the greenbelt.

<sup>3</sup> The Detailed Engineering Design Report for Al-Ghazaliya project, Engicon – 2009

5. Pressure on central businesses: Intensive commercial and industrial activities in central areas have put more pressure, which consequently led to traffic problems and threatened the already fragile urban texture.
6. Scattered industrial activities: these were usually placed in residential areas, and even inside commercial areas, which consequently hindered normal life quality and public safety in the city.
7. Orchards: these were invaded either.

## 5. LEGAL AND REGULATORY FRAMEWORK

This section aims to provide a concentrated view to the applicable laws, regulations, instructions, and safeguards in the field of environment and public health in Iraq, both at the national and international levels. The activities of this proposed development are expected to comply with the requirements of this legal register during construction and operation. And it is envisaged also that environmental monitoring during construction and operation will take place in reference to the minimum permissible limits set out in national and international guidelines described below.

Reviews of this framework are provided under thematic areas of concern as follows:

### 5.1. Access to Public Water and Sanitation Services:

The Human Right to Water and Sanitation, UN resolution A/RES/64/292 has through its meeting on 28 July, 2010, the United Nations General Assembly declared:

"Safe and clean drinking water and sanitation a human right essential to the full enjoyment of life and all other human rights".

### 5.2. Public Health, Water, and Environment

#### 5.2.1. Public health and Safety

##### **Public Health Law no. 89 – 1981**

The Public Health Law is considered the backbone for protecting public health from harmful interaction with the environment and vice versa. In so doing, the Law tackles issues related to the environment that has direct and indirect impact on human health and wellbeing. The Law has dealt with a number of environmental aspects vulnerable to alteration by human activities like, preserving natural coherence, water, land, and air. The Law has already addressed areas of concern related to public health and the surrounding environment since the early development of the country, from which many national laws, regulations, and instructions have been stemmed later on. For instance, the Law has outlined the healthy burial of waste by determining fundamentals of this act, like site selection, methods of burial, machinery required, and staff involved, amongst many others. In opting for burial, cultivable lands and high groundwater tables should be avoided whenever possible, sought outside of urban/suburban areas, and operated in such a way to prevent odor and pest breeding.

The Law has also stipulated general provisions for the safe handling and storage of chemicals. Precautions involved the need for suitable signage, minimizing quantities and the need to store hazardous materials, and replacing them with less hazardous ones if possible.

Noise and vibration, on the other hand, has got a good level of attention, which is connected to the protection of workers from sources of noise and vibration. By the virtue of this Law, the employer is required to use low-vibration equipment, monitor levels of vibration in workplace, provide their workers with proper protection equipment, as well as offer their workers proper medical checks and

treatment for those directly exposed to noise and vibration sources. Last but not least, the Law, in its Article 99, has set out penalties for breaching cases in comparison to limits detailed in relevant regulations.

### 5.2.2. Environment protection

#### **Preservation of Water Resources Regulation no. 2 – 2001**

As mentioned in article 8 of this regulation, it is prohibited to discharge or throw any kind or any amount of waste from the location to the common water of any kind or quantity, whether the discharge is regular, irregular or temporary, for any reason, unless granted permission from the Office of Protection and Improvement of the Environment or whom it shall authorize.

#### **Protection and Improvement of the Environment Law no. 27 – 2009**

The law aims at protecting and improving the environment through elimination and treatment of existing damages or those likely to be caused. It also aims at preserving public health, natural resources, and biodiversity as well as natural and cultural heritage in coordination with the relevant authorities in a manner that ensures sustainable development through international and regional cooperation. Article 3 of this Law establishes the "Environment Protection and Improvement Council", which is associated with the Ministry of Environment and includes 22 representative members from all ministries and commissions. The objectives of this Council are concerned with (but not limited to): providing advice on environmental issues; reviewing plans, projects, programs, including emergency and environmental disaster plans, all in relation to environmental aspects before approval; internally coordinating between authorities and externally presenting the country in the environmental regional and international forums; implementing environment improvement project in Iraqi provinces; and taking part in formulating environmental legislations as well as preparing annual reports on the environmental situation. Article 7 of the Law entails the establishment of Environment Protection and Improvement Councils in each governorate with some power attached to their own environmental matters. Articles 11 and 12 relate to new and expansion projects respectively, and the need to prevent or encourage developments in line with protecting natural resources, adopting sustainable and environmentally sound systems, and exploring renewable energy sources.

However, this law addresses the following environmental areas in particular:

- Article 14 (protection of water resources from pollution) prohibits: Discharge of domestic, industrial, and agricultural effluents to inland water resources without proper treatment, in compliance with specifications set out in environmental-related legislations; Disposal of solid waste, animal waste and corpses, or scrap material into water resources; Discharge of waste oil, wastewater, or fuel from tankers to surface water or territorial waters; Any act that would lead to pollution of surface water bodies as a result of exploitation of the river, unless otherwise approved.
- Article 15 (Air pollution and noise reduction) prohibits: Emissions of fumes, gases, or vapors in excess from production processes, or burning fuel, and considers that a breach of national environmental legislations; Excessive emissions from engines and vehicles above permissible



limits; Burning of solid waste outside of designated areas, given that this is done in an environmentally friendly manner.

- Article 16 prohibits high levels of noise that exceed permissible limits, in the operation of machinery, equipment, horns, and loudspeakers.
- Article 17 (Protection of land) which prohibits: Activities that would lead to degradation or pollution of soil either directly or indirectly; Non-compliant urban sprawl on land; Activities that would result in desertification or impacting natural environment, unless otherwise approved; Damage to designated areas of natural and cultural heritage, including unauthorized disposal of solid waste in such places.
- Article 18 (Protection of biodiversity) which prohibits: Damaging biota in their habitat; Fishing, hunting, killing, and transferring endangered/ protected species; Damaging plants/ herbs of medical, scientific, industrial, and trade values; Cutting perennial trees in public areas (30 years of age or more), logging in the forest, and introducing new animals and plants in the environment all unless otherwise permitted.
- Article 19 urges the development of a national register for hazardous materials in use in the country and establishment of a manifest system for hazardous wastes.
- Articles 20 addresses the need to: control the use of pesticides and chemical compounds; Apply an environmentally sound methods for transferring, handling, storing, and disposing hazardous materials including radioactive ones; ensure those materials not causing harm/ damage to the environment; prohibit treatment of hazardous waste without prior permit.
- Article 22 is related to the environmental monitoring for prohibited activities that impact the environment,
- Article 23 urges the operator of a facility, which is subject to environmental control, to maintain records of releases to the environment.

#### **Protection of Ambient Air Quality Regulation no. 4 – 2012**

This Regulation was derived from the Protection and Improvement of Environment Law no. 27 described above. It was intended to emphasize the need for protecting ambient air quality and controlling the various sources of pollution. According to the Regulation, the Ministry of Environment is responsible for: establishing a monitoring program on the national scale, including the provision of monitoring equipment and pursuing fund opportunities; using data collected from monitoring stations and utilizing them in preparing environmental reports; putting a national guide for air-polluting substances; issuing allowable limits of air pollutants; managing and controlling air pollution from stationary and mobile sources in collaboration with relevant authorities.

The Regulation requires that stationary emitting sources adhere to national thresholds and use monitoring devices to ensure compliance. It is also required that emissions from electricity generators using a hydrocarbon fuel are kept within limits, applying corrective measures in case of exceeding limits, and seeking alternative/new technologies to replace the old ones.

According to the Regulation, it is prohibited to burn all types of plastics, rubber, used oils, materials containing heavy metals, medical wastes, domestic wastes, inside a facility, or in the open air, or next to a residential area or a water source. Dumping facilities and incinerators are to be established in full compliance with national and international standards.

### **Protection of Wild Animals and Birds Law no. 21 – 1997**

As detailed in Article 2, implementation and monitoring shall be entrusted to the "Special Administration", whereas Article 3 is concerned with the breeding of wild animals in protected areas and creation of natural habitats for wild animals and birds. The law requires the Minister of Agriculture and Land Reclamation to issue a list of protected species of birds and animals, prohibited zones, and hunting seasons. Hunting may only be authorized by the Minister of Agriculture and Land Reclamation, which if not granted will result in a fine or an imprisonment or both.

### **Decision Concerning the Cutting of Trees no. 1 – 1991**

By the virtue of this decision, it is prohibited to cut trees from natural forests and street sides, as well as from areas with young trees and green belts. Failing to comply with the Order will result in punishment according to the provisions of the "Protection and Improvement of the Environment Law no. 76 – 1986."

### **Forest Law no. 30 – 2009**

According to this Law, forests are classified into three categories: State Forests, Endowed Forests, and Private Forests. The provisions of the Law are applicable to State Forests, though; Article 4 still contains general provisions for all forests. In particular, the Law is assigning administration of protected/reserved forests to the Directorate General of Forests and Plantation. The Law also deals with enforcement and sets out offences and penalties. Furthermore, the Law prohibits cutting forest trees for charcoal and commercial purposes in specified natural forests according to Article 1. However, villagers are allowed – for particular purposes – to cut trees for timber and to transport it within the forest region (Articles 3 & 4).

### **Projects on International Waterways – OP/BP 7.50**

The World Bank recognizes the issues involving projects on international waterways and attaches importance to the riparian countries making appropriate agreements or arrangements for the entire waterway, or parts thereof. In the absence of such agreements or arrangements, the Bank requires, as a general rule, that the prospective borrower notify the other riparian countries of the project. The Policy lays down detailed procedures for the notification requirement, including the role of the Bank in affecting the notification, period of reply and the procedures in case there is an objection by one of the riparian countries to the project.

Note: The project area is located on the Tigris which is an international waterway. However, the project involves rehabilitation of existing pumping stations, construction of potable water reservoir, and non-revenue water including replacement of old drinking water distribution network. The project does not involve works and activities that would exceed the original capacity of the pumping stations and will not increase water off-take from the Tigris. Therefore, the project falls within the exception to the notification requirements of OP 7.50, set forth in paragraph 7(a) of OP 7.50.

## The new determinants for the Prevention of Pollution of Rivers and Public Water Regulation, no. 25 – 1967

This instruction lays down the new determinants for the prevention of pollution of rivers by the virtue of Regulation 25, 1967. These instructions set physical, chemical, and biological guidelines for water quality and wastewater discharges. The Regulation defines Water Resources as:

- Rivers and its tributaries and branches;
- Streams, waterways, canals, and their branches;
- Lakes, ponds, and other pools of water; and
- Springs, wells, and groundwater.

In particular, these instructions apply to wastewater from cities, industry, agriculture, and other activities including:

- Wastewater discharges to a public water source;
- Wastewater discharged to public sewer treatment works; and
- Wastewater discharged to the marshes.

Table 8 below shows the limits defined for discharges to both natural waters (water resources) and sewers (which generally have higher permissible discharge limits).

Table 8: Discharge consent parameters

Pollutant	Limits for discharge to water resources	Limits for discharge to public sewers
Color	-	-
Temperature	Less than 35°C	45°C
Suspended solids	60	750
pH	6 – 9.5	6 – 9.5
Dissolved Oxygen (DO)	-	-
Biochemical Oxygen Demand (BOD)	Less than 40	1,000
Chemical Oxygen Demand (COD)	Less than 100	-
Cyanide (CN <sup>-</sup> )	0.05	0.5
Fluoride (F <sup>-</sup> )	5.0	10
Free Chlorine (Cl <sub>2</sub> )	Traces	100
Chloride (Cl <sup>-</sup> )	A. If the ratio of the amount of water discharged to the amount of source water is 1000:1 or less, the chloride concentration of the discharge is permitted at 1% of the concentration of the natural source before discharge. B. If the ratio of the amount of water discharged to the amount of source water is more than 1000:1 the wastewater discharge must not exceed a chloride concentration of greater than 600 mg/L. C. If the concentration of chloride in the source water is less than 200 mg/L then the permitted discharge limit must be established on a case by case basis	600
Phenol	0.01 – 0.05	5 – 10
Sulfate (SO <sub>4</sub> <sup>2-</sup> )	A. If the ratio of the amount of water discharged to the	300

Pollutant	Limits for discharge to water resources	Limits for discharge to public sewers
	<p>amount of source water is 1000:1 or less, the sulfate concentration of the discharge is permitted at 1% of the concentration of the natural source before discharge.</p> <p>B. If the ratio of the amount of water discharged to the amount of source water is more than 1000:1 the wastewater discharge must not exceed a sulfate concentration of greater than 400 mg/L.</p> <p>C. If the concentration of sulfate in the source water is less than 200 mg/L then the permitted discharge limit must be established on a case by case basis</p>	
Nitrate (NO <sub>3</sub> <sup>-</sup> )	50	-
Phosphate (PO <sub>4</sub> <sup>3-</sup> )	3	-
Ammonium (NH <sub>4</sub> <sup>+</sup> )	-	-
DDT	Nil	-
Lead (Pb)	0.1	0.1
Arsenic (As)	0.05	0.05
Copper (Cu)	0.2	-
Nickel (Ni)	0.2	0.1
Selenium (Se)	0.05	-
Mercury (Hg)	0.005	0.001
Cadmium (Cd)	0.01	0.1
Zinc (Zn)	2.0	0.1
Chromium (Cr)	0.1	0.1
Aluminum (Al)	5.0	20
Barium (Ba)	4.0	0.1
Boron (B)	1.0	1.0
Cobalt (Co)	0.5	0.5
Iron (Fe)	2.0	15
Manganese (Mn)	0.5	-
Silver (Ag)	0.05	0.1
Total Hydrocarbons & Derivatives	<p>Allows discharge of total hydrocarbons to water sources and A1 and A2 according to the concentrations and limitations set forth in the tables below; the concentration of hydrocarbons must be measured discharging to the water source. Hydrocarbons shall not be discharged to water sources A3 and A4.</p> <p>For rivers in continuous flow 10 mg/l according to the ratio of the amount of wastewater discharged to the amount of the water source should not be less than 1000:1.</p> <p>For a river in a continuous flow 3 mg/L and in accordance with the ratio of the amount of the wastewater discharged to the amount of water source should not be 300:1 or less.</p>	-
Sulfide (S <sup>2-</sup> )	Nil	3.0
Ammonia (NH <sub>3</sub> )	Nil	10
Ammonia gas (free NH <sub>3</sub> )	Nil	6.0
Sulfur dioxide SO <sub>2</sub>	Nil	7.0
Calcium Carbide CaC	Nil	Not allowed
Organic solvents	Nil	Not allowed
Benzene	Nil	0.5
Chlorobenzene	Nil	0.1
TNT	Nil	0.5

Pollutant	Limits for discharge to water resources	Limits for discharge to public sewers
Bromine (Br <sub>2</sub> )	Nil	1 – 3

The Iraqi authorities have classified public waters into four main grades (A1, A2, A3, and A4) according to environmental quality standards represented by chemical and physical values.

Table 9: Public water classification (grades A1 – A4) by chemical and physical determinants

Determinant	A1	A2	A3	A4
Color	Normal	Normal	Normal	Normal
pH	6.5-8.5	6.5-8.5	6.5-8.5	-
Dissolved oxygen	>5	>5	>5	-
BOD5	<5	<3	<3	-
Cyanide	0.02	0.02	0.02	0.02
Fluorine	0.2 or more depending on the concentration in the natural source			
Free chlorine	Traces	Traces	Traces	Traces
Chlorides	200 or more depending on the natural source			
Phenol	0.005	0.005	0.005	0.005
Sulfate	200 or more depending on the natural source			
Nitrate	15	15	15	50
Phosphate	0.4	0.4	0.1	0.4
Ammonium	1.0	1.0	1.0	-
Pesticides (DDT)	0.0	0.0	0.0	0.0
Lead, Arsenic, Copper, Chromium, Cobalt,	0.05	0.05	0.05	0.05
Nickel, Manganese	0.1	0.1	0.1	0.1
Selenium, Silver	0.01	0.01	0.01	0.01
Mercury	0.001	0.001	0.001	0.001
Cadmium	0.005	0.005	0.005	0.005
Zinc	0.5	0.5	0.5	0.5
Aluminum	0.1	0.1	0.5	-
Barium, Boron	1.0	1.0	1.0	1.0
Iron	0.3	0.3	0.3	0.3

### 5.3. Occupational Health and Safety

The Project is expected to involve manpower of different levels (skilled and non-skilled) to carry out rehabilitation works in the construction phase, and afterward, to provide controlling and corrective/preventive measures in the operational phase. In principle, the workplace where construction and operation activities are performed has to meet certain criteria to protect against exceeding norms of ambient air, noise, and vibration. The following will provide reference limits for a range of parameters according to local and internationally-recognized regulators, in addition to showing values against which areas monitoring could be undertaken.

### 5.3.1. Air Quality

According to the Iraqi National Clear Air Act issued in 1979, the Air Quality Standards set out the following limits based on a medium-termed policy targets that take into consideration economic efficiency, practicability, technical feasibility, and timescales, which mostly agree with the WHO guideline limits. However, the following table below compares ambient air quality standards set by the local regulator with those internationally indorsed by the World Health Organization (WHO). These limits are applicable to emissions from stationary sources by different activities rather than being industry-specific. Thus, they could be applied to the construction and operation/maintenance works at the target sewerage pumping stations in Baghdad.

Table 10: Maximum allowable limits for air pollutants (stationary sources) by different regulators

Pollutant	Government of Iraq		World Health Organization (WHO) – 2006		
	Maximum permissible concentration	Remarks	Limit	Monitoring period (averaging time)	Remarks
Sulfur Dioxide (SO <sub>2</sub> )	500 mg/m <sup>3</sup>	-	500 µg/m <sup>3</sup>	10 min	Mean value
			-	1 hr	
			20 µg/m <sup>3</sup>	24 hr	
			-	1 yr	
Carbon Monoxide (CO)	250 mg/m <sup>3</sup>	other than fuel combustion sources	100 µg/m <sup>3</sup>	15 min	Mean value
			60 µg/m <sup>3</sup>	30 min	
	500 mg/m <sup>3</sup>	from old combustors	30 µg/m <sup>3</sup>	1 hr	
			10 µg/m <sup>3</sup>	8 hr	
250 mg/m <sup>3</sup>	from new combustors	30 µg/m <sup>3</sup>	1 hr		
		10 µg/m <sup>3</sup>	8 hr		
Nitrogen Oxides (expressed as NO <sub>2</sub> )	70 mg/m <sup>3</sup>	From gaseous fuel combustion	200 µg/m <sup>3</sup>	1 hr	Mean value
	150 mg/m <sup>3</sup>	From liquid fuel combustion	-	24 hr	
			40 µg/m <sup>3</sup>	1 yr	
Ozone	250 mg/m <sup>3</sup>	-	100 µg/m <sup>3</sup>	8 hr	Mean value
TSP	250 mg/m <sup>3</sup>	From fuel combustion sources	-	-	-
PM <sub>2.5</sub>	-	-	25 µg/m <sup>3</sup>	24 hr	Mean value
			10 µg/m <sup>3</sup>	1 yr	
PM <sub>10</sub>	-	-	50 µg/m <sup>3</sup>	24 hr	Mean value
			20 µg/m <sup>3</sup>	1 yr	
Volatile Organic Compounds (VOCs)	20 mg/m <sup>3</sup>	All sources	-	-	-
<i>Emissions associated with sewer</i>					
Hydrogen	5 mg/m <sup>3</sup>	Other	150 µg/m <sup>3</sup>	24 hrs	Based on effects other than

Pollutant	Government of Iraq		World Health Organization (WHO) – 2006		
	Maximum permissible concentration	Remarks	Limit	Monitoring period (averaging time)	Remarks
Sulfide (H <sub>2</sub> S)		sources than material industries			cancer or odor/annoyance
			7µg/m <sup>3</sup>	24 hrs	for non cancer effects other than cancer
Methane (CH <sub>4</sub> )	-	-	5 – 10 %	-	As explosive
			O <sub>2</sub> < 16%	-	As asphyxiant: (suffocant)
			1,000 ppm (avg)	8 hr	Threshold limit value in work shift
Ammonia & Ammonium compounds	10 mg/m <sup>3</sup>	measured as NH <sub>3</sub>	270 µg/m <sup>3</sup>	24 hr	Mean value
			8 µg/m <sup>3</sup>	1 yr	Mean value, measured as NH <sub>3</sub>

\* Source: National Air Emissions Standards, instructions no. 3 – 2012

The World Health Organization has published a research values of Hydrogen Sulfide at which Human health could be impacted. The study has revealed that the short-term tolerable concentration of Hydrogen Sulfide to the Human being is reached at 2.8 mg/m<sup>3</sup> (exposure durations from 1 – 14 days) measured as Lowest Observed Adverse Effect Level (LOAEL). The following table shows health impacts relative to different exposure concentrations.

Table 11: Human health effects at various hydrogen sulfide concentrations

Exposure (mg/m <sup>3</sup> )	Effect/ Observation
0.011	Odor threshold
2.8	Bronchial constriction in asthmatic individuals
5.0	Increased eye complaints
7 or 14	Increased blood lactate concentration, decreased skeletal muscle citrate synthase activity, decreased oxygen uptake
5 – 29	Eye irritation
28	Fatigue, loss of appetite, headache, irritability, poor memory, dizziness
>140	Olfactory paralysis
>560	Respiratory distress
≥700	Death

Source: Concise International Assessment Document 53 by Dr. Selene J. Chou. WHO 2003

Other sources of air pollutants could significantly come from combustion facilities. Those facilities are systems designed to deliver electrical or mechanical power, steam, heat, or any combination of these, regardless of fuel type, with a total rated heat input capacity of between 3 Megawatt thermal (MWth) and 50 MWth. The Environmental Health and Safety Guide of IFC has set out limits of air pollutants by two types of fuel.

Table 12: Emissions from small-scale combustion facilities (3MWth – 50MWth) – Engine

Combustion Technology / Fuel	Particulate Matter (PM)	Sulfur Dioxide (SO <sub>2</sub> )	Nitrogen Oxides (NO <sub>x</sub> )	Dry Gas, Excess O <sub>2</sub> Content (%)

Combustion Technology / Fuel	Particulate Matter (PM)	Sulfur Dioxide (SO <sub>2</sub> )	Nitrogen Oxides (NO <sub>x</sub> )	Dry Gas, Excess O <sub>2</sub> Content (%)
Gas	N/A	N/A	200 (Spark Ignition) 400 (Dual Fuel) 1,600 (Compression Ignition)	15
Liquid	50 or up to 100 if justified by project specific considerations (e.g. Economic feasibility of using lower ash content fuel, or adding secondary treatment to meet 50, and available environmental capacity of the site)	1.5 percent Sulfur or up to 3.0 percent Sulfur if justified by project specific considerations (e.g. Economic feasibility of using lower S content fuel, or adding secondary treatment to meet levels of using 1.5 percent Sulfur, and available environmental capacity of the site)	If bore size diameter [mm] < 400: 1460 (or up to 1,600 if justified to maintain high energy efficiency.)  If bore size diameter [mm] > or = 400: 1,850	15

Source: Environmental, Health, and Safety Guidelines, Air Emissions and Ambient Air Quality – IFC

The above emission values are applicable to small combustion process installations operating more than 500 hours per year, and those with an annual capacity utilization of more than 30 percent. For combustion facilities using a mixture of fuel, emissions should be compared with these guidelines based on the sum of the relative contribution of each applied fuel. Lower emission values may apply where the facility is located in an ecologically sensitive airshed, or airshed with poor air quality.

### 5.3.2. Noise

#### Noise Prevention Law no. 21 – 1966

The Noise Prevention Law aims to protect against excessive noise levels in public areas. The Law prohibits the use of speakers between 10pm and 8am. And prohibits broadcasting in public places in order not to disturb the peaceful environment, although using internal speakers could be approved by the police department sometimes. Upon Article 3 of the Law, the use of noise-generating equipment should be notified to the police department 3 days beforehand, while sometimes the decision could be made on the same day as the application of that equipment. Article 4 makes clear the right for authorities to supervise and control media broadcast in public places, and to take needed actions in case of violation. Article 5 details violations and penalties should the provisions of the Law be breached.

#### Noise Prevention Law – Instructions no. 2 – 1993

According to the Iraqi Instructions, industrial and commercial operations have a maximum permissible limits of 70 dB(A), while the stated construction and operation noise level guidelines within residential locations is 55 dB(A) for day-time and 45 dB(A) for night-time (see table 13).



Table 13: Noise limits for different working environments – Iraqi Instructions

Reception Zone	Level $L_{Aeq}$ (daytime)	Level $L_{Aeq}$ (nighttime)
Industrial	70	70
Commercial	70	70
Residential	55	45

Source: Iraqi national standards, Instructions no. 2 – 1993

These limits are consistent with the World Bank's guideline, which emphasizes that noise impacts should not result in a maximum increase in background levels of 3 dB at the nearest receptor location off-site. According to the World Bank's guideline, daytime is between 7am – 10pm, while the nighttime is between 10pm – 7am.

The World Bank's Noise Guideline has presented more exposure environments as in table 14 below

Table 14: Noise limits for different working environments – The World Bank Group

Location/ Activity	Equivalent level $LA_{eq,8h}$	Single time event Maximum $LA_{max}$ fast
Heavy Industry (no demand for oral communication)	85 dB(A)	110 dB(A)
Light industry (decreasing demand for oral communication)	50 – 65 dB(A)	110 dB(A)
Open offices, control rooms, service counters, or similar	45 – 50 dB(A)	-
Individual offices (no disturbing noise)	40 – 45 dB(A)	-
Classrooms, lecture halls	35 – 40 dB(A)	-
Hospitals	30 – 35 dB(A)	40 dB(A)
For every 3 dB(A) increase in sound levels, the "allowed" exposure period or duration should be reduced by 50%		

Source: Environmental, Health, and Safety (EHS) Guidelines – IFC

The quoted national and the World Bank's noise levels also correlate with the Guideline values stated by the Guidelines for Community Noise, WHO, 1999. Moreover, the latter guideline is more concerned with health effects associated with different exposure environments.

Table 15: Health effects associated with noise level exceedances

Exposure environment	Health effects	$L_{Aeq}$ (dB)	Exposure time continuous (hr)	Single time event $L_{Amax}$ (dB)
Outdoor living area	Serious annoyance, daytime and evening	55	16	-
	Moderate annoyance, daytime and evening	50	16	-
Dwelling, indoors,	Speech intelligibility and moderate annoyance, daytime and evening	35	16	-
Dwelling indoors, inside bedrooms	Sleep disturbance, night-time	30	8	45
Industrial, commercial, shopping, and traffic areas, indoors and outdoors	Hearing impairment	70	24	110
Public addresses,	Hearing impairment	85	1	110

Exposure environment	Health effects	L <sub>Aeq</sub> (dB)	Exposure time continuous (hr)	Single time event L <sub>Amax</sub> (dB)
indoors and outdoors				

Source: WHO Guideline for community noise, WHO – 1999

Noting again, that for every increase of 3 dB(A) over permissible limits, exposure time should be cut in half, in order to avoid health consequences.

### 5.3.3. Vibration

#### Public Health Law no. 89 – 1981/ Instructions no. 4 – 1993

Pursuant to Article III, General Objectives/ paragraphs VI & VII of the Public Health Law no. 89, Instructions no. 4 (Occupational Health: Protection of Workers from Vibrations) has been issued in 1993, which is still effective since that date.

These Instructions are related to the protection of workers from sources of vibration in workplaces. These instructions stress the requirements for:

- Pre-examining workers before they commence at their job centers to ensure they medically fit to work in environments that involve vibration;
- Performing health surveillance every 6 months for workers exposed to vibration;
- Breaking for 10 minutes during each working hour, and prohibiting smoking;
- Providing vibration resistant gloves; and
- Promoting best practices for workers: like discouraging firm holding of vibration-producing machines, keeping the body warm, dry, and in the least contact possible with those machines.

The Instructions stipulate that the employer must minimize levels of equipment vibration, use low-vibration equipment; monitor levels of vibration in the workplace; and provide training for employees with respect to vibration in the workplace (as above).

The permitted levels of exposure to vibration and the duration of exposure for hands and arms are detailed in the following table:

Table 16: Maximum limit values for exposure of hand-arm to vibration – Iraqi Instructions

Total Daily Exposure (hr)	Maximum Exposure Limit Value Frequency weighted acceleration in the dominant direction that should not be exceeded (g* or m/s <sup>2</sup> )
4 – 8	4 g, or 0.40 m/s <sup>2</sup>
2 – 4	6 g, or 0.61 m/s <sup>2</sup>
1 – 2	8 g, or 0.81 m/s <sup>2</sup>
Less than 1	12 g, or 1.22 m/s <sup>2</sup>

\* Gravity (g) = 9.81 m/s<sup>2</sup>

The above limits is consistent with the Threshold Limit Values (TLVs) for exposure of the hand to vibration in X, Y, or Z direction set by American Conference of Governmental Industrial Hygienists (ACGIH), which is also adopted by the World Bank Group for exposure to vibration in workplace. The Instructions also suggest that vibration to hand is dependent on how a worker can feel it, and many

factors can play a role in this feeling like frequency and the way the vibration-producing machine is held.

### **Public Health Law / Safe storage and handling of chemicals, instructions no. 4 – 1989**

These instructions set out requirements of safe handling and storage of chemicals according to the provisions of Articles 3 & 105 of the Public Health Law. These instructions apply to activities involved in the manufacturing, using, storing, or handling of the following chemical types: explosives; flammables; oxidizing substances; corrosive, radioactive, and carcinogenic chemicals; chemical drugs; toxic chemicals and pesticides; chemical irritants; and inert chemicals. Article 2 outlines necessary precautions for handling and storing chemicals and the need for proper signage. Placement of hazardous with less hazardous materials is required if possible, along with storing hazardous materials at the minimum possible quantities.

Article 3 outlines the suitable signage and labeling, security and safety, as well as adopting an international classification system by the manufacturer.

Article 4 outlines factors that should be taken into consideration when planning for storage including properties of chemicals to be stored, chemicals protection against damage, exposure, or fire, as well as transporting chemicals containers to and from storage places.

Article 5 sets requirements for constructing new chemical stores. While Article 6 puts the rules for correct storage.

The remainder of the instructions details the requirements for safe storage and use of the chemicals, for disposal of waste chemical containers, and the actions to be taken on the event of the release of a chemical. The instructions also include the need to use Personal Protective Equipment (PPE) by individuals working with such chemicals.

#### **5.3.4. Environmental Health and Safety Guidelines**

The Environmental, Health and Safety (EHS) Guidelines, of the World Bank Group (WBG)/ International Finance Corporation (IFC) 2008<sup>4</sup>, are the safeguard guidelines for environment, health and safety for the development of the industrial and other projects. They contain performance levels and measures that are considered to be achievable in new facilities at reasonable costs using existing technologies. When host country regulations differ from the levels and measures presented in the EHS Guidelines, projects are expected to achieve whichever is more stringent. If less stringent levels or measures than those provided in these EHS Guidelines are appropriate, in view of specific project circumstances, a full and detailed justification for any proposed alternative is needed as part of the site-specific environmental assessment. This justification should demonstrate that the choice for any alternative performance level is protective of human health and the environment. Section 4 of EHS Guidelines for “Construction and Decommissioning” provides additional specific guidance on the prevention and control of community health and safety impacts that may occur during a new

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<sup>4</sup> WBG EHS General Guidelines is available on: <http://www.ifc.org/wps/wcm/connect/554e8d80488658e4b76af76a6515bb18/Final%2B-%2BGeneral%2BEHS%2BGuidelines.pdf?MOD=AJPERES>

WBG EHS for Water and Sanitation is available on:  
<http://www.ifc.org/wps/wcm/connect/e22c050048855ae0875cd76a6515bb18/Final%2B-%2BWater%2Band%2BSanitation.pdf?MOD=AJPERES>

project development, at the end of the project life-cycle, or due to expansion or modification of existing project facilities.

## **5.4. Other Applicable Laws, Guides and Conventions**

### **5.4.1. Labour Law no. 71 – 1987**

All works under this Project must be carried out in compliance with the Iraqi Labor Law. Under this Law, equal working conditions and equal opportunities must be guaranteed to all Iraqi citizens able to work, with no discrimination on gender, race, language, or religion bases. All employers and managers, in virtue of the Law, take the responsibility for watching over good behaviors and maintaining decency of child labor, and apprentices less than 18 years old, as well as women work at their workplace. The Law also prohibits child work at hazardous or too strenuous workplaces if under 18. Workers must follow orders and instructions regarding measures of protection and occupational safety and must carefully use the protective devices entrusted to them.

### **5.4.2. Antiquities and Heritage Law no. 55 – 2002**

It is considered a violation of the Law discovering, taking, purchasing or receiving as a gift any antiquity or heritage material that originated in Iraq, without promptly notifying and registering the object with the State Board of Antiquities and Heritage. No one is allowed, by means of excavating, digging, or discovering, to take antiquity material without a written permit. The same is applied to removing or transporting any antiquity or heritage material from Iraq to abroad.

Violating the provisions of the Law could lead to imprisonment (up to 10 years) and a fine of 100,000 IQD. However, illegal excavation would lead to imprisonment (up to 15 years) and a fine of two times the value of the damages sustained. Trafficking in antiquities, on the other hand, is punishable with imprisoning for a period not exceeding 10 years and a fine of up to 1,000,000 IQD.

### **5.4.3. Acquisition Law no. 12 – 1981**

This Law is applicable to all properties of agricultural, non-agricultural lands and orchards. Disposal rights of government-owned land. And other original specified rights relevant to property.

This law is the only Iraqi law that governs the rules of expropriation of property for the purposes of public benefit. According to the Law, acquisition includes: expropriation of property through acquisition, or is, by virtue of the acquisition, similar to taking over the compensations and replacement costs, cancelling the legal right and other applications of expropriation, for the public benefit. The law has adopted rules and foundations common to fair compensation for all property acquisition and guarantees the rights of possessor without prejudice to public interest.

The Law stresses the importance of fair compensation especially for agricultural lands. The Law highlights procedures for negotiating expropriation with the property owner, and addresses administrative acquisition cases.

The Law, so far, has no reference to compensation for lost assets, income, means of livelihood, or displacement from land of no legal right.

#### 5.4.4. Involuntary Resettlement OP/BP 4.12 – The World Bank Group

This policy is triggered in situations involving involuntary taking of land and involuntary restrictions of access to legally designated parks and protected areas. The policy aims to avoid involuntary resettlement to the extent feasible, or to minimize and mitigate its adverse social and economic impacts. It promotes participation of displaced people in resettlement planning and implementation, and its key economic objective is to assist displaced persons in their efforts to improve or at least restore their incomes and standards of living after displacement. The policy prescribes compensation and other resettlement measures to achieve its objectives and requires that borrowers prepare adequate resettlement planning instruments prior to Bank appraisal of proposed projects. The subprojects of rehabilitating Habibiya Doura and Ghazaliya SPSs and main trunk line of Ghazaliya will not involve loss of land. However, around 150 small shops and kiosks could be found in the Right of Way, alongside the course of trunk main in Ghazaliya. Relocation is not required (as confirmed by officials). In the very unlikely scenario that relocation could happen, some minor socio-economic effects, like temporary loss of livelihood due to possible relocation and interruption of social and economic daily life, might be seen on adjacent businesses. Rehabilitation will take place on existing locations and structures of the pumping stations, including existing course for the trunk main, and preparing for work within non-private areas. Involuntary Resettlement OP/BP 4.12 hence, is only triggered for precautionary measures. Therefore, the BWSIP will prepare a Resettlement Policy Framework (RPF) to establish a reference and provide guidance for addressing any unexpected socio-economic impacts that could result by implementing and operating the project.

#### 5.4.5. UN Framework Convention on Climate Change and Kyoto Protocol

This Convention was adopted on 9<sup>th</sup> of May 1992. The 149 states and regional economic integration organizations of the Convention have deposited instruments of ratifications, accessions, approvals or acceptances. Kyoto Protocol constitutes an international and legally binding agreement to reduce greenhouse gases emissions worldwide. The Convention calls for stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous man-made interference with the climate system. Sufficient timeframe should be adopted to allow ecosystems to adapt naturally to climate change. In so doing, food production will not be threatened and economic development will be enabled to proceed in a sustainable manner.

#### 5.4.6. Convention on Biological Diversity

Signed in 1992, the Convention is the first global agreement on the conservation and sustainable use of biological diversity. And it is legally binding for member states. The Convention has three main goals:

- Conservation of diversity;
- Sustainable use of the components of biodiversity; and
- Sharing the benefits arising from the commercial and other utilization of genetic resources in a fair and equitable way.

Main issues include:

- Regulate or manage biological resources important for the conservation of biological diversity whether within or outside protection areas with a view to ensure their conservation and sustainable use;
- Promote the protection of ecosystem, natural habitats and the maintenance of viable population of species in natural surroundings;
- Endeavour to provide the conditions needed for compatibility between present uses and the conservation of biological diversity and sustainable use of its components;
- Where a significant adverse effect on biological diversity has been determined pursuant to Articles 7, regulate and manage the relevant processes and categories of activities;
- Encourage cooperation between its governmental authorities and its private sector in developing methods for sustainable use of biological resources; and
- Promote participation of stakeholder, particularly when it comes to assessing the environmental impacts of development projects that threaten biological diversity.

## 5.5. Environmental Assessment Regulatory Framework

### 5.5.1. The Iraqi framework

#### **Environmental Assessment – Establishing the Ministry of Environment Law No. 37 – 2008**

Because of the importance of protecting and improving the environment and since the Ministry of Environment bears the prime responsibility for protecting the environment and the public health to ensure sustainable development and to achieve international and regional cooperation, this Law was legislated to define the MOE structure, its goals and the means of implementing them.

Article 1: defines the "environmental impact assessment" as the study by which analysis and study of environmental feasibility is conducted for proposed projects. Projects under this requirement are those expected to have effects on human health and environment integrity as a result of going through the project cycle,

Article 4: under item 3, the Ministry of Environment (MoE) is responsible for preparing regulations and issuing instructions for environmental measures and monitoring their best implementation. While under item 8, MoE has the authority to approve locations for new developments in terms of their environmental context, and give advice in coordination with other responsible ministries and entities. Item 14 of this article, however, is making clear the authority given to the MoE to either approve or reject EIAs according to further instructions issued for this purpose.

The Law also empowers the local councils for protection and improvement of the environment to perform field inspections, and monitor actual implementation of environmental management plans on the ground, as well as apply a fine system should provisions of the Law be breached.

#### **EIA categorization – Environmental Criteria for Carrying out Projects and Monitoring Appropriateness of Implementation Instructions no. 3 – 2011**

In the virtue of Item 3 of Article 4 of Ministry of Environment Law no. 37 – 2008, and Item 2 of Article 38 of the Protection and Improvement of Environment Law no. 27 – 2009, these instructions were issued by the MoE to set criteria for classifying projects in Iraq into 3 main categories: A, B, and C, which will be used later on to either approve or reject the proposed project location in light of identified impacts. The criteria were based on level of significance of adverse impacts and magnitude of impacts/ boundaries of influence. Accordingly, projects should be categorized under one of the following for an environmental assessment:

- **Category A:** Projects within this level are expected to have high significant impacts on the vulnerable biological environment, locations of cultural values, or impacts having a much broader area compared to where the project is taking place. Under this category, a resettlement could be triggered as a result of implementing the project. For each type of projects listed under Category A, a set of recommendations/ mitigation measures was proposed;
- **Category B:** Projects within this level are expected to have less significant impacts compared to those of Category A, but these impacts would be considered irreversible on the biological environment. Impacts of Projects under this category are described as being site-specific; a range of mitigation measures could be applied to alleviate negative impacts. A preliminary EIA is to be prepared.
- **Category C:** Projects within this level are expected to have no or minimal adverse impacts on the environment; any resulting impacts could be fully controlled/ minimized. No EIA is required in this case.

The project proponent is also required to apply for an environmental compliance certificate from the Ministry of Environment by initially undergoing an environmental screening/assessment to account for the expected impacts. If not clearly listed in any of the three categories' projects, the project will be screened out by the Ministry of Environment given the submission of necessary documentation by the project proponent.

Note: Projects of storm water and sewerage pumping/lifting stations are categorized "C" under Article 62 of these instructions.

### **EIA Content – Protection and Improvement of the Environment Law no. 27 – 2009**

Article 3: declares the establishment of the "Council for Protection and Improvement of the Environment", which also defines composition, roles and responsibilities, and procedural matters. Such Council is also authorized to review EIA study reports (through a provincial office).

Articles 10 of this law further describes the procedures related to EIA studies as follows:

A project proponent must be committed to providing an EIA study prior to project commencement. The EIA study must include the following:

1. Assessment of positive and negative impacts as a result of project activities;
2. Proposition of mitigation measures to prevent or treat contamination and pollution sources in accordance with the acceptable environmental standards and guidelines;

3. Adoption and discussion of measures for the prevention of potential contamination and emergency pollution;
4. Assessment of alternatives in terms of utilizing proper means/technology that cause the least impact to the environment; in addition to rationalizing and managing the consumption of resources;
5. Reduction and management of wastes and adoption of measures for reuse of materials, and recycling, wherever possible;
6. Estimation of the environmental feasibility of the project and the cost of pollution to production ratio. The technical and economic feasibility study for any project must include the EIA study as described in the first item.

### **Common Procedure for Obtaining Environmental Compliance Certificate in Iraq**

The following figure explains the common procedure that a project proponent should follow in order to obtain an environmental approval (Environmental Compliance Certificate) from the Iraqi Ministry of Environment.



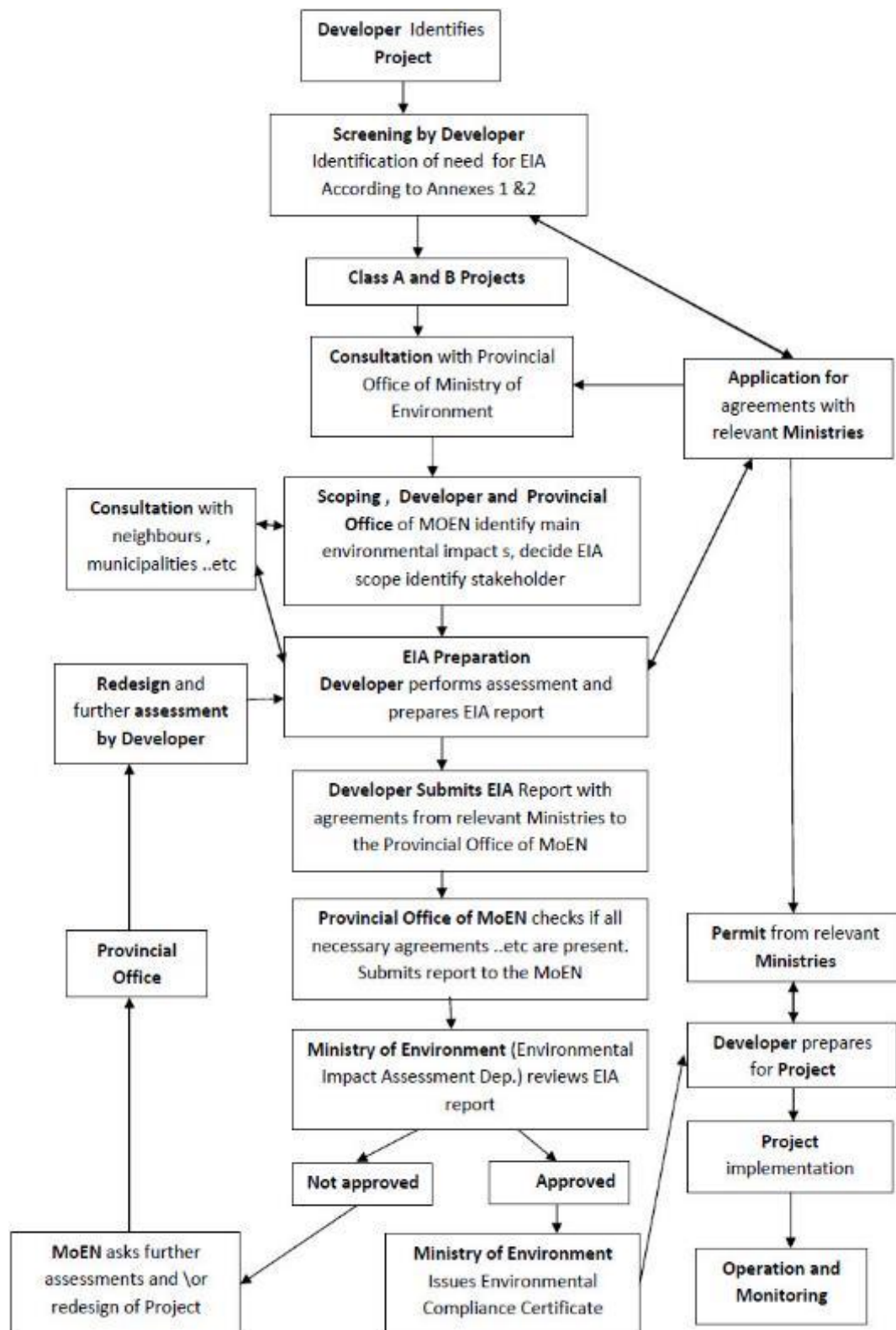


Figure 21: Simplified EIA process diagram in Iraq – categories A and B

Source: United Nations Economic Commission for Europe (UNECE) – 2010

## 5.5.2. The World Bank's EIA framework

### Environmental Assessment – OP/BP 4.01

This OP/BP 4.01 of the World Bank sets objectives, triggers, and implementation mechanisms, which collectively constitute the overarching safeguard policy to identify, avoid, and mitigate the potential negative environmental and social impacts associated with the Bank's lending operations. In the World Bank operations, the purpose of Environmental Assessment (EA) is to improve decision making, to ensure that project options under consideration are sound and sustainable, and that potentially affected people have been properly consulted. The borrower is responsible for carrying out the EA and the Bank advises the borrower on the Bank's EA requirements. The Bank classifies the proposed project into three major categories, depending on the type, location, sensitivity, and scale of the project and the nature and magnitude of its environmental impacts. These are as follows:

- Category "A": The proposed project is likely to have significant adverse environmental impacts that are sensitive, diverse, or unprecedented. These impacts may affect an area broader than the sites or facilities subject to physical works.
- Category "B": The proposed project's potential adverse environmental impacts on the human population or the environmentally important areas-including wetlands, forests, grasslands, or other natural habitats- are less adverse than those of Category "A" projects. These impacts are site-specific; few of them, if any, are irreversible; and in most cases, mitigation measures can be designed more readily than Category "A" projects.
- Category "C": The proposed project is likely to have minimal or no adverse environmental impacts.

### Environmental Assessment Bank Procedure

The following diagram summarizes the procedure for obtaining the WB's environmental clearance.

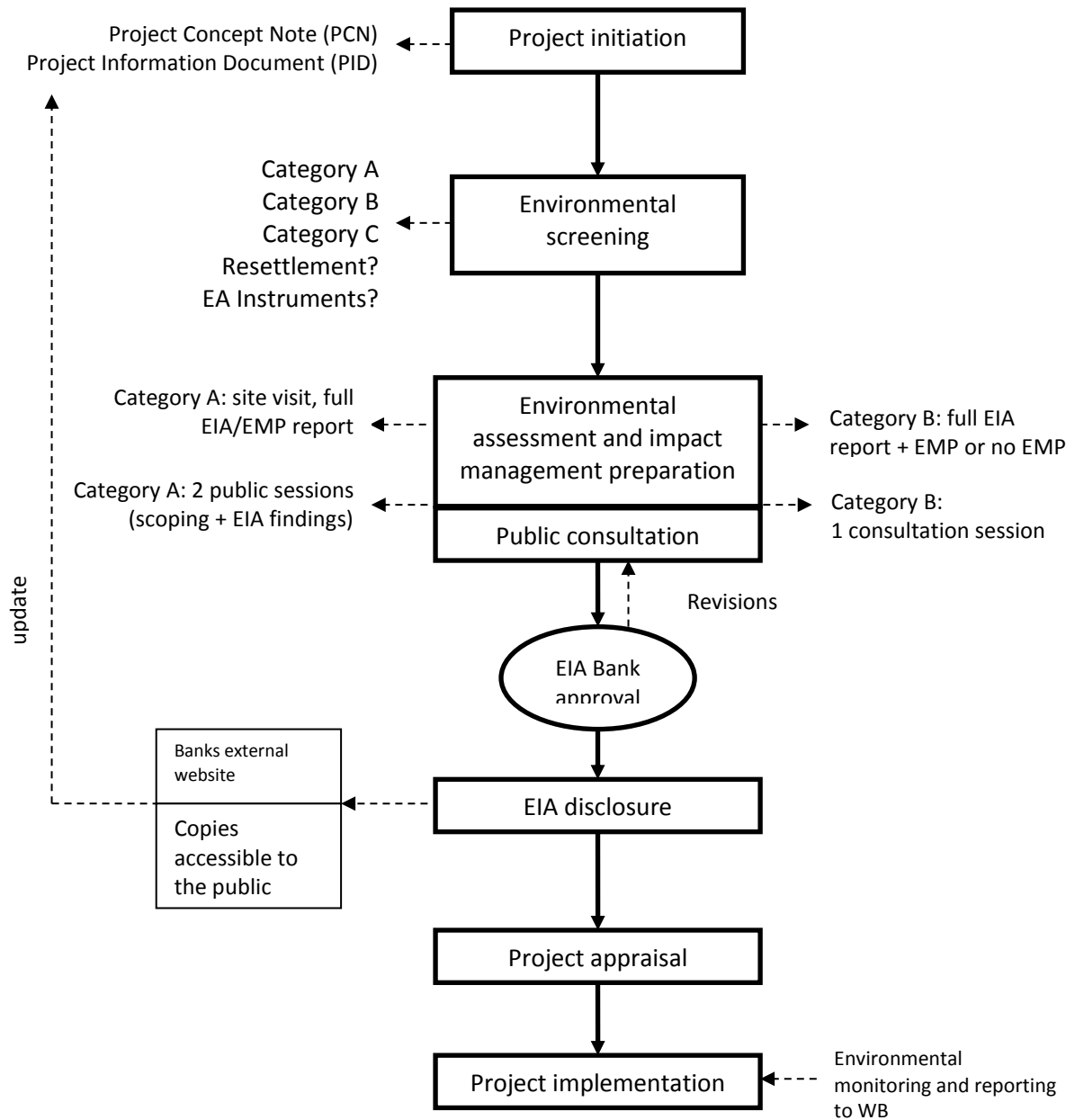


Figure 22: Simplified EIA process diagram according to the World Bank Operations Manual

### 5.5.3. Gap analysis

The Project – rehabilitation of Al-Habibiya, Al-Doura 1, and Al-Ghazaliya subprojects – is financed by the World Bank, which entails fulfilling environmental and social safeguards issued by the World Bank Group. Once safeguards have been fulfilled, the financial assistance will be authorized for the borrower accordingly. At the same time, the Project needs to be approved locally from the Iraqi Ministry of Environment, which by the Law, is responsible for screening out the project, reviewing EIA study report, and accordingly issuing certificate of environmental compliance.

As mentioned above, the Council for Protection and Improvement of the Environment (established by virtue of Law 27) has set out 3 categories/ levels of environmental assessment against which a project in Iraq should be classified. These 3 categories were based on the level of significance and magnitude/ boundaries of effect that a project would have on the environment. The 3 categories of Iraqi instructions furnished by the Iraqi Government were also based on as the same criteria as those set out by the WB; (severity on a proposed location, and magnitude/ boundaries of influence).

This Project is taking place on an existing infrastructure, including no new constructions, no additional land, and no involuntary resettlement, thus, environmental and social impacts are much localized and could be managed easily. Therefore, the project is screened out as category B (i.e. partial assessment) should the new interventions, in general, have less significant and site-specific impacts on the surrounding environment. On the other hand, the Iraqi instructions no. 3 explicitly classifies storm water and sewerage pumping/lifting stations projects under category C (Article 62), which implies that a project of rehabilitating existing sewerage pumping/lifting stations could also be classified as category C. According to instructions 3, requirements of obtaining an environmental clearance under category C is less stringent than those of category B. which means that some instruments required by the WB could be dropped off by the Iraqi Ministry of Environment, yet no major mismatch is expected in the way impacts are analyzed. In any scenario, the project proponent (the BSA in this case) must approach the Ministry of Environment as early as possible to get the requirements for attaining an Environmental Clearance Certificate and to establish agreement and harmony between the Iraqi and WB's sets of requirements.

On another hand, the WB's requirements for category B projects would entail the undertaking of a public consultation, in order to share views with Project Affected Persons (PAPs) before commencing the Project; to collect feedback about the most pressing environmental and social areas to be assessed; and to put the most feasible and sound mitigatory measures that would ensure best attenuation of adverse impacts. A public participation requirement for development projects in Iraq is neither explicitly mentioned in the aforementioned Iraqi EIA instructions, nor is it referred to in the Iraqi Laws 37 and 27. This would also constitute another shortcoming. Conducting a public consultation for this project would fulfill WB's requirements and consequently would not cause any conflict with the Iraqi EIA process.

The Project of rehabilitating Al-Habibiya, Al-Doura and Al-Ghazaliya SPSs is all about introducing new interventions to existing facilities and does not require any additional land to expand. Thus no involuntary resettlement is foreseen in this Project. In the very unlikely cases, where relocation could happen, , the Project has triggered OP/BP 4.12 as a precautionary measure and hence, prepared a Resettlement Policy Framework (RPF) to provide a suitable guidance.

It is worth mentioning that involuntary resettlement is addressed in the WB's "Involuntary Resettlement OP/BP 4.12" in terms of applicability and means for compensation. However, the Iraqi "Acquisition Law no. 12" does not entitle such vulnerable group (those who do not have the legal right on a property, and are subject to involuntary loss of livelihoods/assets) for any kind of compensation in return. This leads to a potential shortcoming in the area of involuntary resettlement.

With respect to disclosing EIA study findings, the Bank requires the disclosure of the EIA findings to the public in an accessible way and by using a language fairly understandable by the target community. This is attained through providing a non-technical summary of the study (officially referred to as an Executive Summary) in the same language as of the receiving community. The WB would also publish the whole EIA study on the Bank's external website. This requirement is adequately explained in both "Environmental Assessment OP/BP 4.01" and "The World Bank Policy on Access to Information" of the World Bank Group. There is neither a clear mentioning on the need to disclose the findings of the EIA study publicly, by the Iraqi framework, nor is it specifying how such information could reach the hands of the target community.

The following table may provide a brief analysis of different EIA process requirements between the WB's and Iraqi frameworks/safeguards.

Table 17: the WB's and Iraqi EIA frameworks – analysis of requirements

EIA framework	Requirements					
	Classification of projects according to severity of impacts and magnitude	Classification of Rehabilitation of Habibiya, Doura & Ghazaliya subprojects	Level of EIA study	Public Participation	Involuntary Resettlement	EIA disclosure
<b>WB's</b>	Fairly presented	Category B	Full EIA + EMP	Fairly presented in OP/BP 4.01	Fairly presented in OP/BP 4.12	Fairly presented in OP/BP 4.01 and Policy on Access to Information
<b>Iraqi</b>	Fairly presented	Anticipated category C	Anticipated EIA report (must be included in technical and feasibility study)	Not presented	Not presented	Not presented
<b>Action proposed</b>	N/A	Consult MoE at the earliest convenience	Proceed with full EIA including EMP	Proceed with a public consultation meeting	Prepare RPF according to OP/BP 4.12	Disclose through a public consultation/ Bank's external website

## 6. PUBLIC CONSULTATION

Public consultations in general aim at introducing various interventions during the lifetime of the Project to the Project Affected Persons (PAPs), to enable discussing possible environmental and social impacts in much transparency; and to collect views on how to strengthen opportunities and diminish adverse consequences brought about by the Project.

### 6.1. Public Meetings – preparations

For the three locations of sewerage subprojects (Al-Habibiya, Al-Doura, and Al-Ghazaliya) public consultations were held in order to introduce the project components in details, construction timeline, activities, potential impacts and benefits brought about by the project, and concerns and views of possible effects (including socio-economic effects). For this, the study team used a pre-designed questionnaire to collect views from participants in all three locations. Questions have concentrated on environmental impacts and issues related to public health, and were directed to people working and/or living in the vicinity of the Project area. The questionnaire applied was intended to provide a simple and straightforward means of communication. Therefore, most questions were designed for Yes/No answers. Nevertheless, it provided some space to allow for providing expectations about the rehabilitation projects, and suggestions for further improvement. Annex VIII provides all questionnaires filled out during public meetings, along with attendees' sheets.

Consultation meetings were held inside premises of Al-Habibiya, Al-Doura 1, and Al-Ghazaliya (GH6) pumping stations in 15 November 2015, 16 December, 2015, and 30 January 2017, respectively. Invitations were made individually to a randomly selected group of people, which targeted neighbors in close proximity of the pumping stations in addition to operational crews of all three stations. The consultation team, who was mostly composed of BSA personnel, has chosen to go this way for consultation (i.e. limited and randomly selected groups of people) for the following reasons:

- The locals were not expecting a new construction to pop up in their neighborhood, since all stations were already existing and running (either fully or partially). And no new services were to be introduced by the Project;
- At the time meetings were conducted, life was not going smoothly, and the area was lacking enough security to go about a meeting in public;
- Simple questions were used to match educational level of participants, who were mostly expected from community elders;
- Some people were reached out at their workplace as getting them in one place would require more time and effort;
- Effects generated from pumping stations are much localized, more focus was made on receptors residing within an area not exceeding 1 – 3.5 km in diameter;

The following subsections provide a review of feedback collected at the aforementioned consultation meetings.

## 6.2. Al-Habibiya SPS Consultation Meeting – 15 November, 2015

The Baghdad Sewerage Authority (BSA) has conducted a consultation meeting for Al-Habibiya SPS rehabilitation Project on the 15th of November 2015. The meeting was held in the premises of Al-Habibiya pumping station, and included 26 interviewees (men and women), who represented local people living in the vicinity of the station (see figure 21), along with some attendees from BSA and Al-Habibiya SPS (see Annex VIII for the attendees' sheet).



Figure 23: Photos of the consultation meeting – Al-Habibiya SPS

The following table summarizes distribution of participants according to gender, education, and profession.

Table 18: Distribution of participants by gender, education, and profession – Al-Habibiya SPS

#	Name	Gender	Education	Profession	Email/ Phone
1	Farked kadhemi Atyeh	F	First degree	Housekeeper	<a href="mailto:farkedK@yahoo.com">farkedK@yahoo.com</a> 07702646147
2	Raja' Hameed Ibrahim	F	First degree	Teacher	-
3	Ahmed Kadhemi Atyeh	M	First degree	Free business	<a href="mailto:Ahmedhillo@gmail.com">Ahmedhillo@gmail.com</a> 07700071251
4	Haneen Adel Qasem	F	Basic school	Student	<a href="mailto:HaneenAlhasony@gmail.com">HaneenAlhasony@gmail.com</a> 07712772279
5	Haider Elewi	M	First degree	Civil service/ Sadr 2 municipality	-
6	Zainab Elewi	F	First degree	Civil service/ BSA	-
7	Ameer Hatem Qasem	M	Basic school	Student	-

#	Name	Gender	Education	Profession	Email/ Phone
8	Lama Hassan	F	First degree	Housekeeper	07801543794
9	Shaima' Maitham Mahmoud	F	First degree	-	-
10	Hatem Qasem Mohammed	M	High school	Technician	-
11	Nawal Mohammed Ali	F	Basic school	Worker	-
12	Hakeem Rustom Naser	M	First degree	Civil service/ BSA	-
13	Wesam Hameed Hassan	M	First degree	Free business	-
14	Amal Muhsen Mohammed	F	First degree	Civil service/ GIS dept	<a href="mailto:Amaal.sharaa@yahoo.com">Amaal.sharaa@yahoo.com</a> 07715229154
15	Hamed Jasem Mohammed	M	First degree	Free business	07706029259
16	Sami Fenjan Al-Oqabi	M	Basic school	Free business	-
17	Ammar Bashar Sa'id	M	Basic school	Free business	07711058944
18	Ahmed Hussein Kadhem	M	Basic school	Free business	07718971304
19	Mohammed Hamzeh Elewi	M	Basic school	Free business	07709205576
20	Karam Mohsen Mohammed	M	Basic school	Free business	-
21	Nofal Omran Norouz	M	Basic school	-	-
22	Ahmad Jasem Hameed	M	Basic school	Free business	-
23	Kafi Muhsen	M	Basic school	Civil service/ Al-Habibiya SPS	07728140606
24	Rasool Hmoud	M	Literate	Free business	-
25	Mortada Jasem	M	Basic school	Free business	07704982360
26	Ra'ed Mokhles Swadi	M	Basic school	Free business	-
<b>Total participants: 26</b> <b>Gender:</b> Male: 18 (69%), Female: 8 (31%) <b>Education level:</b> Literate: 1 (3.8%), Basic school: 13 (50.0%), High school: 1 (3.8%), First degree: 11 (42.4%) <b>Profession:</b> None: 2 (7.7%), Housekeeper: 2 (7.7%), Student: 2 (7.7%), Worker: 1 (3.8%), Technician: 1 (3.8%), Free business: 12 (46.2%), Teacher: 1 (3.8%), Civil service: 5 (19.3%)					

### 6.3. Al-Doura SPS Consultation Meeting– 16 December, 2015

BSA has also held a consultation meeting with PAPs of the Project, during which an introduction was made on the Project's interventions, and feedback on expectations and concerns was collected. The meeting was held in the premises of the Al-Doura pumping station, and included 25 interviewees (men and women), who represented local people living in the vicinity of the station, along with some participation from BSA and Al-Habibiya SPS personnel (see Annex VIII for the attendees' sheet).





Figure 24: Photos of the consultation meeting – Al-Doura SPS

The following table shows distribution of participants according to gender, education, and profession.

Table 19: Distribution of participants by gender, education, and profession – Al-Doura SPS

#	Name	Gender	Education	Profession	Email/ Phone
1	Abbas Sa'ed Sadeq	M	Basic school	Free business	07500492918
2	Ziad Tareq Hussein	M	First degree	Civil service/ Al-	07906740769

#	Name	Gender	Education	Profession	Email/ Phone
				Doura SPS	
3	Asma' Abdel Wahid	F	Diploma	Civil service	07728629036
4	Salem Jasem Eid	M	Basic school	Free business	07710066609
5	Ali Abdel Hussein Tali	M	PhD	Parliament representative	-
6	Salam Mansour Elewi	F	Diploma	-	-
7	Qasem Habib	M	Basic school	Free business	-
8	Mushtaq Abdel Kadhem	M	Basic school	Parliament representative	-
9	Na'om Jasem Sadeq	F	Diploma	Retired	07814228194
10	Haider Hashem Mohammed	M	Basic school	Retired	07712046007
11	Maitham Mansour Al-Wes	M	Basic school	Civil service	07717844995
12	Ahmed Muhsen	M	First degree	Free business	07904189909
13	Sami Fadel	M	Basic school	Free business	-
14	Haider Jasem Fadel	M	Basic school	Free business	0780202731
15	Alia' Imad	F	Basic school	Housekeeper	07715161379
16	Flah Abu-Hadlah	M	Basic school	Free business	-
17	Obeidah Jaddou'	F	Literate	Housekeeper	-
18	Fu'ad Ajami	M	Basic school	Free business	-
19	Imad Hekmat	M	Basic school	Policeman	-
20	Salah Abu-Hadlah Hadi	M	Basic school	Free business	07700484622
21	Salem Jasem	M	Basic school	Free business	-
22	Zuhair Mahdi Hamadi	M	Basic school	Free business	-
23	Laith Jaber	M	Basic school	-	-
24	Issam Khaled Mahdi	M	Basic school	Free business	-
25	Azhar Ali Hannoun	F	Basic school	Housekeeper	07714461634
26	Jasem Nasif	M	Basic school	Business owner	-
<p><b>Total participants:</b> 26  <b>Gender:</b> Male: 20 (77%), Female: 6 (23%)  <b>Education level:</b> Literate: 1 (3.8%), Basic school: 19 (73.1%), Diploma: 3 (11.6%), First degree: 2 (7.7%), PhD: 1 (3.8%)  <b>Profession:</b> None: 2 (7.7%), Retired: 2 (7.7%), Housekeeper: 3 (11.5%), Free business: 13 (50.0%), Civil service: 6 (23.1%),</p>					

#### 6.4. Al-Ghazaliya SPSs Consultation Meeting– 30 January, 2017

Additionally, the Baghdad Sewerage Authority (BSA) has conducted a consultation meeting for Al-Ghazaliya rehabilitation project of main sewer line and 5 pumping stations on the 30<sup>th</sup> of January 2017. The meeting was held in the premises of Al-Ghazaliya 6 pumping station (GH6), and included 23 interviewees (men & women), who represented local people living in the vicinity of the station, as well as operational staff of pumping stations (see Photos below ). See Annex VIII for the attendees' sheet.



Figure 25: Photos of the consultation meeting – Al-Ghazaliya SPS (GH6)

The following table shows distribution of participants according to gender, education, and profession.

Table 20: Distribution of participants by gender, education, and profession – Al-Ghazaliya subprojects

#	Name	Gender	Education	Profession	Email/ Phone
1	Eman Ali Hussein	F	First degree	Employee	
2	Anwar Hasan Mohammed	F	High school	Housekeeper	
3	Salman Hashim	M	High school	Karkh	
4	Mustafa Ibrahim	M	Basic school	Free business	
5	Ameer Jawad Ali	M	First degree	Employee	
6	Alawi Sa'eed Qamer	M	Basic school	Employee	07901670060
7	Rou'a Abdul Razaq Ali	F	First degree	Housekeeper	07801596531
8	Yousef Khalil Ibrahim	M	First degree	Free business	07801543794
9	Ali Ahmed Mahmoud	M	Diploma	Private sector employee	07731218901
10	Ahmed Waleed Abdulla	M	Diploma	Employee	
11	Mohanad Adel	M	First degree	Free business	
12	Abdul Rahman Abdulla	M	First degree	Free business	
13	Adnan Majeed Ahmad	M	Basic school	Free business	
14	Jabar Mohammad Ali	M	High school	Employee	

#	Name	Gender	Education	Profession	Email/ Phone
15	Hisham Haitham Talib	M	First degree	Employee	
16	Jawad Sebty Najim	M	Basic school	Free business	
17	Atheer Ashor	M	Literate	Free business	
18	Shaimaa Mohmmad	F	First degree	Housekeeper	
19	Ahmed Taha	M	High school	Retired	
20	Ghaneya Mohammed Jasim	F	Diploma	Housekeeper	
21	Nawres Sabah Khalil	F	First degree	-	
22	Bashar Ahmed Khudair	M	Basic school	Free business	
23	Saif Ahmed Abed	M	First degree	Employee	07717751840
<p>Total participants: 23  Gender: Male: 17 (74%), Female: 6 (26%)  Education level: Literate: 1 (4.3%), Basic school: 5 (21.7%), High school: 4(17.3%), First degree &amp;Diploma: 13 (56.6%)  Profession: None: 2 (8.6%), Housekeeper: 4 (17.4%), Employee &amp; private sector employee: 8 (34.8%), Free business: 8 (34.8%), Retired: 1 (4.3%).</p>					

## 6.5. Consultation Results

Interviews of the all three consultation meetings (a total of 75 people) have resulted in the following outcome:

Table 21: Feedback collected on a prepared public consultation questionnaires

#	Question	Answer		
		Yes	No	No answer
1	Are you impacted by noise when operating pumps, motors, and other parts of the SPS?	50 (66.7%)	25 (33.3%)	0
2	Are you impacted by odors and fumes generating from the SPS?	65 (86.7%)	10 (13.3%)	0
3	Do you have any health problems linked to emissions from the Sewerage Pumping Station?	39 (52.0%)	35 (46.7%)	1 (1.3%)
4	Do you expect that rehabilitation work will provide job opportunities in your neighborhood?	49 (94.2%)	2 (3.8%)	1 (2.0%)
5	Do you think installing fumes and odor scrubbers in the SPS will help reduce risk of harmful emissions?	70 (93.3%)	3 (4.0%)	2 (2.7%)

Participants were also given the opportunity to express their expectations after rehabilitation works have been concluded. Expectations are summarized as follows:

- More investment in the wastewater sector to enhance services and connect more users;
- Enhancing air quality through reducing bad smells and air pollutants generating from the pumping stations;
- Reducing flooding incidents;
- Reducing communicable diseases and enjoying a healthier and more hygienic life,

- Avoiding/ Reducing flooding incidents by developing operational procedures pertinent to overflows and diversions;
- Providing job opportunities for the local community;
- Positive impacts on the surrounding environment, increasing green areas, and reducing environmental pollution;
- Avoiding incidents of clogging the piping system and decreasing overflows in Al-Karkh, Abu-Disher and Al-Ghazaliya areas; and
- Relocating pumping stations outside populated areas.

According to participants, areas for improvement are best described as follows:

- Providing an enclosed design to help avoid emissions to outer environment;
- Providing proper ventilation systems to minimize air emissions in a modernized way;
- Setting pumping stations in as far away as possible from populated areas, in order to reduce noise and contamination;
- Providing a better landscape to the area and planting trees to avoid topsoil erosion,
- Targeting local people when advertising job opportunities;
- Fulfilling the neighborhood's needs of power supply;
- Completing rehabilitation works as planned (by BSA), and selecting competent international companies to finish the job properly;
- Flushing sewerage pipelines and mains; and
- Fixing damages in main lines.

## 6.6. Other Means of Public Feedback

Service users could also lodge their complaints electronically through social media. The Mayorality of Baghdad has dedicated a page on Facebook in order to facilitate complaints from the public (<http://www.amanatbaghdad.gov.iq/facebook>). The project team of BSA was able to collect some comments received via this page, which generally have expressed the need for implementation of sewerage pumping stations and network projects, and have emphasized the importance of maintenance work after rehabilitation. Specifically for Al-Ghazaliya subprojects, a number of complaints from the local community (657 Colonels, 679, Salam, and Um Al-Qura) were randomly selected and summarized in the following table.

Table 22: Summary complaints about wastewater services in Al-Ghazaliya district

#	Complainer	Date of complaint	Subject of complaint
1	Ahmed Alsaidy	6/10/2016	Sewer flooding in the Neighborhood 679 alley 70 Ghazaliya
2	Lawyer Hussain Fadel	26/10/2016	The need to serve the Neighborhood 657 (Behind Um Al-Qura) Ghazaliya by network streams
3	Um Taib	6/11/2016	The need to serve the Neighborhood 679 alley 40 Ghazaliya by network streams
4	Abu Farouq	6/11/2016	Sewer flooding The need to serve the Neighborhood 657 Ghazaliya by network streams
5	Mohammed Nidhal	7/11/2016	The need to serve the Neighborhood 657 Ghazaliya by network streams

#	Complainer	Date of complaint	Subject of complaint
6	Mohammad Espro	8/11/2016	The need to serve the Neighborhood 657 (Colonels) Ghazaliya by network streams
7	Mahmod Yaseen Al-Awsi	12/11/2016	The need to serve the Neighborhood 679 Ghazaliya by network streams
8	Lawyer Hussain Fadel	12/11/2016	The need to serve the Neighborhood 657 Ghazaliya by network streams
9	Abu Farouq	16/11/2016	Sewer flooding The need to serve the Neighborhood 657 Ghazaliya by network streams
10	Wafaa Fawzi Al-Jubori	29/11/2016	The need to serve the Neighborhoods 657 (peace, Colonels, 19-21) Ghazaliya by network streams
11	Ibrahim Al-Mufraji	23/12/2016	The need to serve the Neighborhood 657 Ghazaliya by network streams
12	Mohammed Nidhal	24/12/2016	The need to serve the Neighborhoods 657( Um Al-Qura) Ghazaliya by network streams

MOB usually responds to pressing needs, like flooding incidents, and considers other long term needs in its planning for infrastructural projects.

## 6.7. Grievance Redress Mechanism

Throughout the lifetime of the Project, it is expected that the PAPs could receive very limited and less significant socio-economic impacts. These could be attributed to:

- Temporary interruption of daily social and economic activities by the Project activities,
- Temporary loss of comfort and welfare due to nuisance resulted by the Project to the neighborhood,
- Potential loss of opportunities for the local community to take part in the construction phase.

For any of the cases above, expected to arise during the lifecycle of the Project, It is required that, a Grievance Redress Mechanism (GRM) be setup in the early planning stages of the Project. This provision should be managed and maintained at the MOB level. This mechanism could also be integrated into the already existing complaining system at MOB. In addition to the official channel, it is encouraged to establish a Grievance Redress Mechanism at the project level to ensure any grievance can be addressed in an amicable manner. Resolving complaints at community level is always encouraged as it could address the problem of distance and cost the PAP may have to face in pursuing grievance redress. However, the whole process of raising a complaint should be described to the Project Affected Persons (PAPs) prior to commencing construction activities. This could be done by reaching out the community or by conducting a meeting with community representatives. In this regard, PAPs had the opportunity to learn about the current complaining system of MOB during public meetings. The GRM should also facilitate lodging a complaint by PAP(s) easily and anonymously. However, the form of the GRM should be posted at each subproject site in Arabic Language with the contact information of the person in charge. Information to be deposited in the complaining system, include contact information, a full description of the issue, and attaching to it all necessary material to support the case (see a sample form for GRM in Annex VII). GRM should be accessible to all PAPs (by writing, phone, email, official portals) and should be able to receive grievances and complaints at any time of the Project lifecycle. Personnel responsible for processing complaints have to inform complainers on the legal time period for responding to the grievance/

complaint in final. Responses to complainers should be returned in no more than 14 calendar days, and before handing the site over to the contractor(s), i.e. before the actual commencement of decommissioning/ construction activities. The complainers will have the right to appeal their case at a tribunal should the offered compensation(s) deemed unsatisfactory. The GRC should continuously report updates to the MOB higher management and to the World Bank Group. Refer to Resettlement Policy Framework (RPF) of BWSIP for more details.

## 7. ASSESSMENT APPROACH

This Project is taking place on an existing infrastructure in specific locations, including no new constructions, no additional land, and no expected involuntary resettlement, thus, environmental and social interventions are much localized, impacts are less significant and site-specific, and could be managed easily. Consequently, the project is screened out as category B according to the provisions of WB's OP/BP 4.01: Environmental Assessment, which means conducting partial environmental and social assessment, and preparing ESIA/ESMP.

As described for the components of the proposed Project, there is either the Project or the No-Project alternative. This chapter aims to provide a full discussion of positive and negative impacts brought about by implementing or not implementing the proposed Project.

Either implemented or not implemented, the operational process of all pumping stations would still resemble the following interaction with the surroundings (see figure below). This kind of interaction will involve four main categories, and these are: the local community, the biotic and abiotic environments, as well as the personnel responsible for operation, maintenance and supervision.

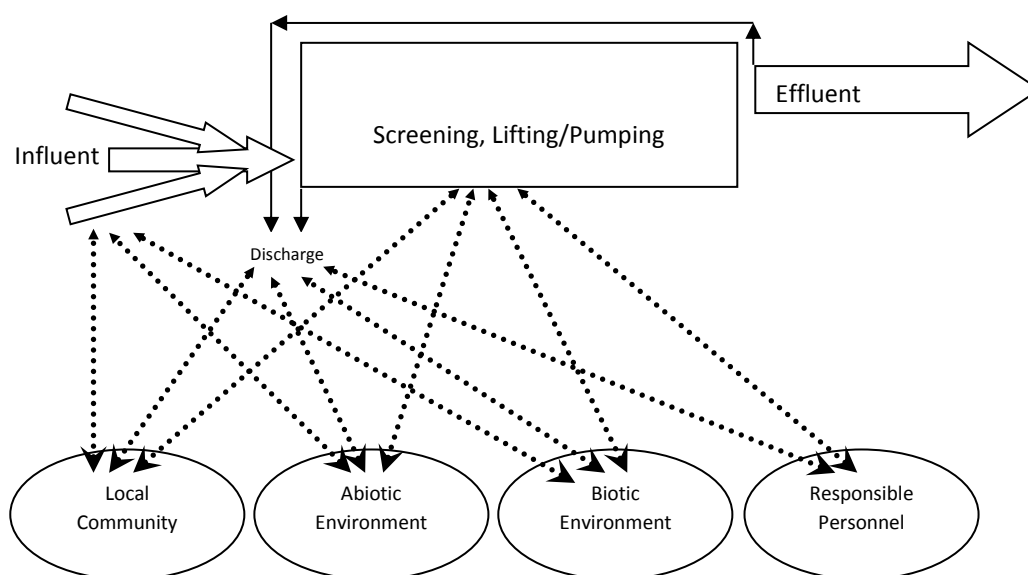


Figure 26: Interaction between the sewerage pumping process and the surrounding

The above diagram suggests that the process of lifting/pumping sewerage has three key points of interaction with the surroundings, and these encompass stages of receiving influents, in-house activities, and managing overflows.

When the effluents are ready to exit the process (final stage), integrity is ensured, and very unlikely interaction is anticipated. However, this unlikely interaction may occur in extremely unusual conditions like vandalism/looting actions, war, or natural catastrophes.

Impact analysis presented in the following subsequent sections will study positive and negative impacts brought about by the suggested interactions during the operational phase of the No-Project



scenario, and during decommissioning/constructional and operational/maintenance phases of the proposed Project.

As suggested above, the process involved in this kind of industry will mainly interact with the following four sensitive receptors:

- The local community: including people advantaged by connecting to the sanitation service, people illegally connecting to the service, and people staying shortly in close proximity to the pumping station without necessarily benefiting from the service,
- Responsible staff: this category would include on-site staff like operators, engineers, maintenance staff, guards, and janitors, as well as supervisors and higher management who could visit the site in any time,
- Biotic environment: including sensitive habitats, flora and fauna, either having a threatened/endangered listing status, of concern, or currently non-threatened.
- Abiotic environment: including non-living natural media like air, water, soil, land, as well as the human-made media which compose all existing infrastructures.

During the construction phase, impact analysis will take into account (among many others) occupational health and safety related activities, and usage of materials, road networks, and utilizing other kinds of infrastructure. This kind of impact analysis (for this phase) is mostly common for projects involving civil works, thus, impacts would be presented in a generic way. However, the study will address some specific activities like those related to decommissioning old mechanical and electrical parts, obstruction of public access (especially for activities involving pipework), as well as public engagement in the Project. Again, impacts will be evaluated against the four main sensitive receptors.

Mitigation measures are put according to industrial recommendations and guides set out locally, and promulgated in the environmental and social World Bank safeguards, as well as best practices globally recognized. However, the most stringent measures are recommended for this study.

## **7.1. Assessment Methodology**

The environmental and social assessments done for the purpose of this Project have utilized the following references and resources:

- Applicable provisions of the laws, regulations, instructions, decrees and safeguards set out either by the Iraqi government, or the financing agency the "World Bank Group", as well as other international conventions and guides foreseen applicable to the Project;
- Baseline information collected by the Iraqi team;
- Detailed designs, design specifications, and tender documents prepared for the proposed Project;
- Public consultations at the municipal and individual levels (held on 15 Nov 2015, 16 Dec 2015, and 30 Jan 2016);
- Literature review of similar investments; and

- Practical experience (expert evaluation) in the field of Environmental Assessment and Environmental Management.

By understanding the operational process that all Al-Habibiya, Al-Doura, and Al-Ghazaliya SPSs undergo, and by understanding the type of work that is deployed in the constructional phase of this type of projects, and by understanding interactions between the prescribed process and the sensitive receptors, the study team has embarked on evaluating positive and negative impacts of the two alternatives (i.e. Project and No project), during construction and operation phases. Impacts were assessed under the following three key areas:

- Physiochemical aspects: land, soil, water, air, etc.
- Biological aspects: habitats, flora, fauna, etc.
- Socio-economic aspects: public health, municipal services, etc.

The negative impacts were ranked according to their level of significance when compared to the prevailing baseline conditions, prior to starting the Project and just before any mitigation measures could take place. The ranking of level of significance included: High, Moderate, Low, Negligible, and None. Additionally, impacts were further described as being:

- Direct and indirect,
- Cumulative, and noncumulative,
- Short term and long term,

Views of the Project Affected Persons (PAPs) were also taken into consideration and consequently have been reflected on the expected type and level of impacts.

Next step was putting the soundest mitigation measures, for both construction and operation phases of the proposed Project, after which impacts were evaluated once again for their remaining level of significance, assuming mitigation measures fully implemented by responsible parties. In general, negative impacts are either to be avoided, eliminated, minimized, mitigated, or to be accepted, depending on the degree of risk each one poses. So a second round of ranking was provided to give more sense to the effectiveness of applying mitigation measures.

To ensure the best alleviation of adverse impacts during construction and operation of the Project, the study presented an Environmental and Social Management Plan (ESMP), which basically provides key requirements of managing environmental and social-related impacts; responsible parties for management; requirements, and timeline for implementing mitigation measures.

The ESMP was designed in such a way as to form a binding document to the Contractor(s) who will then hold the responsibility for integrating the ESMP in their daily work. However, the contractors as well as the Project proponent are also required to monitor environmental and social parameters and to ensure the full adherence to the ESMP, so a monitoring plan has been prepared to ensure impacts addressed to an acceptable level. Such Plan includes parameters to be monitored during construction and operation phases; Key Performance Indicators (KPIs); Monitoring requirements; Monitoring frequency and tools; as well as budgetary estimates.

## 7.2. Selection of Action Measures – Risk Assessment

In the Project lifecycle, contractors and operators are required to evaluate risk associated with their activities that have a hazardous nature. Consequently, risks associated with construction and operation activities of sanitation projects is getting more attention. Occupational health and safety related works can have a wide range of hazards in such field of activities, which are – fortunately – localized and easy to detect. Well-experienced staff should be commissioned and mobilized at the onset of the project, to extensively identify and evaluate principal risks and set out the most feasible and stringent precautions. Precautionary measures should be introduced according to the following priorities:

- Eliminating the hazard by removing the activity from the work process. Examples include substitution with less hazardous tools and materials, using different techniques, etc;
- Controlling the hazard at its source through use of engineering controls. Examples include using ventilators, isolation rooms, machine guarding, acoustic insulation, etc;
- Minimizing the hazard through design of safe work systems and administrative or institutional control measures. Examples include job rotation, training on and applying safe work procedures, lock-out and tag-out machinery according to their status, workplace monitoring, limiting exposure or work duration, etc.
- Providing appropriate Personal Protective Equipment (PPE) in conjunction with training, use, and maintenance of the PPE.

Identified risks could be evaluated according to the risk matrix shown in the table below

Table 23: Risk ranking table to classify worker scenarios based on likelihood and consequences

Likelihood	Consequences				
	Insignificant 1	Minor 2	Moderate 3	Major 4	Catastrophic 5
A. Almost certain	L	M	E	E	E
B. Likely	L	M	H	E	E
C. Moderate	L	M	H	E	E
D. Unlikely	L	L	M	H	E
E. Rare	L	L	M	H	H

*Legend*  
 E: extreme risk; immediate action required  
 H: high risk; senior management attention needed  
 M: Moderate risk; management responsibility should be specified  
 L: low risk; manage by routine procedures

Source: Environmental, Health, and Safety (EHS) Guidelines – IFC

## 8. THE "NO-PROJECT" ALTERNATIVE – IMPACTS AND POSSIBILITIES FOR MITIGATION

Basically, there will be no positive impacts gained by not implementing the proposed Project. On the contrary, if the operational situation of Al-Habibiya, Al-Doura, or Al-Ghazaliya SPSs was kept as is, the surrounding environments will receive more adverse impacts. The Tigris and the Diyala Rivers in particular, will be among the most affected abiotic environments by sanitary and emergency discharges. Moreover, quantities of disposed wastes to those water bodies are directly proportional to the operational failures at the target pumping stations. Therefore, if the operational status is not yet to be improved, receiving water bodies will remain in constant deterioration mode. Similarly, any under-ground water available in the area will also be subject to contamination. Land topping watersheds is relatively permeable and easily allows for infiltration. Moreover, water influx between the river water and the adjacent aquifers is becoming more evident.

A great amount of health hazards are also expected to arise from discharging raw sewage in upstream canals of Al-Saqlawiya, Al-Shorta and Al-Jaish and eventually enters Tigris and Diyala.

Public health, including people in residential areas and commercial establishments, will be largely impacted by flooding roads, vector nuisance, odor, and water-borne diseases from continuous failure at the pumping stations and blocked pipelines and manholes. This is also applicable to other living species in the area.

However, working staff (either on-site or visiting, but to a greater extent resident workers) will remain in direct exposure to high levels of air pollutants, noise, and vibration. Poisonous emissions from raw sewage, like hydrogen sulfide, methane, and VOCs, encountered in wet wells, confined places, and during maintenance events w/o proper ventilation, will pose high risks of suffocation and death due to insufficient ventilation or ineffective odor controlling, or inadequate usage of Personal Protective Equipment (PPE). Noise exceeding permissible limits will continue generating from poorly maintained motors and loose parts (especially in the motor rooms), hence causing more damage to hearing. Excessive vibrations generating from rotary devices and unstiffened floors will have many negative impacts that are well-annotated in literature. On another hand, workers will also be subject to electrical shocks from uncovered wiring or misused/unmaintained electrical switches and control panels.

Generally speaking, with the No-Project option, workers' health will remain in great risk due to poor usage of Personal Protective Equipment (PPE) and shortage of emission controlling measures, as well as due to insufficient precautionary measures and procedures. The following table provides a better insight to the level of significance for the No-Project scenario.

Table 24: Summary impacts for the No-Project option and possibilities for mitigation

Area of concern	Impact	Sensitive receptor	Level of significance	Mitigation?
Abiotic environment (Cross-media interaction)	Land and soil contamination due to accidental discharges	Land and soil at discharge point	H	Minimize discharges
	River water contamination due to flooding, and emergency discharges,	Receiving river bed (Diyala, Tigris)	H	Minimize discharges

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Area of concern	Impact	Sensitive receptor	Level of significance	Mitigation?
	Aquifer water contamination due to infiltration and water influx with river	Receiving aquifer basin (under-ground resources that could coexist)	H	Minimize discharges
Biotic environment (flora and fauna species)	Biological life poisoning due to high loads of chemical and microbial constituents	<ul style="list-style-type: none"> <li>- Endangered and not threatened flora at discharge point,</li> <li>- Endangered and not threatened fauna at the discharge point,</li> <li>- Aqua life (Diyala and Tigris)</li> </ul>	H	Minimize discharges
Occupational Health and Safety (OHS)	Suffocation and/or death due to inhalation of hazardous air emissions (H2S, CH4, VOCs, etc) for prolonged times.	<ul style="list-style-type: none"> <li>- On-site operators,</li> <li>- Maintenance staff,</li> <li>- Supervisors,</li> <li>- The station guards.</li> </ul>	H	<ul style="list-style-type: none"> <li>- Apply best management practices,</li> <li>- Provide PPE,</li> <li>- Provide training on first aid,</li> <li>- Spread awareness on hazards</li> </ul>
	Hearing nuisance due to exposure to excessive noise levels for prolonged times.	<ul style="list-style-type: none"> <li>- On-site operators,</li> <li>- Maintenance staff,</li> <li>- Supervisors,</li> <li>- The station guards.</li> </ul>	H	<ul style="list-style-type: none"> <li>- Apply best management practices,</li> <li>- Provide PPE,</li> <li>- Provide training on first aid,</li> <li>- Spread awareness on hazards</li> </ul>
	Vibration nuisance due to contact with unstiffened floors and vibrating parts (motors, pumps) for prolonged times.	<ul style="list-style-type: none"> <li>- Operators,</li> <li>- Maintenance staff</li> </ul>	M	<ul style="list-style-type: none"> <li>- Apply best management practices,</li> <li>- Provide PPE,</li> <li>- Provide training on first aid,</li> <li>- Spread awareness on hazards</li> </ul>
	Electrical shock due to uncovered wiring and misused/unmaintained switches and control panels	<ul style="list-style-type: none"> <li>- Operators,</li> <li>- Maintenance staff</li> </ul>	M	<ul style="list-style-type: none"> <li>- Apply best management practices,</li> <li>- Provide PPE,</li> <li>- Provide training on first aid,</li> <li>- Spread awareness on hazards</li> </ul>
Community Health & Safety	Various health issues due to direct and indirect contact with waterborne pathogens (sanitary and emergency discharges to canals and rivers),	Populations in close proximity to raw sewage outlets, including commercial and residential areas	H	<ul style="list-style-type: none"> <li>- Minimize discharges,</li> <li>- Rehabilitate blocked pipelines and manholes</li> <li>- Spread awareness on hazards</li> </ul>
	Noise and odor nuisances	Populations living or staying shortly in the vicinity of the pumping station and trunk lines and manholes.	M	<ul style="list-style-type: none"> <li>- Minimize discharges,</li> <li>- Rehabilitate blocked pipelines and manholes</li> <li>- Spread awareness on hazards</li> </ul>

Most of the above impacts are considered highly significant, which entails putting prompt and sound measures. Improvements to affected environments can only occur by fixing pollution sources, stopping/ minimizing releases, and providing enough education to PAPs. These measures would never occur on the ground unless the Project is carried out.

## 9. THE "PROJECT" ALTERNATIVE – IMPACTS AND MITIGATION

### MEASURES

#### 9.1. Positive Impacts in the Operation Phase

The rehabilitation of Al-Habibiya, Al-Doura 1, and Al-Ghazaliya subprojects are envisaged to have a number of positive impacts on all receptors described above. These are mostly foreseen in the operational phase of the Project (incl. day-to-day operations and maintenance works).

##### 9.1.1. Abiotic Environment

Al-Habibiya SPS has direct discharge outlets on the Diyala River through two canals, Al-Jaish and Al-Shorta, through which surplus flows are discharged during events of failure and overflow seasons. While Al-Ghazaliya pumping stations have their overflows discharged to Al-Saqlawiya canal.

On another hand, Al-Doura 1 SPS has no discharge pipeline to the outer environment, and conveys effluents directly to Al-Karkh WWTP, however, the trunk main still traverses some cultivated areas, and intersects with an irrigational canal, which would increase risk of accidental discharge.

Discharges are made to the outer environment (mostly into waterways) because of a pumping failure (blockage, mechanical and electrical failure, etc.); or because of overflows during wet weather conditions. In any case, discharges to the environment are not acceptable, because of the huge adverse deterioration those will bring on the abiotic environment at the point of discharge and downstream. However, the new mechanical and electrical parts as well as facility rehabilitation that will be provided through the Project would improve functionality and would increase coherence of all pumping stations. The project interventions – if implemented as designed – would definitely decrease quantities discharged into the environment (specifically Tigris River), when compared to the current situation, thus, indirectly helps protect land, soil, and water against deterioration. Additionally, periodic testing of effluent characteristics at Rusafa and Karkh WWTPs indicate that treated wastewater is currently within national acceptable limits (refer to Table 1, sec 2.1). Therefore, it is also expected that additional quantities delivered to those WWTPs via the boosted pumping stations (under this project) will still have an acceptable quality at the outlet, assuming that WWTPs are not overloaded and they continue to function as designed.

Collectively, the Impact of having this project is expected positive, indirect, and long term on the abiotic environment (incl. receiving water bodies).

##### 9.1.2. Biotic Environment

The area where all pumping stations and associated pipework projects lie is not well-known for its biological diversity/abundance. This is so because of the area being heavily urbanized, and land use is increasingly shifting from natural habitats. However, as the biological baseline of the area suggests, some floral and faunal scenes can still be found. Decreasing discharges of raw sewage to the environment, which means less interference with the wild life, would not restore the already

degraded ecological life in the area, but undoubtedly, would have a positive, indirect, and long term impact on the biotic life in general.

### **9.1.3. Working Personnel – Occupational Health and Safety**

The new interventions at all pumping stations of Al-Habibiya, Al-Doura, and Al-Ghazaliya will increase occupational safety of the working staff (operators, guards, engineers, etc.). The new mechanical and electrical parts, if implemented as designed, would reduce risks of releasing hazardous materials to the environment, and would reduce harm to the working staff. The newly installed mechanical parts are envisaged to provide easier access for maintenance and troubleshooting, while the newly replaced electrical parts will provide a better means of control, and will reduce electrical hazards accordingly.

The Project will also involve building capacity of the workers in the site. These provisions will include awareness and educational programs on working hazards and best management practices, as well as operational procedures and evacuation drills in case of emergency.

### **9.1.4. Local Community – Service enhancement**

Rehabilitation of sewerage pumping stations will improve sanitation services provided by MOB to the people of Baghdad, in terms of quantity and quality. And will also have a substantial positive and indirect impact on the biotic and abiotic environments. The rehabilitation (incl. trunk lines construction and rehabilitation) would allow for more service to the local community through allowing more people to get the service. This in turn, will reduce pressure on old networks and will reduce burdens on the surrounding environment, of which Diyala and Tigris Rivers are going to be the most affected. In terms of local economy, all businesses located alongside the trunk main and manholes will enjoy more hygienic working conditions, which will also improve working conditions and consequently will boost local economy. However, MOB will be more encouraged to improve environmental conditions in the area where the rehabilitated lines pass through, or at least within the Right of Way, as a proactive measure for maintaining operability of the project (trunk main and manholes). On another hand, prices of land and other estates in the area are not expected to increase, since the trunk line is already passing through populated areas and will require no land acquisition.

The overall project is expected to target workers from local markets, thus, creating job opportunities for skilled and non-skilled workers, and enhance local supply markets.

All in all, if the Project is implemented as planned, the affected environments will get more indirect improvement, and so will decrease the stress on associated infrastructure and the served communities.

Nevertheless, and similar to any new development on the ground that includes new interventions, the Project would have a number of adverse impacts in the construction phase. These impacts are best described as follows:



## 9.2. Negative Impacts in the Construction Phase

The Construction phase is also intended to include dismantling and decommissioning of old pumps, motors and electrical parts in all pumping stations. In addition to the Al-Ghazaliya trunk main, and cleaning and rehabilitating existing lines and manholes.

This type of Projects will involve mobilization of workers and equipment to the site, establishing small site working areas (which are to be identified in liaison with MOB) and installing jacking plants. Negative impacts encountered in the construction phase are connected to occupational health and safety, sanitation, and public health. The following would provide a full discussion of the impacts and proposed mitigation measures for this phase of the Project.

### 9.2.1. Occupational Health and Safety

Working personnel are considered one of the most sensitive receptors during this phase of the Project. Effects are related to Occupational Health and Safety (OHS). Expected adverse impacts will originate from carrying out all activities of dismantling outdated and malfunctioned mechanical and electrical parts in all pumping stations of the project. OHS-related impacts would also be unavoidable during trunk line construction, and other cleaning and rehabilitating works.

The Standard Procurement Document (SPD) of the World Bank (revised in 2017) has incorporated changes to enhance environmental, social, health and safety performance and set out an important guidance for contractors to address all aspects of environmental, social, health and safety aspects encountered during construction work. Contractors are required to adhere to existing policies and regulations, providing needed ESHS work through appointing an ESHS specialist, and has provided general contract provisions.

<u>General Conditions of Contract</u>	
<i>Sub-clause 1.13</i>	<i>Compliance with Laws</i>
<i>Sub-clause 2.2</i>	<i>Permits, Licenses and Approvals</i>
<i>Sub-clause 4.1</i>	<i>Contractor's General Obligations</i>
<i>Sub-clause 4.4</i>	<i>Subcontractors</i>
<i>Sub-clause 4.8</i>	<i>Safety Procedures</i>
<i>Sub-clause 4.14</i>	<i>Avoidance of Interference</i>
<i>Sub-clause 4.18</i>	<i>Protection of the Environment</i>
<i>Sub-clause 4.23</i>	<i>Contractor's Operations on the Site</i>
<i>Sub-clause 4.24</i>	<i>Fossils</i>
<i>Section 6</i>	<i>Staff and Labour (includes health and safety)</i>
<i>Sub-clause 7.1</i>	<i>Manner of Execution</i>
<i>Sub-clause 11.11</i>	<i>Clearance of Site</i>

The following will provide a full discussion of impacts, impact ranking, and proposed mitigation measures for all OHS-related impacts.

## **Over-exertion**

*Impact: Health issues related to over-exertion and ergonomic injuries and illnesses*

Over-exertion, and ergonomic injuries and illnesses, such as repetitive motion, over-exertion, and manual handling, are among the most common causes of injuries in construction and decommissioning sites. If not properly mitigated, the resulted health impact is considered moderately significant, direct, and short and long term. Recommended mitigation measures would include:

- Prevent and control through training of workers in lifting and material handling techniques, including placing of weight limits above which mechanical assists or two-person lifts are necessary,
- Plan work site layout to minimize the need for manual transfer of heavy loads,
- Select tools and design work stations that reduce force requirements and holding times, and promote improved postures, including, where applicable, user adjustable work stations,
- Implement administrative controls into work processes, such as job rotations and rest or stretch breaks.

If mitigated properly, the foreseen impact is expected to be reduced to minor.

## **Slips and falls**

*Impact: Health issues related to accidental slips and falls*

Slips and falls on the same elevation associated with poor housekeeping, such as excessive waste debris, loose construction materials, liquid spills, and uncontrolled use of electrical cords and ropes on the ground, are among the most frequent cause of lost time accidents at the construction site of all pumping stations (incl. pipework routes). If not properly mitigated, the resulted health impact is considered highly significant, direct, short and long term. Recommended mitigation measures would include:

- Implement good house-keeping practices, such as the sorting and placing of loose construction materials or demolition debris in established areas away from foot paths,
- Clean up excessive waste debris and liquid spills regularly,
- Locate electrical cords and ropes in common areas and marked corridors,
- Use slip retardant footwear.

If mitigated properly, the foreseen impact is expected to be reduced to minor.

## **Work in heights**

*Impact: Health issues related to working in heights*

Falls from elevation associated with working with ladders, scaffolding, and partially built or demolished structures are among the most common cause of fatal or permanent disabling injury at construction/ decommissioning sites (including all sites under rehabilitation). If not properly mitigated, the resulted health impact is considered highly significant, direct, short and long term. Recommended mitigation measures would include:

- Train and use temporary fall prevention devices, such as rails or other barriers able to support a weight of 90.7kg at a minimum, when working at heights equal or greater than 2m or at any height if the risk includes falling into operating machinery, into water or other liquid, into hazardous substances, or through an opening in a work surface,
- Train and use personal fall arrest systems, such as full body harnesses and energy absorbing lanyards,
- Use control zones and safety monitoring systems to warn workers of their proximity to fall hazard zones (if applicable). As well as secure, mark, and label covers for openings in floors and roads, roofs, or walking surfaces.

If mitigated properly, the foreseen impact is expected to be reduced to minor.

### **Struck by objects**

*Impact: Health issues related to getting struck by objects*

Decommissioning, dismantling of old parts and structures, as well as installing new parts and structures may pose significant hazards related to the potential fall of materials or tools, as well as ejection of solid particles from abrasive, or other types of power tools, which can result in injury to the head, eyes, and extremities. If not managed properly, the resulted health impact is considered highly significant, direct, and short term. Recommended mitigation measures would include:

- Use a designated and restricted waste drop or discharge zones, and /or a chute for safe movement of wastes from upper to lower levels,
- Conduct sawing, cutting, grinding, sanding, chipping or chiseling with proper guards and anchoring as applicable,
- Maintain clear traffic ways to avoid driving of heavy equipment over loose scrap,
- Use temporary fall protection measures in scaffolds and out edges of elevated work surfaces, such as hand rails and toe boards to prevent materials from being dislodged,
- Wear appropriate PPE, such as safety glasses with side shields, face shields, hard hats, and safety shoes.

If mitigated properly, the foreseen impact is expected to be reduced to minor.

### **Moving machinery**

*Impact: Health and accidental issues related to exposing to moving machinery*

At the construction site of all pumping stations (incl. truck line construction routes), vehicle traffic and use of lifting equipment in the movement of machinery and materials may pose temporary hazards, such as physical contact, spills, dust, emissions, and noise. Center articulated vehicles create a significant impact or crush hazard zone on the outboard side of a turn while moving. If not managed properly, the health impact associated with risk is considered moderately significant, direct, and short term. Recommended prevention and control measures include:

- Ensure the visibility of personnel through their use of high-visibility vests,
- Ensure moving equipment is outfitted with audible back-up alarms,

- Use inspected and well-maintained lifting devices that are appropriate for the load, such as cranes, and securing loads when lifting them to higher job-site elevations.

If mitigated properly, the foreseen impact is expected to be negligible.

### **Electrical hazards**

*Impact: Health issues related to working with exposed electrical parts*

Electrical hazards are expected to arise during dismantling of old and unsafe electrical parts. Exposed or faulty electrical devices such as circuit breakers, panels, cables, cords and hand tools, can pose a serious risk to workers in the site, like electrical shocks. Overhead wires can be struck by metal devices, such as poles or ladders, and by vehicles with metal booms. If not managed properly, the health impact associated with electrical hazards is considered highly significant, direct, and short term. Recommended prevention and control measures include:

- Conduct detailed identification and marking of all buried electrical wiring prior to any excavation work,
- Lock out (de-charge and leave open with a controlled locking device) and tag-out (by a warning sign placed on the lock) devices during dismantling and maintenance,
- Check all electrical cords, cables, and hand power tools for frayed or exposed cords and follow manufacturer recommendations for maximum permitted operating voltage of the portable hand tools,
- Ensure circuit breaking before starting the work on electrical parts,
- Use electricity-specific PPE, including insulating clothing, suits, and gloves,
- Use specially trained personnel to dismantle electrical parts.

If mitigated properly, the foreseen impact is expected to be minor.

### **Respiratory hazards**

*Impact: health issues related to respiratory hazards mismanagement*

During decommissioning and construction of the Project, many activities may generate dust, like on-site excavation, movement of earth materials, contact of construction machinery with bare soil, and exposure of bare soil and soil piles to wind. Other emissions include exhaust gases from diesel engines and from open burning of solid waste on-site. If not managed properly, the impact of mismanaging air pollutants is expected highly significant, direct, cumulative, and short term. Recommended techniques and measures include:

- Minimize dust from material handling sources, such as conveyors and bins, by using covers and/or water suppression,
- Minimize dust from open area sources (storage piles) by applying control measures, like installing enclosures and covers,
- Remove potential hazardous air pollutants such as asbestos, from existing infrastructures prior to demolition,
- Use PPE, such as dust masks, where dust levels are excessive,
- Avoid burning of solid wastes.

If mitigated properly, the expected impact will be minor.

### **Confined spaces**

*Impact: Health issues related to working in confined places*

This type of projects involves dealing with confined places and compartments. For instance, hoppers, utility vaults, tanks, sewers, pipes, and access shafts, as well as trenches excavated for pipework. The workers in the site need to enter these places in order to accomplish various types of dismantling mechanical and electrical equipment and parts, and to enter manholes and lay pipes along trenched routes. However, poisonous gas pockets may exist (but exclusive for pump houses and manholes), like hydrogen sulfide, methane, mercaptans, ammonia, VOCs, etc.. These gases would have serious health consequences upon unmanaged exposures, ranging from suffocation to death. Workers in the site are the most affected receptors of these impacts. If not mitigated properly, these impacts are considered highly significant, direct, and short and long term. Mitigation measures would include the following:

- Provide safe means of access and egress from confined places, such as stairs and ladders, and safety ropes,
- Avoid operating combustion equipment for prolonged periods unless the area is actively ventilated,
- Use special PPE including respirators, protective suits, gloves, and eye protection.

If mitigated properly, the expected impacts will be reduced to a minor significance.

### **Hazardous solid and liquid materials**

*Impact: hazardous solid and liquid materials mismanagement*

During this phase of the Project, construction and decommissioning activities may pose the potential for release of petroleum based products, such as lubricants, hydraulic fluids, or fuels during storage, transfer or use in equipment. These materials are also expected to appear during decommissioning of old structures and mechanical parts. If not managed properly, this impact is expected to be highly significant, direct, cumulative, short and long term, on the workers on-site as well as on the surrounding environment. Prevention and control measures include:

- Provide adequate secondary containment for fuel storage tanks and for the temporary storage of other fluids such as lubricating oils and hydraulic fluids. Adequate secondary containment will be included wherever liquid waste is stored in volumes greater than 220 liters. Available volume of secondary containment should be at least 110% of the largest storage container, or 25% of the total storage capacity (whichever is greater), in that specific location,
- Provide adequate ventilation where volatile hazardous wastes are stored,
- Use impervious surfaces for refueling areas and other fluid transfer areas,
- Train workers on the correct transfer and handling of fuels and chemicals and the required response to spills,
- Provide portable spill containment and cleanup equipment on site, and provide needed training,

- Assess the contents of the hazardous materials and petroleum-based products in building systems (PCB containing electrical equipment, asbestos-containing building materials) and process equipment,
- Provide awareness to workers on EHS related risks,
- Remove contents of hazardous materials prior to initiation of construction activities,
- Identify types and quantities of hazardous waste expected during construction,
- Identify available collection and treatment programs and infrastructure to manage hazardous waste in an environmentally sound manner,
- Put procedures and operational controls for on-site storage.

If mitigated properly, the expected impact will be minor.

### **Noise and vibration**

*Impact: health issues related to noise and vibration mismanagement*

During decommissioning and construction activities, including trunk line construction and rehabilitation works, noise and vibration may be caused by operation of pile drivers, earth moving and excavation equipment, air compressors, hand and power tools, concrete mixers, cranes and jacking equipment. It is expected that these would cause health issues to workers onsite. If not managed properly, this impact will be highly significant, direct, and short term. Some recommended noise and vibration reduction controls and mitigation measures would include:

- Use noise control devices, such as exhaust muffling devices for combustion engines,
- Use vibration protecting gear, like gloves and clothing,
- Install vibration damping pads or devices, and minimize exposure duration.

If managed properly, the expected impact will be negligible.

### **9.2.2. Public health and safety**

#### **Spread of pests and communicable diseases**

*Impact: public issues related to spread of pests and communicable diseases*

This impact may result from exposure to biologically hazardous environments. This includes illnesses communicated by different kinds of water, land, air-borne pathogens among workers on-site. As a result of rehabilitating existing sewers, cleaning manholes, and dismantling old parts of the Habibiya, Doura, and Ghazaliya 5 pumping stations, unhygienic construction conditions are expected to arise, which would attract rodents, mosquitoes, and pathogens to the area. Workers onsite and adjacent communities will be among the most affected people. The impact could extend off-site when infected workers come in touch with local communities. This impact, if not managed properly, would be considered highly significant, direct, indirect, and short and long term. Some recommendations for mitigation include:

- Provide surveillance and active screening and treatment of workers,
- Prevent illness among workers in local communities by, undertaking health awareness and educational initiatives,

- Train health workers in disease treatment,
- Conduct immunization programs to improve health and guard against infection,
- Provide treatment through standard case management in on-site or community health care facilities,

*For vector-borne diseases the following are recommended:*

- Eliminate unusable impounded water,
- Consider application of residual insecticide to dormitory walls,
- Implement integrated vector control programs,
- Promote use of personal protective means and barriers to protect against insect bites,
- Communicate with public health officials to help eradicate disease reservoirs,
- Educate project personnel and area residents on risks, prevention, and available treatment,
- Monitor communities during high-risk seasons to detect and treat cases,
- Follow safety guidelines for the storage, transport, and distribution of pesticides, to prevent human exposure.

If managed properly, this impact is reduced to minor.

#### **Excavation sites**

*Impact: health and safety issues due to excavation*

During construction, especially, excavations related to pipework and trunk mains rehabilitation and construction) public safety could be at risk. This includes dust and noise, as well as casualties due to falling or exposure to materials and equipment. The impact can be moderately significant, direct, and short term. The contractor is required to establish and control protection control procedures onsite for excavations and trenching. Mitigation measures in this regard may include:

- Plan activities in consultation with local communities so that activities with greatest potential to generate dust and noise are planned during the days with least disturbance;
- Use dust suppression techniques by applying water or non-toxic chemicals to minimize dust from vehicle movements;
- Coordinate with utility service providers (power lines, water lines, gas etc.) and have a designated point of contact person for coordination requirements and have a representative available on site when utilities interruption is required;
- Post warning signs and warning lights near the residential areas. In addition, use safety fences near residential areas, schools and roads; and
- Avoid piling excavation soil or debris as well as building materials and water pipes on the narrow roads in high densely populated areas.

#### **Access to working sites**

*Impact: public safety issues due to unauthorized access to working sites*

Working sites could be subject to unauthorized access from the local community, which will pose unlimited risks on public health and safety. This impact is considered moderately significant, direct, and short term. For mitigation, the following are recommended:

- Restrict access to the working site, through a combination of institutional and administrative controls, like fencing, signage, and communication of risks to the local community,
- Remove hazardous conditions on construction sites that cannot be controlled by restricting access, such as covering opening to small confined spaces, and ensuring means of escape, like in case of locked storage of hazardous materials.

If mitigated as recommended above, the impact should become minor.

## **Traffic**

### *Impact: Traffic safety*

Construction activities are expected to result in a significant movement of heavy vehicles for the transportation of new parts and construction materials, as well as transporting waste and rubble back from working sites, which in turn, would increase dust and noise, and increase traffic-related accidents and injuries to communities and public properties. If not managed properly, this impact is considered moderately significant, direct, and short term. Recommendations for mitigation include:

- Emphasize safety aspects among drivers,
- Avoid or minimize driving through community areas and dangerous routes and times of day to reduce the risk of accidents,
- Alert drivers on local speed limits, and monitor implementation, by using speed control devices on trucks,
- Apply regular maintenance of vehicles, and use manufacturer approved parts,
- Collaborate with local communities and responsible authorities to improve signage and enhance visibility and overall safety of roads,
- Minimize traffic, to the extent possible, for instance, by purchasing from the local markets and provide transportation for site workers.

If managed properly, this impact will be negligible.

## **9.2.3. Waste Management**

### **Solid waste**

#### *Impact: solid waste mismanagement*

Upon decommissioning old parts from the existing structures, and carrying out excavations for trunk lines, non-hazardous waste will produce, which includes excess fill materials from grading/excavation activities, scrap wood and metals, and concrete spills. Other non-hazardous wastes would include wastes from working sites as they are part of the construction project activities. This is expected to cause nuisance to residential areas and disturbance to agricultural lands existing in close proximity. If not managed properly, the impact of this will be moderately significant, direct, and short term. Recommended actions to best manage non-hazardous materials include:

- Identify types and estimate quantities of waste expected during construction;



- Identify available collection and treatment programs and infrastructure to manage waste in environmentally sound manner;
- Establish collection and treatment priorities according to potential EHS risks during the waste cycle;
- Identify opportunities for reduce, reuse, and recycle; and
- Put procedures and operational controls for on-site storage.

If mitigated properly, the expected impacts will be negligible.

### **Wastewater from working sites**

#### *Impact: domestic wastewater mismanagement*

The construction and decommissioning activities of the Project may include the generation of sanitary wastewater discharges, from working sites, in varying quantities depending on the number of workers involved (expected 50 – 75). If not managed properly, the impact of mismanaging these wastewater releases will be highly significant, direct, short and long term on the working personnel, on local community, as well as on the environment. Recommendations in this regard include:

- Identify types and estimate quantities of wastewater expected during construction,
- Segregate wastewater streams to ensure compatibility with selected treatment option,
- Segregate and pre-treat oil and grease containing effluents, by using grease traps prior to discharge to the sewer system,
- Discharge to sanitary network only after confirming compliance with discharge quality requirements,
- Contain in septic tanks if discharge to sanitary sewer network is not possible. Transport to wastewater treatment plants for final treatment, by using tankers,
- Avoid direct contact with wastewater through applying an enclosed system for collection, containment, and disposal.
- Monitor groundwater quality that could exist close to the working areas to ensure compliance.

If mitigated properly, the expected impacts will be minor.

## **9.2.4. Physical environment**

### **Land contamination**

#### *Impact: contamination of land*

It is expected to encounter land contamination in all project sites (Al-Habibiya, Al-Doura, and Al-Ghazaliya) during decommissioning old structures and parts, as well as during new constructions and installation (trunk lines, jacking plants, etc.). Source of contamination may be unknown, or due to historical releases of hazardous materials or oil, or due to presence of abandoned infrastructure formerly used to store or handle these materials, including underground storage tanks. This impact, if not properly managed, is expected to be highly significant, direct, cumulative, and long term. Basic management measures include:

- Manage contaminated land with the objective of protecting the safety and health of the occupants of the site, the surrounding community, and the environment post construction,
- Understand the historical use of the land with regard to the potential presence of hazardous materials or oil prior to initiation of construction activities,
- Prepare a management plan to manage contaminated land remaining similar to the management of obsolete, abandoned, hazardous materials found on-site,
- Transfer contaminated land remaining to a legal dumpsite designated to this type of waste,
- Avoid direct contact to the extent applicable.
- Monitor groundwater quality that could exist close to the working areas to ensure compliance.

If managed properly, this impact is reduced to minor.

### **Soil erosion**

*Impact: soil erosion and sediment mobilization*

Soil erosion is expected to occur by exposure of soil surfaces to rain and wind during various site activities. The mobilization of soil particles may, in turn, result in sedimentation of surface drainage networks, which eventually result in affecting quality of natural water systems and ultimately the biological systems that use these waters downstream. If not managed properly, this impact is expected to be moderately significant, indirect, and long term. Recommendations include:

- Schedule to avoid heavy rainfall periods, to the extent practical, during dry seasons,
- Minimize steepness of slopes,
- Re-vegetate if applicable,
- Design channels and ditches for expected flows during construction,
- Reduce or prevent off-site sediment transport by applying sediment ponds or silt fences,
- Modify or suspend activities during extreme rainfall and high winds to the extent practical,
- Segregate or divert clean runoffs from water containing high solids content to minimize treatment,
- Provide adequate drainage system onsite to minimize and control infiltration.

If managed properly, this impact will be reduced to minor.

### **9.2.5. Biotic environment**

*Impact: altering/ endangering biological life*

The area of influence during rehabilitation phase is site-specific. Activities involved in this phase will take place inside the stations' boundaries. Workers are also envisaged to localize themselves in a working area inside the pumping stations' perimeter. Therefore, it is not expected that the Project will have serious impacts on the natural life in the area. Adding to that, the decommissioning and construction activities during this phase will not involve shutdown of either station, and will not include by passing flows to the surrounding environment. However, there might be some minor impacts on habitats, flora, and fauna from transporting materials, parts, equipment, and machinery. Minor impacts most likely generate from exhaust emissions and accidental spillage/ illegal dump on

roadsides. These are considered minor. Transportation activities will use the local road network. These roads are not passing through areas of well-known natural value. And drivers are not expected to divert their course through remote areas of any natural value. Impacts on the biotic environment, hence, are minor, indirect, and long term. Mitigation measures include:

- Ensure full adherence to the zero-discharge criterion to the surrounding environment during dismantling and installing of new parts,
- Oblige by available and approved routes, and avoid driving off-roads, or through naturally valued areas,
- Oblige by legal transportation and dumping of materials in their pre-designated and approved dumpsites,
- Stay in constant contact with the concerned authorities should any emergent spillage occurs, and apply prompt and approved site cleanup procedures,
- Raise awareness on the importance of natural life in the area and possible ways for protection.

If managed properly, this impact will be negligible.

### 9.2.6. Cultural heritage and chance finds

*Impact: Possible damage to objects of historical/ cultural value*

Baghdad is well-known for many of its historical places, and there is a high potential for historical and cultural discoveries anywhere in the area. The Project will involve a pipe jacking trunk sewer main line construction, which is 2.2 meters in diameter under the international Baghdad-Amman highway of a length of about 725 meters and a depth of 5 to 7 meters in Al-Ghazaliya district including ancillary works. Other civil works will include replacement of collapsed sections in the main sewer line (NW), and applying micro-tunneling at some other parts of the network. Workers in the site may encounter chance finds, which could range from little remains and coins to larger crafts of historical/ cultural values. Workers at the site need to be aware of such discoveries and should be able to manage any type of finds. Historical finds could be damaged due to excavation activities, or they could lose their value if relocated from their original place. This impact is considered highly significant, direct, and ranging from short to long term. Recommendations in this regard include the following:

- Educate site workers on possibilities of unearthing objects of historical/ cultural value,
- Make workers aware of the significance and legal liabilities in case of mismanaging chance finds,
- Put simple and clear instructions for workers in response to managing any chance finds during excavation,
- Liaise with responsible authorities, the department of antiquities, for endorsing instructions prepared by the Contractor(s),
- Suspend excavation work and promptly communicate any chance finds to the responsible authorities for further actions.

This impact would be reduced to minor if managed as recommended above.

### 9.2.7. Socio-economic aspects

*Impact: temporary loss of livelihoods and interruption of social and economic activities*

Subprojects of Al-Habibiya and Doura, as well as the 5 pumping stations of Al-Ghazaliya are expected to have minor disturbance to economic and social activities of the surrounding areas, as these will take place in close proximity to commercial and residential areas. No land acquisition will be required for these subprojects. Trunk main rehabilitation and manhole cleaning (between NW1 – NW11), in addition to construction of 8 manholes within the collapsed manhole line (NW16 – NW23) will not have major socio-economic impacts on shops and businesses existing in the ROW as well. As site surveillance showed, these businesses are not located right above the trunk main or manholes, and some of them do not have the legal right on their locations. They are existing in a varying distance (5 – 25 m) from trunk main. Cleaning and rehabilitating manholes will take place in a very limited space (2 sq m), which is the opening area of the manhole for exposing. Additionally, the construction of collapsed line (NW16 – NW23) will take place in the ROW. These activities are expected to have minor effects on daily activities alongside the line (partial loss of assets, temporary loss of livelihood and income, as well as interruption of daily social and economic activities). No land acquisition is planned for these subprojects, however, OP/BP 4.12 is triggered for precautionary measures. Therefore, the project has prepared A Resettlement Policy Framework (RPF) according to the WB's OP/BP 4.12 to set principles of evaluation, compensation, and monitoring.

In case of any of these shops is necessary to relocate, which is not expected, some economic disturbance and/or loss of business might occur. Consequently, a Resettlement Action Plan (RAP) for Project Affected Persons (PAPs) has to be prepared according to the WB's OP/BP 4.12. If number of PAPs are less than 200, this RAP is to be provided in a shortened mode (Abbreviated Resettlement Action Plan ARAP). This RAP/ARAP should be prepared in such a way to ensure restoration of original economic conditions of the affected people. And at a minimum it should provide a full inventory and a workable plan to relocate and restore PAP's original conditions, including all possible means of compensation.

To this end, Socio-economic impacts are considered less significant, direct & indirect, and short term.

### 9.3. Negative Impacts in the Operation Phase

This phase of the Project includes daily operations, maintenance and supervision at pumping stations of Doura, Habibiya, and Ghazaliya. Operations within these facilities are expected to improve after introducing new interventions. Personnel at all subproject sites will enjoy safer environment compared to the prevailing work hazards. And the surrounding environment is expected to have less pollution. Nevertheless, and as globally perceived by operating sewerage pumping/lifting stations, routine operations of all stations could have some risks both on-site and off-site. These are all about impacts related to occupational health and safety, as well as possible off-site interactions with biotic, abiotic and local communities' environments, which can be managed and reduced to acceptable limits. The following discussion provides more insight to possible impacts, and proposes mitigation measures in this regard.

### 9.3.1. Public health and safety

#### Overflow

*Impact: public health issues and contamination of environment due to mismanagement of overflows*

Al-Ghazaliya pumping stations (four sub-stations and one main station) are used to discharge their untreated wastewater to Al-Saqlawiya canal, which then enters bigger water bodies (Tigris). The same operation is done when having events of overflow. Similarly, Al-Habibiya SPS, overflows resulted from wet weathers, accidental stoppage, and blockage, or any other unusual situation are normally discharged to Al-Jaish and Al-Shorta canals, in which case great risks can impact the integrity of the surrounding environment. The situation is even worse with the Al-Habibiya SPS which possesses no by-pass to the outer environment allowing for unpredictable risks in case of unavoidable accidents. With the new interventions at both sites, it is expected to have less significant impacts due to much safer operations. For example, the new interventions will include stand-by pumps and flow control and alarm systems to accommodate exceptional situations. Along with upgraded power generators that can cope with power-cuts. However, there will be some minor impact when unusual situations prevail, which can be mitigated through more contingency planning. Furthermore, the new Project will involve cleaning and rehabilitating existing trunk mains as well as manholes, which in turn, would reduce events of blockage and flooding streets.

To this end, the impact of overflow on the surrounding environment is foreseen less significant, either direct or indirect, short and long term. Recommendations for mitigation and improvement would include:

- Develop and implement appropriate protocols to reduce risks to safety, public health, and environment that include well-written instructions,
- Develop a contingency plan (site-specific),

*Control measures in the contingency plan could include (but not limited to) the following:*

- Provision of alternative pumping mechanisms and associated controls,
- Alternative power supplies,
- Standard connections for emergency by-pass pumps,
- Standard connections for mobile generators/ backup power source,
- Identification of critical components to ensure timely access to spare parts,
- Access for maintenance and emergency activities,
- Allowing for flows to adjoining areas of the network to accommodate overflows in one catchment,
- Erecting appropriate signage, barriers, and notification methods for designated areas subject to flows from the pumping station (schools, playgrounds, farmlands, etc.),
- Including remediation procedures aftermath, including timely clean-up and rehabilitation,
- Incident investigations, monitoring, and reporting,
- Reviewing procedures for improvement,
- Appropriate notification procedure to stakeholders,
- Record keeping.

- Response to overflows by preventing, containing, minimizing, the overflow where it is feasible and safe to do so,
- Protect SPS's components from flood damage where it is feasible to do so, for instance, by protecting components from rising flood water to enable reinstating more rapidly,
- Notify responsible parties, which include the Baghdad Sewerage Department in this case.

If managing the impact as suggested, significance will be reduced to minor.

### **Odor and noise**

*Impact: Odor and noise nuisance to adjacent sensitive receptors*

The new interventions at all pumping stations will provide new odor control units, equipped with more appropriate bio-ticklers and scrubbers. In addition to the renovation and new installation of ventilation systems, especially motor/control rooms, wet and dry wells. All sites will also get new less noisy mechanical devices, new motors, pumps, vertical shafts, etc., which in turn, will have a greater noise reduction compared to the current situation. The impact of odor and noise nuisance during operational activities is expected minor, direct, and short term. Recommendations to get more alleviation to the negative impact may include:

- Apply preventive and corrective maintenance procedures on odor and noise generating equipment and facilities, according to the manufacturer's instructions,
- Apply preventive and corrective maintenance on odor control units, according to the manufacturer's instructions,
- Establish a Standard Operating Procedure (SOP) to include requirements for maintenance, monitoring, and personnel training,
- Monitor outdoor odor and noise levels within all pumping stations boundaries, to ensure limits are not exceeded,
- Create retrofitting noise controls where practical, like fencing and enclosures,
- Keep records of the maintenance logs, local complaints, and analyze trends.

If managed properly, this impact is expected to become negligible.

### **Pest management**

*Impact: pest spreading issues*

During operation, the rehabilitation projects of the subject pumping stations will significantly enhance pest control measures inside pumping facilities, as well as in the vicinity. Impact of spreading rodents and breeding of insects are foreseen less significant if managed properly by BSA and MOB. It should be noted here that synthetic pesticides should be guided by the World Health Organization's Recommended Classification of Pesticides by Hazard and Guidelines to Classifications. See Annex VI for full lists of pesticides and their classification and usage.

### **Hazardous wastes and materials**

*Impact: public health issues and contamination of environment due to mismanagement of hazardous waste and materials*

A wide range of materials can be dealt with during daily operations of the sewerage pumping stations. These include, but not limited to, the use of lubricants, oils, solvents, cleanup chemicals, as well as fuels. These materials are considered hazardous to workers in-house and to the environment as spillage or vaporization may occur, which are released to the environment by means of runoff and wind. Impacts may arise if storage and handling were inadequate, of which working personnel and local adjoining community and physical environment among the most affected.

Leakage of the raw sewage is of special concern during the operation phase. This could happen due to poor maintenance of washout and by-pass networks, including poor maintenance of heavy equipment like control logs, pumps, screens, etc. Screening residues are also hazardous to human health and environment if not managed and disposed of appropriately.

The impact on health and environment is highly significant, direct, and cumulative, both short and long terms. Proposed mitigation measures include:

- Train operators on release prevention, including drills specific to hazardous materials as part of an emergency preparedness and response training,
- Implement inspection programs to maintain the mechanical integrity and operability of pressure vessels, tanks, pipework, relief and vent valve systems, containment infrastructure, emergency shutdown systems, controls and pumps, and all associated process equipment,
- Prepare Standard Operating Procedures (SOPs) for filling containers or machinery (incl. transfer operations), and provide spill prevention plans, by qualified personnel,
- Apply SOPs for the management of secondary containment structures, specifically the removal of any accumulated fluid, such as rainfall, to ensure that the intent of the system is not accidentally or willfully defeated,
- Identify locations of hazardous materials and associated activities,
- Transport and dump waste residues from screens in legal and approved dumpsites,
- Make available specific PPE and provide the know-how,
- Make available spill response equipment sufficient to handle at least initial stages of a spill and a list of possible interventions,
- Train and educate operational personnel on response activities in the event of spill, release, or chemical emergency. That would include:
  - Internal and external notification procedures.
  - Specific responsibilities of individuals or groups.
  - Facility evacuation routes.
  - Post-event activities such as clean-up and disposal, incident investigation, employee re-entry, and restoration of spill response equipment.

This impact, if mitigated properly, will be reduced to minor.

### 9.3.2. Occupational health and safety

During the daily operation and maintenance of all pumping station of Al-Habibiya, Al-Doura, and Al-Ghazaliya, working staff, including operators, supervisors, and engineers, will yet be subject to common OHS hazards usually associated with this type of industry. The new Project was designed to increase safety of working environment, to facilitate maintenance activities, and to build technical

and managerial capacities of responsible workers on the best management practices, documentation, and reporting procedures, either during normal or contingency conditions. The operational and maintenance-related impacts include the following.

### **Over-exertion**

*Impact: Health issues related to over-exertion and ergonomic injuries and illnesses*

Over-exertion, and ergonomic injuries and illnesses, such as repetitive motion, over-exertion, and manual handling, are among the most common causes of injuries in maintenance activities. That would include, lifting mechanical parts, pipes, hatches, metal bars, motors, etc. If not properly mitigated, the resulted health impact is considered moderately significant, direct, short and long term. Recommended mitigation measures would include:

- Prevent and control, by training workers on lifting and material handling techniques, including placing of weight limits above which mechanical assists or two-person lifts are necessary,
- Plan work site layout to minimize the need for manual transfer of heavy loads,
- Select tools and design work stations that reduce force requirements and holding times, and promote improved postures, including, where applicable, user adjustable work stations,
- Integrate administrative controls into work processes, such as job rotations and rest or stretch breaks.

If mitigated properly, the foreseen impact is expected to be reduced to minor.

### **Slips and falls**

*Impact: Health issues related to accidental slips and falls*

Slips and falls on the same elevation associated with poor housekeeping, such as excessive waste debris, loose materials, liquid spills, and uncontrolled use of electrical cords and ropes on the ground, are among the most frequent cause of lost time accidents at the maintenance sites of all pumping stations. If not properly mitigated, the resulted health impact is considered highly significant, direct, short and long term. Recommended mitigation measures would include:

- Implement good house-keeping practices, such as the sorting and placing of loose materials or debris in established areas away from foot paths,
- Clean up excessive waste debris and liquid spills regularly,
- Locate electrical cords and ropes in common areas and marked corridors,
- Use slip retardant footwear, especially when using stairs to access underground facilities.

If mitigated properly, the foreseen impact is expected to be reduced to minor.

### **Work in heights**

*Impact: Health issues related to working in heights*

Falls from elevation associated with working with ladders, and scaffolding, are among the most common cause of fatal or permanent disabling injury at maintenance sites (including all sites under



rehabilitation). If not properly mitigated, the resulted health impact is considered highly significant, direct, short and long term. Recommended mitigation measures would include:

- Train and use temporary fall prevention devices, such as rails or other barriers able to support a weight of 90.7kg at a minimum, when working at heights equal or greater than 2m or at any height if the risk includes falling into operating machinery, into water or other liquid, into hazardous substances, or through an opening in a work surface (inspection hatches),
- Train and use personal fall arrest systems, such as full body harnesses and energy absorbing lanyards,
- Use control zones and safety monitoring systems to warn workers of their proximity to fall hazard zones (if applicable). As well as secure, mark, and label covers for openings in floors, roofs, or walking surfaces.

If mitigated properly, the foreseen impact is expected to be reduced to minor.

### **Electrical hazards**

*Impact: Health issues related to working with electrical equipment and control panels*

Electrical hazards are expected to arise during maintenance works most frequently, in addition to daily exposure. Exposed or faulty electrical devices such as circuit breakers, panels, cables, cords and hand tools, can pose a serious risk to workers in the site, which can result in electrical shocks. Of particular risk is dealing with power generators and motors. Overhead wires can be struck by metal devices, such as poles or ladders, and by vehicles with metal booms. If not managed properly, the health impact associated with electrical hazards is considered highly significant, direct, and short term. Recommended prevention and control measures include:

- Conduct detailed identification and marking of all electrical connections prior to any maintenance work,
- Lock out (de-charge and leave open with a controlled locking device) and tag-out (by a warning sign placed on the lock) devices during demounting and lifting electrical devices for maintenance,
- Ensure circuit breaking before starting work on electrical parts,
- Use electricity-specific PPE, including insulating clothing, suits, and gloves,
- Use specially trained personnel to demount electrical parts.

If mitigated properly, the foreseen impact is expected to be minor.

### **Confined spaces**

*Impact: Health issues related to working in confined places*

This type of projects involves dealing with confined places and compartments. For instance, hoppers, utility vaults, tanks, sewers, pipes, and access shafts. The workers in the site need to enter these places in order to perform various types of mechanical and electrical maintenance activities. However, poisonous gas pockets may exist, like hydrogen sulfide, methane, mercaptans, ammonia, VOCs, etc. These gases would have serious health consequences upon unmanaged exposures,

ranging from suffocation to death. Workers in the site are the most affected receptors of these impacts. If not mitigated properly, these impacts are considered highly significant, direct, and short and long term. Mitigation measures would include the following:

- Provide safe means of access and egress from confined places, such as stairs and ladders, and safety ropes,
- Avoid operating combustion equipment for prolonged periods unless the area is actively ventilated,
- Use special PPE that include respirators, protective suits, gloves, and eye protection,
- Minimize exposure period to the extent possible.

If mitigated properly, the expected impacts will be reduced to a minor significance.

### Noise and vibration

*Impact: health and stress issues due to noise and vibration in work environment*

During operation, working personnel will be exposed to excessive noise and vibration levels generating from motor rooms in particular. Prolonged exposure periods play a significant role in increasing risk of health and stress issues, thus exacerbating overall health consequences. However, it is anticipated that the Project would provide the least noisy and vibrant equipment and environment. If not managed properly, this impact is considered of minor significance, direct, and short term. Measures to offset this impact would include:

- Effectively insulating the control room from noise and vibration,
- Avoid prolonged exposure periods beyond tolerable times,
- Avoid exposure to excessive levels beyond permissible limits set out by local and international regulations,
- Monitor noise and vibration levels frequently, by following Standard Operating Procedures (SOPs) and using appropriate instrumentation,
- Use noise hearing protection gear and vibration resistant boots, gloves, and clothing,
- Keep records of breaching incidents, and report to the higher management.

If managed properly, this impact would be negligible.

## 9.4. Summary Impacts and Mitigation

The following table summarizes impacts, their ranking before and after mitigation measures applied, in both construction and operation phases.

Table 25: Summary adverse impacts – construction and operation phases

Area of concern	Impact	Sensitive receptor	Ranking before mitigation	Ranking after mitigation
<i>Construction phase</i>				
OHS	Health issues related to over-exertion and ergonomic injuries and illnesses	Working personnel	moderately significant, direct, and short and long term	Low
	Health issues related to accidental slips and falls	Working personnel	highly significant, direct, and short and	Low

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Area of concern	Impact	Sensitive receptor	Ranking before mitigation	Ranking after mitigation
			long term	
	Health issues related to working in heights	Working personnel	highly significant, direct, and short and long term	Low
	Health issues related to getting struck by objects	Working personnel	highly significant, direct, and short term	Low
	Health and accidental issues related to exposing to moving machinery	Working personnel	moderately significant, direct, and short term	Negligible
	Health issues related to working with exposed electrical parts	Working personnel	highly significant, direct, and short term	Low
	health issues related to respiratory hazards mismanagement	Working personnel	highly significant, direct, cumulative, and short term	Low
	Health issues related to working in confined places	Working personnel	highly significant, direct, and short and long term	Low
	hazardous solid and liquid materials mismanagement	Working personnel & environment	highly significant, direct, cumulative, short and long term	Low
	health issues related to noise and vibration mismanagement	Working personnel	highly significant, direct, and short term	Negligible
Public health and safety	public issues related to spread of pests and communicable diseases	The public residing in project areas	highly significant, direct, indirect, and short and long term	Low
	health and safety issues due to excavation	The public residing in project areas	moderately significant, direct, and short term	Low
	public safety issues due to unauthorized access to working sites	The public residing in project areas	moderately significant, direct, and short term	Low
	Traffic safety	The public residing in project areas	moderately significant, direct, and short term	Negligible
Waste management	solid waste mismanagement	Working personnel, Local community, Surrounding environment.	moderately significant, direct, and short term	Negligible
	domestic wastewater mismanagement	Working personnel, Local community, Surrounding environment.	highly significant, direct, short and long term	Low
Land	contamination of land	Surrounding environment	highly significant, direct, cumulative, and long term	Low
	soil erosion and sediment mobilization	Surrounding environment	moderately significant, indirect, and long term	Low
Biotic life	Altering/ endangering biological life	Biotic environment	Less significant, indirect, and long term	Negligible
Cultural heritage and chance finds	Possible damage to objects of historical/ cultural value	Abiotic environments and local community	highly significant, direct, and short to long term	Low
Socio-economic	temporary loss of livelihoods and interruption of social and economic activities	Public/business owners residing in project areas	Less significant, direct & indirect, and short term	Negligible
<i>Operation phase</i>				
Public health and	Public health issues due to	The public residing in	Less significant, direct	Low

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 Baghdad Water Supply and Sewerage Improvement Project

Area of concern	Impact	Sensitive receptor	Ranking before mitigation	Ranking after mitigation
safety	mismanagement of overflows	project areas	and indirect, short and long term	
	Odor and noise nuisance to adjacent sensitive receptors	The public residing in project areas	minor, direct, and short term	Negligible
	pest spreading issues	The public residing in project areas	less significant	Negligible
	public health issues and contamination of environment due to mismanagement of hazardous waste and materials	The public residing in project areas	highly significant, direct, and cumulative, both short and long terms	Low
OHS	Health issues related to over-exertion and ergonomic injuries and illnesses	Working personnel	moderately significant, direct, short and long term	Low
	Health issues related to accidental slips and falls	Working personnel	highly significant, direct, short and long term	Low
	Health issues related to working in heights	Working personnel	highly significant, direct, and short and long term	Low
	Health issues related to working with electrical equipment and control panels	Working personnel	highly significant, direct, and short term	Low
	Health issues related to working in confined places	Working personnel	highly significant, direct, short and long term	Low
	health and stress issues due to noise and vibration in work environment	Working personnel	Less significant, direct, and short term	Negligible

## 10. MANAGEMENT AND MONITORING

### 10.1. Environmental and Social Management Program

#### 10.1.1. General principles

In order to mitigate expected impacts during construction (including decommissioning old parts and installing new ones) the Contractor is required to update and implement an Environmental and Social Management Plan (ESMP), which is usually called a Construction Environmental Management Plan (CEMP). This Plan will form a binding document to the agreement with the Contractor. Actions required by this Plan is embedded in the Contractor's daily activity in the construction site, who takes a full responsibility for maintaining enough provisions and safe environments for implementing the work. Mitigation measures proposed for this Project are in compliance with Iraqi standards for this type of industry. More stringent standards and Best Management Practices (BMPs) have also been considered for avoiding, minimizing, and mitigating adverse impacts brought about by various types of activities of the Project. Namely the Environmental, Health and Safety Guideline issued by the International Funding Corporation (IFC), which is one part of the World Bank Group. Therefore, the Plan sheds more light on impacts linked to occupational health and safety, and gives the best practices to alleviate them. As preventive and mitigation actions are inherent in the Contractor's daily activities, so are the costs incurred for implementation, which forms the overall contract price.

The Contractor is deemed responsible for collecting all necessary approvals before commencing constructions, one of which is the CEMP. The Contractor is also expected to carry out/ update all needed site surveys, like soil investigations. The Contractor should only start working in the site after MOB has resolved/ worked on all grievances raised by local community. Annex IV “Environmental Requirements for Contractors” provides more information, which is also to be included in the tender documentation, so that potential bidders are aware of environmental and social performance standards expected from them and are able to reflect that in their bids. Additionally, Annex V on “Environmental and Social Liabilities for BWSIP” should be added further to environmental compliance section where breakdown for the cost of each mitigation measure noncompliance is detailed, and will be enclosed in bidding documents.

The BSA team will still hold responsibility for providing the Contractor with needed site plans (including mechanical and electrical layouts) and historical information. In post-construction phase, a supervision contract with a third party will be provided. All supervision works are also expected to be reported back to MOB/BSA. Costs of a supervision contract is covered by the project, however, follow-ups of BSA will be incurred as part of the BSA's budget.

In operation phase, BSA team is expected to follow their daily procedures to prevent, minimize, and mitigate all operational and maintenance-related impacts, on their working personnel, as well as on outdoor environments and local communities. Impacts should be managed effectively by continuously building staff capacities and by applying enough monitoring on the sensitive environmental and social parameters. Costs of managing impacts during operation are included in the BSA's budget. The following are tabulated formats for the ESMP in construction as well as in operation phases.

10.1.2. Proposed ESMP

Table 26: Environmental and Social Management Plan – Construction phase

#	Area	Impact	Mitigation	Roles & Responsibilities	Requirements	Time/frequency
1	OHS	Health issues related to over-exertion and ergonomic injuries and illnesses	<ul style="list-style-type: none"> <li>Prevent and control through training of workers in lifting and material handling techniques, including placing of weight limits above which mechanical assists or two-person lifts are necessary,</li> <li>Plan work site layout to minimize the need for manual transfer of heavy loads,</li> <li>Select tools and design work stations that reduce force requirements and holding times, and promote improved postures, including, where applicable, user adjustable work stations,</li> <li>Implement administrative controls into work processes, such as job rotations and rest or stretch breaks.</li> </ul>	<ul style="list-style-type: none"> <li>Contractor to implement,</li> <li>Supervision contract,</li> <li>BSA to follow up</li> </ul>	<ul style="list-style-type: none"> <li>Training on OHS,</li> <li>Site layout,</li> <li>The best design of work station,</li> <li>Personnel rotation system,</li> <li>First aid.</li> </ul>	<ul style="list-style-type: none"> <li>Prior to construction for training and work station,</li> <li>Weekly for rotation,</li> <li>Daily for others</li> </ul>
2		Health issues related to accidental slips and falls	<ul style="list-style-type: none"> <li>Implement good house-keeping practices, such as the sorting and placing of loose construction materials or demolition debris in established areas away from foot paths,</li> <li>Clean up excessive waste debris and liquid spills regularly,</li> <li>Locate electrical cords and ropes in common areas and marked corridors,</li> <li>Use slip retardant footwear.</li> </ul>	<ul style="list-style-type: none"> <li>Contractor to implement,</li> <li>Supervision contract,</li> <li>BSA to follow up</li> </ul>	<ul style="list-style-type: none"> <li>Housekeeping practices,</li> <li>Cleanup kits,</li> <li>First aid,</li> <li>PPE,</li> <li>Site layout</li> </ul>	On daily basis
3		Health issues related to working in heights	<ul style="list-style-type: none"> <li>Train and use temporary fall prevention devices, such as rails or other barriers able to support a weight of 90.7kg at a minimum, when working at heights equal or greater than 2m or at any height if the risk includes falling into operating machinery, into water or other liquid, into hazardous substances, or through an opening in a work surface,</li> <li>Train and use personal fall arrest systems, such as full body harnesses and energy absorbing lanyards,</li> <li>Use control zones and safety monitoring systems to warn workers of their proximity to fall hazard zones (if applicable). As well as secure, mark, and label covers for openings in floors and roads, roofs, or walking surfaces.</li> </ul>	<ul style="list-style-type: none"> <li>Contractor to implement,</li> <li>Supervision contract,</li> <li>BSA to follow up</li> </ul>	<ul style="list-style-type: none"> <li>Education,</li> <li>Acquisition of right expertise,</li> <li>Provision of safety devices,</li> <li>Provision of safety monitoring systems,</li> <li>PPE,</li> <li>First aid,</li> <li>Site layout</li> </ul>	<ul style="list-style-type: none"> <li>Prior to construction for Education and right expertise,</li> <li>Daily for other provisions</li> </ul>
4		Health issues related to getting struck by objects	<ul style="list-style-type: none"> <li>Use a designated and restricted waste drop or discharge zones, and /or a chute for safe movement of wastes from upper to lower levels,</li> <li>Conduct sawing, cutting, grinding, sanding, chipping or chiseling with proper guards and anchoring as applicable,</li> <li>Maintain clear traffic ways to avoid driving of heavy equipment over loose scrap,</li> </ul>	<ul style="list-style-type: none"> <li>Contractor to implement,</li> <li>Supervision contract,</li> <li>BSA to follow up</li> </ul>	<ul style="list-style-type: none"> <li>Education,</li> <li>Acquisition of right expertise,</li> <li>Provision of safety devices,</li> <li>First aid,</li> </ul>	<ul style="list-style-type: none"> <li>Prior to construction for Education and right expertise,</li> <li>Daily for</li> </ul>

#	Area	Impact	Mitigation	Roles & Responsibilities	Requirements	Time/frequency
			<ul style="list-style-type: none"> <li>Use temporary fall protection measures in scaffolds and out edges of elevated work surfaces, such as hand rails and toe boards to prevent materials from being dislodged,</li> <li>Wear appropriate PPE, such as safety glasses with side shields, face shields, hard hats, and safety shoes.</li> </ul>		<ul style="list-style-type: none"> <li>PPE</li> </ul>	other provisions
5		Health and accidental issues related to exposing to moving machinery	<ul style="list-style-type: none"> <li>Ensure the visibility of personnel through their use of high-visibility vests,</li> <li>Ensure moving equipment is outfitted with audible back-up alarms,</li> <li>Use inspected and well-maintained lifting devices that are appropriate for the load, such as cranes, and securing loads when lifting them to higher job-site elevations.</li> </ul>	<ul style="list-style-type: none"> <li>Contractor to implement,</li> <li>Supervision contract,</li> <li>BSA to follow up</li> </ul>	<ul style="list-style-type: none"> <li>Provision of safety devices,</li> <li>Provision of safety monitoring systems,</li> <li>Provision of suitable equipment,</li> <li>First aid,</li> <li>PPE.</li> </ul>	<ul style="list-style-type: none"> <li>Prior to construction for devices and systems,</li> <li>Daily for other provisions</li> </ul>
6		Health issues related to working with exposed electrical parts	<ul style="list-style-type: none"> <li>Conduct detailed identification and marking of all buried electrical wiring prior to any excavation work,</li> <li>Lock out (de-charge and leave open with a controlled locking device) and tag-out (by a warning sign placed on the lock) devices during dismantling and maintenance,</li> <li>Check all electrical cords, cables, and hand power tools for frayed or exposed cords and follow manufacturer recommendations for maximum permitted operating voltage of the portable hand tools,</li> <li>Ensure circuit breaking before starting the work on electrical parts,</li> <li>Use electricity-specific PPE, including insulating clothing, suits, and gloves,</li> <li>Use specially trained personnel to dismantle electrical parts.</li> </ul>	<ul style="list-style-type: none"> <li>Contractor to implement,</li> <li>Supervision contract,</li> <li>BSA to follow up</li> </ul>	<ul style="list-style-type: none"> <li>Education,</li> <li>Acquisition of right expertise</li> <li>Provision of safety devices,</li> <li>PPE,</li> <li>First aid,</li> <li>Site layout</li> </ul>	<ul style="list-style-type: none"> <li>Prior to construction for education and right expertise,</li> <li>Daily for safety devices and PPE</li> </ul>
7		health issues related to respiratory hazards mismanagement	<ul style="list-style-type: none"> <li>Minimize dust from material handling sources, such as conveyors and bins, by using covers and/or water suppression,</li> <li>Minimize dust from open area sources (storage piles) by applying control measures, like installing enclosures and covers,</li> <li>Remove potential hazardous air pollutants such as asbestos, from existing infrastructures prior to demolition,</li> <li>Use PPE, such as dust masks, where dust levels are excessive,</li> <li>Avoid burning of solid wastes.</li> </ul>	<ul style="list-style-type: none"> <li>Contractor to implement,</li> <li>Supervision contract,</li> <li>BSA to follow up</li> </ul>	<ul style="list-style-type: none"> <li>Provision of respiratory controls,</li> <li>PPE,</li> <li>Best management practices.</li> </ul>	<ul style="list-style-type: none"> <li>Daily for controls,</li> <li>Weekly for local communication</li> </ul>

#	Area	Impact	Mitigation	Roles & Responsibilities	Requirements	Time/frequency
8		Health issues related to working in confined places	<ul style="list-style-type: none"> <li>• Provide safe means of access and egress from confined places, such as stairs and ladders, and safety ropes,</li> <li>• Avoid operating combustion equipment for prolonged periods unless the area is actively ventilated,</li> <li>• Use special PPE including respirators, protective suits, gloves, and eye protection.</li> </ul>	<ul style="list-style-type: none"> <li>• Contractor to implement,</li> <li>• Supervision contract,</li> <li>• BSA to follow up</li> </ul>	<ul style="list-style-type: none"> <li>• Education,</li> <li>• Provision of safety devices,</li> <li>• Ventilation system,</li> <li>• PPE,</li> <li>• First aid.</li> </ul>	<ul style="list-style-type: none"> <li>• Prior to construction for education,</li> <li>• Daily for safety devices, ventilation, and PPE</li> </ul>
9		hazardous solid and liquid materials mismanagement	<ul style="list-style-type: none"> <li>• Provide adequate secondary containment for fuel storage tanks and for the temporary storage of other fluids such as lubricating oils and hydraulic fluids. Adequate secondary containment will be included wherever liquid waste is stored in volumes greater than 220 liters. Available volume of secondary containment should be at least 110% of the largest storage container, or 25% of the total storage capacity (whichever is greater), in that specific location,</li> <li>• Provide adequate ventilation where volatile hazardous wastes are stored,</li> <li>• Use impervious surfaces for refueling areas and other fluid transfer areas,</li> <li>• Train workers on the correct transfer and handling of fuels and chemicals and the required response to spills,</li> <li>• Provide portable spill containment and cleanup equipment on site, and provide needed training,</li> <li>• Assess the contents of the hazardous materials and petroleum-based products in building systems (PCB containing electrical equipment, asbestos-containing building materials) and process equipment,</li> <li>• Provide awareness to workers on EHS related risks,</li> <li>• Remove contents of hazardous materials prior to initiation of construction activities,</li> <li>• Identify types and quantities of hazardous waste expected during construction,</li> <li>• Identify available collection and treatment programs and infrastructure to manage hazardous waste in an environmentally sound manner,</li> <li>• Put procedures and operational controls for on-site storage.</li> </ul>	<ul style="list-style-type: none"> <li>• Contractor to implement,</li> <li>• Supervision contract,</li> <li>• BSA to follow up,</li> <li>• MOB to approve final treatment.</li> </ul>	<ul style="list-style-type: none"> <li>• Education,</li> <li>• Secondary containment,</li> <li>• Ventilation,</li> <li>• Refueling areas,</li> <li>• Spill and cleanup,</li> <li>• Waste management plan,</li> <li>• Material storage plan</li> </ul>	<ul style="list-style-type: none"> <li>• Prior to construction for education,</li> <li>• Daily for management</li> </ul>
10		health issues related to noise and vibration mismanagement	<ul style="list-style-type: none"> <li>• Use noise control devices, such as exhaust muffling devices for combustion engines,</li> <li>• Use vibration protecting gear, like gloves and clothing,</li> <li>• Install vibration damping pads or devices, and minimize exposure duration.</li> </ul>	<ul style="list-style-type: none"> <li>• Contractor to implement,</li> <li>• Supervision contract,</li> <li>• BSA to follow up</li> </ul>	<ul style="list-style-type: none"> <li>• Education to workers,</li> <li>• Preventive and corrective Maintenance,</li> </ul>	<ul style="list-style-type: none"> <li>• Prior to construction for education,</li> <li>• Daily for</li> </ul>



#	Area	Impact	Mitigation	Roles & Responsibilities	Requirements	Time/frequency
11	Public health and & safety	public issues related to spread of pests and communicable diseases	<ul style="list-style-type: none"> <li>• Provide surveillance and active screening and treatment of workers,</li> <li>• Prevent illness among workers in local communities by, undertaking health awareness and educational initiatives,</li> <li>• Train health workers in disease treatment,</li> <li>• Conduct immunization programs to improve health and guard against infection,</li> <li>• Provide treatment through standard case management in on-site or community health care facilities,</li> </ul> <p><i>For vector-borne diseases the following are recommended:</i></p> <ul style="list-style-type: none"> <li>• Eliminate unusable impounded water,</li> <li>• Consider application of residual insecticide to dormitory walls,</li> <li>• Implement integrated vector control programs,</li> <li>• Promote use of personal protective means and barriers to protect against insect bites,</li> <li>• Communicate with public health officials to help eradicate disease reservoirs,</li> <li>• Educate project personnel and area residents on risks, prevention, and available treatment,</li> <li>• Monitor communities during high-risk seasons to detect and treat cases,</li> <li>• Follow safety guidelines for the storage, transport, and distribution of pesticides, to prevent human exposure.</li> </ul>	<ul style="list-style-type: none"> <li>• Contractor to implement,</li> <li>• Supervision contract,</li> <li>• Health centers to immunize,</li> <li>• Municipalities to apply controls (in liaison with the environmental dept of MOB),</li> <li>• BSA to follow up,</li> </ul>	<ul style="list-style-type: none"> <li>• PPE,</li> <li>• Immunization programs,</li> <li>• Municipalities to apply pest control programs</li> </ul>	<ul style="list-style-type: none"> <li>• management</li> <li>• Prior to construction for immunization</li> <li>• monthly for pest management</li> </ul>
12		Public health and safety issues due to excavation	<ul style="list-style-type: none"> <li>• Plan activities in consultation with local communities so that activities with greatest potential to generate dust and noise are planned during the days with least disturbance;</li> <li>• Use dust suppression techniques by applying water or non-toxic chemicals to minimize dust from vehicle movements;</li> <li>• Coordinate with utility service providers (power lines, water lines, gas etc.) and have a designated point of contact person for coordination requirements and have a representative available on site when utilities interruption is required;</li> <li>• Post warning signs and warning lights near the residential areas. In addition, use safety fences near residential areas, schools and roads; and</li> <li>• Avoid piling excavation soil or debris as well as building materials and water pipes on the narrow roads in high densely populated areas.</li> </ul>	<ul style="list-style-type: none"> <li>• Contractor to implement and coordinate,</li> <li>• Supervision contract,</li> <li>• BSA to follow up</li> </ul>	<ul style="list-style-type: none"> <li>• Public outreach</li> <li>• Warning signage</li> </ul>	<ul style="list-style-type: none"> <li>• Daily during construction</li> </ul>
13		public safety issues due to unauthorized	<ul style="list-style-type: none"> <li>• Restrict access to the working site, through a combination of institutional and administrative controls, like fencing, signage, and communication of</li> </ul>	<ul style="list-style-type: none"> <li>• Contractor to implement,</li> </ul>	<ul style="list-style-type: none"> <li>• Education,</li> <li>• Acquisition of</li> </ul>	<ul style="list-style-type: none"> <li>• Prior to construction</li> </ul>

#	Area	Impact	Mitigation	Roles & Responsibilities	Requirements	Time/frequency
		access to working sites	risks to the local community, <ul style="list-style-type: none"> <li>Remove hazardous conditions on construction sites that cannot be controlled by restricting access, such as covering opening to small confined spaces, and ensuring means of escape, like in case of locked storage of hazardous materials.</li> </ul>	<ul style="list-style-type: none"> <li>BSA to follow up,</li> </ul>	right expertise, <ul style="list-style-type: none"> <li>Collection and disposal plan,</li> <li>Provision of safety devices,</li> <li>PPE,</li> <li>First aid,</li> <li>Site layout,</li> <li>Site security.</li> </ul>	for education and right expertise, <ul style="list-style-type: none"> <li>Daily for other provisions</li> </ul>
14		Traffic safety	<ul style="list-style-type: none"> <li>Emphasize safety aspects among drivers,</li> <li>Avoid or minimize driving through community areas and dangerous routes and times of day to reduce the risk of accidents,</li> <li>Alert drivers on local speed limits, and monitor implementation, by using speed control devices on trucks,</li> <li>Apply regular maintenance of vehicles, and use manufacturer approved parts,</li> <li>Collaborate with local communities and responsible authorities to improve signage and enhance visibility and overall safety of roads,</li> <li>Minimize traffic, to the extent possible, for instance, by purchasing from the local markets and provide transportation for site workers.</li> </ul>	<ul style="list-style-type: none"> <li>Contractor to implement,</li> <li>Supervision contract,</li> <li>BSA to follow up,</li> <li>Traffic department to advise,</li> <li>Local representatives to get in touch</li> </ul>	<ul style="list-style-type: none"> <li>Education,</li> <li>Provisions of suitable means of transportation,</li> <li>Best management practices,</li> <li>Provision of regular maintenance,</li> <li>Provisions of traffic safety measures,</li> <li>Considering local market</li> </ul>	<ul style="list-style-type: none"> <li>Daily for education,</li> <li>Weekly for traffic communication,</li> <li>Weekly for local communication,</li> <li>Periodically for local market inclusion.</li> </ul>
15	<b>Waste Management Physical environment</b>	solid waste mismanagement	<ul style="list-style-type: none"> <li>Identify types and estimate quantities of waste expected during construction;</li> <li>Identify available collection and treatment programs and infrastructure to manage waste in environmentally sound manner;</li> <li>Establish collection and treatment priorities according to potential EHS risks during the waste cycle;</li> <li>Identify opportunities for reduce, reuse, and recycle; and</li> <li>Put procedures and operational controls for on-site storage.</li> </ul>	<ul style="list-style-type: none"> <li>Contractor to implement,</li> <li>Supervision contract,</li> <li>BSA to follow up,</li> <li>MOB to approve dumpsite.</li> </ul>	<ul style="list-style-type: none"> <li>Waste management plan,</li> <li>Material storage plan</li> </ul>	<ul style="list-style-type: none"> <li>Prior to construction for plans,</li> <li>Daily for management</li> </ul>

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#	Area	Impact	Mitigation	Roles & Responsibilities	Requirements	Time/frequency
16		domestic wastewater mismanagement	<ul style="list-style-type: none"> <li>• Identify types and estimate quantities of wastewater expected during construction,</li> <li>• Segregate wastewater streams to ensure compatibility with selected treatment option,</li> <li>• Segregate and pre-treat oil and grease containing effluents, by using grease traps prior to discharge to the sewer system,</li> <li>• Discharge to sanitary network only after confirming compliance with discharge quality requirements,</li> <li>• Contain in septic tanks if discharge to sanitary sewer network is not possible. Transport to wastewater treatment plants for final treatment, by using tankers,</li> <li>• Avoid direct contact with wastewater through applying an enclosed system for collection, containment, and disposal.</li> <li>• Monitor groundwater quality that could exist close to the working areas to ensure compliance.</li> </ul>	<ul style="list-style-type: none"> <li>• Contractor to implement,</li> <li>• Supervision contract,</li> <li>• BSA to follow up,</li> <li>• MOB to approve dumpsite.</li> </ul>	<ul style="list-style-type: none"> <li>• Waste management plan,</li> <li>• Storage plan,</li> <li>• Quality testing for groundwater resources</li> <li>• Provisions for on-site treatment</li> </ul>	<ul style="list-style-type: none"> <li>• Prior to construction for plans,</li> <li>• Daily for management</li> <li>• Quarterly for water quality monitoring</li> </ul>
17	<b>Physical environment</b>	contamination of land	<ul style="list-style-type: none"> <li>• Manage contaminated land with the objective of protecting the safety and health of the occupants of the site, the surrounding community, and the environment post construction,</li> <li>• Understand the historical use of the land with regard to the potential presence of hazardous materials or oil prior to initiation of construction activities,</li> <li>• Prepare a management plan to manage contaminated land remaining similar to the management of obsolete, abandoned, hazardous materials found on-site,</li> <li>• Transfer contaminated land remaining to a legal dumpsite designated to this type of waste,</li> <li>• Avoid direct contact to the extent applicable.</li> </ul>	<ul style="list-style-type: none"> <li>• Contractor to implement,</li> <li>• Supervision contract,</li> <li>• BSA to follow up,</li> <li>• MOB to designate and approve dumpsite.</li> </ul>	<ul style="list-style-type: none"> <li>• Waste management plan,</li> <li>• Best management practices,</li> </ul>	Upon earth work

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#	Area	Impact	Mitigation	Roles & Responsibilities	Requirements	Time/frequency
18		soil erosion and sediment mobilization	<ul style="list-style-type: none"> <li>• Schedule to avoid heavy rainfall periods, to the extent practical, during dry seasons,</li> <li>• Minimize steepness of slopes,</li> <li>• Re-vegetate if applicable,</li> <li>• Design channels and ditches for expected flows during construction,</li> <li>• Reduce or prevent off-site sediment transport by applying sediment ponds or silt fences,</li> <li>• Modify or suspend activities during extreme rainfall and high winds to the extent practical,</li> <li>• Segregate or divert clean runoffs from water containing high solids content to minimize treatment,</li> <li>• Provide adequate drainage system onsite to minimize and control infiltration.</li> <li>• Monitor groundwater quality that could exist close to the working areas to ensure compliance.</li> </ul>	<ul style="list-style-type: none"> <li>• Contractor to implement,</li> <li>• Supervision contract,</li> <li>• BSA to follow up,</li> <li>• Meteorological department for weather forecast</li> </ul>	<ul style="list-style-type: none"> <li>• Best management practices,</li> <li>• Provision of drainage/ segregation systems,</li> <li>• Weather forecast</li> <li>• Quality testing for groundwater resources</li> </ul>	<ul style="list-style-type: none"> <li>• Daily for best practices,</li> <li>• Seasonally for rainfall seasons</li> <li>• Quarterly for water quality monitoring</li> </ul>
19	<b>Biotic environment</b>	altering/ endangering biological life	<ul style="list-style-type: none"> <li>• Ensure full adherence to the zero-discharge criterion to the surrounding environment during dismantling and installing of new parts,</li> <li>• Oblige by available and approved routes, and avoid driving off-roads, or through naturally valued areas,</li> <li>• Oblige by legal transportation and dumping of materials in their pre-designated and approved dumpsites,</li> <li>• Stay in constant contact with the concerned authorities should any emergent spillage occurs, and apply prompt and approved site cleanup procedures,</li> <li>• Raise awareness on the importance of natural life in the area and possible ways for protection.</li> </ul>	<ul style="list-style-type: none"> <li>• Contractor to implement,</li> <li>• Supervision contract,</li> <li>• BSA to follow up,</li> <li>• MOB to designate and approve dumpsite,</li> <li>• Environment department to advise,</li> </ul>	<ul style="list-style-type: none"> <li>• Best management practices,</li> <li>• Provisions of off-site cleanup,</li> <li>• Waste and spill management plan,</li> <li>• Flora and fauna mapping,</li> <li>• Awareness on natural life</li> </ul>	<ul style="list-style-type: none"> <li>• Prior to construction for flora and fauna mapping,</li> <li>• Daily for zero-discharge, driving routes,</li> <li>• Weekly for awareness,</li> <li>• Continuously for contact with environment dept.</li> </ul>

#	Area	Impact	Mitigation	Roles & Responsibilities	Requirements	Time/frequency
20	<b>Cultural heritage and chance finds</b>	Possible damage to objects of historical/cultural value	<ul style="list-style-type: none"> <li>Educate site workers on possibilities of unearthing objects of historical/cultural value,</li> <li>Make workers aware of the significance and legal liabilities in case of mismanaging chance finds,</li> <li>Put simple and clear instructions for workers in response to managing any chance finds during excavation,</li> <li>Liaise with responsible authorities, the department of antiquities, for endorsing instructions prepared by the Contractor(s),</li> <li>Suspend excavation work and promptly communicate any chance finds to the responsible authorities for further actions.</li> </ul>	<ul style="list-style-type: none"> <li>Contractor to implement,</li> <li>Supervision contract,</li> <li>BSA to follow up,</li> <li>Dept. of antiquities to approve chance finds procedures,</li> </ul>	<ul style="list-style-type: none"> <li>Education &amp; awareness,</li> <li>Procedures for chance finds,</li> <li>Well-defined communication channels,</li> </ul>	<ul style="list-style-type: none"> <li>Prior to excavation for "education",</li> <li>Prior to excavation for "chance finds procedures",</li> <li>On daily basis during excavation works</li> </ul>
21	<b>Socio-economic</b>	temporary loss of livelihoods and interruption of social and economic activities if relocation is deemed necessary	<ul style="list-style-type: none"> <li>Prepare and apply a RAP/ARAP in case some business owners alongside trunk main has to be relocated.</li> </ul>	<ul style="list-style-type: none"> <li>BSA</li> <li>PIC's Environmental and Social Safeguards Specialist</li> </ul>	<ul style="list-style-type: none"> <li>RPF/RAP/ARAP</li> </ul>	<ul style="list-style-type: none"> <li>Prior to construction</li> </ul>

Table 27: Environmental and Social Management Plan – Operation phase

#	Area	Impact	Mitigation	Responsibility	Requirement	Frequency
1	Public health and safety	public health issues and contamination of environment due to mismanagement of overflows	<ul style="list-style-type: none"> <li>• Develop and implement appropriate protocols to reduce risks to safety, public health, and environment that include well-written instructions,</li> <li>• Develop a contingency plan (site-specific),</li> <li>• Response to overflows by preventing, containing, minimizing, the overflow where it is feasible and safe to do so,</li> <li>• Protect SPS's components from flood damage where it is feasible to do so (by for instance, protecting components from rising flood water to enable reinstating more rapidly,</li> <li>• Notify responsible parties, which include the Baghdad Sewerage Department in this case.</li> </ul>	<ul style="list-style-type: none"> <li>• Working personnel to implement,</li> <li>• BSA to monitor,</li> <li>• Environment dept,</li> <li>• Local representatives,</li> </ul>	<ul style="list-style-type: none"> <li>• Contingency plan,</li> <li>• Public health standards,</li> <li>• Maintenance plans,</li> <li>• Community outreach</li> </ul>	<ul style="list-style-type: none"> <li>• Daily for contingency, and maintenance,</li> <li>• Seasonally for community outreach</li> </ul>
2		Odor and noise nuisance to adjacent sensitive receptors	<ul style="list-style-type: none"> <li>• Apply preventive and corrective maintenance procedures on odor and noise generating equipment and facilities, in a frequency applicable to manufacturer's instructions,</li> <li>• Apply preventive and corrective maintenance on odor control units, in a frequency applicable to the manufacturer's instructions,</li> <li>• Establish a Standard Operating Procedure (SOP) to include requirements for maintenance, monitoring, and personnel training,</li> <li>• Monitor outdoor odor and noise levels within pumping station boundary, to ensure limits are not exceeded,</li> <li>• Create retrofitting noise controls where practical, like fencing and enclosures,</li> <li>• Keep records of the maintenance logs, local complaints, and analyze trends.</li> </ul>	<ul style="list-style-type: none"> <li>• Working personnel to implement,</li> <li>• BSA to monitor,</li> <li>• Environment dept to advise,</li> <li>• Local representatives,</li> </ul>	<ul style="list-style-type: none"> <li>• Provision of noise and odor controls,</li> <li>• Maintenance plans and procedures,</li> <li>• Monitoring plans,</li> <li>• Community outreach</li> </ul>	<ul style="list-style-type: none"> <li>• Daily for management and maintenance plans,</li> <li>• Weekly for monitoring,</li> <li>• Seasonally for community outreach</li> </ul>
3		Pest spreading issues	Use of pesticides that are compatible with "Recommended Classification of Pesticides by Hazard and Guidelines to Classifications" of the WHO	<ul style="list-style-type: none"> <li>• Working personnel to implement,</li> <li>• BSA to monitor,</li> <li>• Environment dept to advise,</li> </ul>	<ul style="list-style-type: none"> <li>• Pesticides compatible with WHO guidance</li> </ul>	Monthly

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#	Area	Impact	Mitigation	Responsibility	Requirement	Frequency
4		public health issues and contamination of environment due to mismanagement of hazardous waste and materials	<ul style="list-style-type: none"> <li>• Train operators on release prevention, including drills specific to hazardous materials as part of emergency preparedness response training,</li> <li>• Implement inspection programs to maintain the mechanical integrity and operability of pressure vessels, tanks, piping systems, relief and vent valve systems, containment infrastructure, emergency shutdown systems, controls and pumps, and associated process equipment,</li> <li>• Prepare written Standard Operating Procedures (SOPs) for filling containers or equipment as well as for transfer operations by personnel trained in the safe transfer and filling of the hazardous material, and in spill prevention and response,</li> <li>• Apply SOPs for the management of secondary containment structures, specifically the removal of any accumulated fluid, such as rainfall, to ensure that the intent of the system is not accidentally or willfully defeated,</li> <li>• Identify locations of hazardous materials and associated activities,</li> <li>• Transport and dump waste residues from screens in legal and approved dumpsites,</li> <li>• Make available specific PPE and training needed to respond to an emergency,</li> <li>• Make available spill response equipment sufficient to handle at least initial stages of a spill and a list of,</li> <li>• Train and educate operational personnel on response activities in the event of spill, release, or chemical emergency.</li> <li>• Provide quality monitoring tests for groundwater resources adjacent to subproject locations</li> </ul>	<ul style="list-style-type: none"> <li>• Working personnel to implement,</li> <li>• BSA to monitor,</li> <li>• Environment dept to advise,</li> <li>• Local representatives,</li> </ul>	<ul style="list-style-type: none"> <li>• Capacity building,</li> <li>• Inspection programs,</li> <li>• Documented procedures,</li> <li>• Best management practices,</li> <li>• Legal and approved dumpsite,</li> <li>• Provision of PPE,</li> <li>• Provision of spill equipment.</li> <li>• Provision of water quality monitoring</li> </ul>	On daily basis Semiannual for water quality monitoring
5	OHS	Health issues related to over-exertion and ergonomic injuries and illnesses	<ul style="list-style-type: none"> <li>• Prevent and control by training workers on lifting and material handling techniques, including placing of weight limits above which mechanical assists or two-person lifts are necessary,</li> <li>• Plan work site layout to minimize the need for manual transfer of heavy loads,</li> <li>• Select tools and design work stations that reduce force requirements and holding times, and promote improved postures, including, where applicable, user adjustable work stations,</li> <li>• Implement administrative controls into work processes, such as job rotations and rest or stretch breaks.</li> </ul>	<ul style="list-style-type: none"> <li>• Working personnel to implement,</li> <li>• BSA to provide medical insurance, monitor implementation, and provide training.</li> </ul>	<ul style="list-style-type: none"> <li>• Capacity building,</li> <li>• Best practices,</li> <li>• Personnel rotation system,</li> <li>• First aid and medical insurance.</li> </ul>	<ul style="list-style-type: none"> <li>• Daily for best practices and medical care,</li> <li>• Periodically for capacity building and job rotation,</li> </ul>
6		Health issues related to	<ul style="list-style-type: none"> <li>• Implement good house-keeping practices, such as the sorting and</li> </ul>	<ul style="list-style-type: none"> <li>• Working personnel</li> </ul>	<ul style="list-style-type: none"> <li>• Capacity building,</li> </ul>	<ul style="list-style-type: none"> <li>• Daily for best</li> </ul>

#	Area	Impact	Mitigation	Responsibility	Requirement	Frequency
		accidental slips and falls	placing of loose materials or debris in established areas away from foot paths, <ul style="list-style-type: none"> <li>• Clean up excessive waste debris and liquid spills regularly,</li> <li>• Locate electrical cords and ropes in common areas and marked corridors,</li> <li>• Use slip retardant footwear, especially when using stairs to access underground facilities.</li> </ul>	to implement, <ul style="list-style-type: none"> <li>• BSA to provide medical insurance, monitor implementation, and provide training.</li> </ul>	<ul style="list-style-type: none"> <li>• Best practices,</li> <li>• Cleanup kits,</li> <li>• First aid and medical insurance,</li> <li>• PPE,</li> </ul>	practices, medical care, and PPE, <ul style="list-style-type: none"> <li>• Periodically for capacity building and job rotation,</li> </ul>
7		Health issues related to working in heights	<ul style="list-style-type: none"> <li>• Train and use temporary fall prevention devices, such as rails or other barriers able to support a weight of 90.7kg at a minimum, when working at heights equal or greater than 2m or at any height if the risk includes falling into operating machinery, into water or other liquid, into hazardous substances, or through an opening in a work surface (inspection hatches),</li> <li>• Train and use personal fall arrest systems, such as full body harnesses and energy absorbing lanyards,</li> <li>• Use control zones and safety monitoring systems to warn workers of their proximity to fall hazard zones (if applicable). As well as secure, mark, and label covers for openings in floors, roofs, or walking surfaces.</li> </ul>	<ul style="list-style-type: none"> <li>• Working personnel to implement,</li> <li>• BSA to provide medical insurance, monitor implementation, and provide training.</li> </ul>	<ul style="list-style-type: none"> <li>• Capacity building,</li> <li>• Best practices,</li> <li>• Provision of safety devices,</li> <li>• Provision of monitoring systems,</li> <li>• First aid and medical insurance,</li> <li>• PPE,</li> </ul>	<ul style="list-style-type: none"> <li>• Daily for best practices, medical care, safety devices, monitoring systems PPE,</li> <li>• Periodically for capacity building,</li> </ul>
8		Health issues related to working with electrical equipment and control panels	<ul style="list-style-type: none"> <li>• Conduct detailed identification and marking of all electrical connections prior to any maintenance work,</li> <li>• Lock out (de-charge and leave open with a controlled locking device) and tag-out (by a warning sign placed on the lock) devices during demounting and lifting electrical devices for maintenance,</li> <li>• Ensure circuit breaking before starting work on electrical parts,</li> <li>• Use electricity-specific PPE, including insulating clothing, suits, and gloves,</li> <li>• Use specially trained personnel to demount electrical parts.</li> </ul>	<ul style="list-style-type: none"> <li>• Working personnel to implement,</li> <li>• BSA to provide medical insurance, monitor implementation, and provide training.</li> </ul>	<ul style="list-style-type: none"> <li>• Capacity building,</li> <li>• Best practices,</li> <li>• Acquisition of right expertise,</li> <li>• Provision of safety devices,</li> <li>• Provision of monitoring systems,</li> <li>• First aid and medical insurance,</li> <li>• PPE,</li> </ul>	<ul style="list-style-type: none"> <li>• Daily for best practices, medical care, safety devices, monitoring systems PPE,</li> <li>• Periodically for capacity building and employing right expertise</li> </ul>
9		Health issues related to working in confined places	<ul style="list-style-type: none"> <li>• Provide safe means of access and egress from confined places, such as stairs and ladders, and safety ropes,</li> <li>• Avoid operating combustion equipment for prolonged periods unless the area is actively ventilated,</li> <li>• Use special PPE including respirators, protective suits, gloves, and eye protection,</li> <li>• Minimize exposure period to the extent possible.</li> </ul>	<ul style="list-style-type: none"> <li>• Working personnel to implement,</li> <li>• BSA to provide medical insurance, monitor implementation, and provide</li> </ul>	<ul style="list-style-type: none"> <li>• Education,</li> <li>• Provision of safety devices,</li> <li>• Ventilation system,</li> <li>• PPE,</li> <li>• First aid.</li> </ul>	<ul style="list-style-type: none"> <li>• Daily for best practices, medical care, safety devices, PPE,</li> <li>• Periodically for capacity building</li> </ul>



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#	Area	Impact	Mitigation	Responsibility	Requirement	Frequency
10		health and stress issues due to noise and vibration in work environment	<ul style="list-style-type: none"> <li>Effectively isolating control room against noise and vibration,</li> <li>Avoid prolonged exposure periods beyond permissible times,</li> <li>Avoid exposure to excessive levels beyond permissible limits set out by local and international regulations,</li> <li>Monitor noise and vibration levels frequently (within a SOP),</li> <li>Use noise hearing protection gear and vibration resistant boots, gloves, and clothing,</li> <li>Keep records of breaching incidents, and report to the higher management.</li> </ul>	training. <ul style="list-style-type: none"> <li>Working personnel to implement,</li> <li>BSA to provide medical insurance, monitor implementation, and provide training.</li> </ul>	<ul style="list-style-type: none"> <li>Education,</li> <li>Provision of isolation,</li> <li>Provision of monitoring devices and programs,</li> <li>PPE,</li> <li>Medical insurance,</li> <li>Record keeping</li> </ul>	<ul style="list-style-type: none"> <li>Daily for best practices, medical care, PPE,</li> <li>Weekly and monthly for monitoring,</li> <li>Periodically for capacity building</li> </ul>

## 10.2. Monitoring Program

### 10.2.1. General principles

A monitoring program is required in both construction and operation phases. Monitoring aims at ensuring effective and timely implementation of environmental and social mitigation measures. A monitoring program should include all sensitive environmental and social parameters in both construction and operation; should be performed by well-trained personnel; within a pre-defined timeline; and by utilizing available management resources and systems. This would include for instance, water quality monitoring, records of incidents, complaints, traffic, health care, etc.

In construction phase, the Contractor holds responsibility for monitoring pollutant releases to the on-site and off-site environments. These include air pollutants, noise/vibration levels, ground and surface water quality, sediment and waste quantities, etc. the Contractor is also responsible for adherence to OHS measures and transportation measures, by analyzing and responding to incident and complaining reports (see Annex IV for more details). The project will have for supervision a Project Implementation Consulting (PIC) firm. This PIC will be responsible for monitoring contractors' implementation and specifically the implementation of environmental and social safeguards through having an Environmental and Social Safeguard Specialist onboard. The BSA team also may share responsibility along with a PIC firm for conducting site visits jointly with other departments, like the Al-Sha'ab and Al-Doura Municipalities, including participation from the contractor's side. Site visits should result in furnishing visit reports by the PIC firm. On another hand, BSA should have within its team an **Environmental and Social Officer (ESO)** to represent his/her department in all communications, visits, and reporting (see more detail in institutional arrangements section). Feedback from local communities on environmental and social related issues – could also be received through community representatives, for instance. Section 10.2.4 below, details the schedule of visits to the construction site and reporting pathways between all related parties.

In operation phase, monitoring responsibility is foreseen within the capacity of operational staff and higher management of BSA and MOB. Releases to the environment will need to be monitored. That would include (but not limited to) impacts caused by accidental overflows, odor and noise emissions, ground and surface water pollutants, and vibration levels on working personnel. OHS measures at the site will be ones of the important issues to be followed up with site management. Adverse impacts will need to be monitored by utilizing available management systems, as well as performing site measurements for air, land, and water (both surface and underground). Feedback from the local community on environmental issues is also important for a sounder implementation of the corrective and preventive actions. In order to carry out this function, the BSA should have its ESO continue work from the previous construction phase. Duties include for example overseeing the day-to-day implementation of the Environmental Management Plan in the project sites and reporting back to the PMU and relevant higher management.

The monitoring program takes into account a number of KPIs and pollutant thresholds set out by regulators, against which parameters are to be monitored. Additionally, monitoring devices, either handheld or stationary, have to be well-maintained and calibrated with proper certified standard materials, especially in the cases of air, noise, vibration, land, and water measurements. A well

trained staff should be commissioned to perform and analyze measurements. The required expertise could be acquired from the existing laboratory staff. Finally, costs incurred for monitoring impacts during construction is embedded in the PIC's contract, while costs of monitoring during operation phase will be part of the BSA budget. Tables 28 & 29 below provide monitoring programs pertinent to the construction and operation phases respectively, while table 31 shows timeline for implementation at both Project sites during construction.

### **10.2.2. Surface and Groundwater Quality Monitoring**

A surface and groundwater monitoring program will be further developed in the onset of the project with technical support from the central labs of BWA. The monitoring program aims to monitor impacts of the project construction and operation activities on adjacent surface and groundwater resources. The monitoring program should at minimum include the following:

Full mapping of the affected water bodies, either surface or underground, including collection of baseline quality information and extraction/discharge capacities.

Monitoring locations are to be agreed on with BWA's personnel. And should basically include:

- Intake points from Tigris River to water projects;
- Discharge points of untreated sewage into Tigris River;
- Groundwater wells within 1km of point of discharge into Tigris River; and
- Groundwater wells within 1 km distance along open canals of untreated sewage.

Sampling is suggested to take place every two weeks for a total period of 2 months prior to construction for each of the 4 monitoring locations suggested above. This initial monitoring will provide a better understanding of the baseline quality information, which will be used later on to compare the effect of implementing and operating the project.

Another round of monitoring should be done every three months during construction phase from the same 4 suggested monitoring locations, in order to depict any deviation from baseline.

During operation of the project, monitoring can still continue but in a semiannual mode. However, an annual trend analysis should be conducted for each set of parameters for a specific monitoring location, with a possibility to update locations as necessary.

A grab sample will be taken from monitoring points using a verified sampling methods and suitably referenced to a handbook source like the "Standard Methods for the Examination of Water and Wastewater". Sampling should be done by specialized monitoring agencies like the water quality laboratories of BSA and BWA.

Testing parameters should include physical characteristics like temperature, color, and odor. Chemical characteristics like: pH, Turbidity, Electrical conductivity, TSS, TDS, Sulfate, Nitrate, Nitrite, Ammonia, Phosphate, BOD, COD, Total Halo Methanes, VOCs, and Heavy metals. As well as Microbiological characteristics: Plate count, Total coliform, E-coli, Salmonella.

All means of testing should be made available at the water quality labs, which include either handheld devices or bench-top analyzers. Additionally all standard materials, testing kits, and calibration services (if needed) should be provided.

Prior to construction phase, the central water laboratories of BWA may assume responsibility for preparing baseline quality information. During construction phase, the Project Implementing Consultancy (PIC) firm can handle water quality monitoring as an independent party from the contractor and project proponent. Mitigation measures applied by the contractor have to be in full compliance with standards and limits. However, during operation, the water monitoring laboratories will again resume monitoring on a semiannual basis.

Monitoring costs include sampling, testing, and operational. For each round of testing (pre-construction, during construction, and operations) costs are estimated as follows:

Sampling: 100 USD per a chemical or microbiological sample per location. Total cost of sampling from 4 suggested locations would be:  $200 \text{ USD} * 4 = 800 \text{ USD}$ .

Testing: 200 USD per physical, chemical, or microbiological parameter at a governmental monitoring agency like the central laboratories of BWA. Therefore, for all parameters, one round of testing would cost:  $200 \text{ USD} * 22 \text{ parameter} = 4,400 \text{ USD}$  (either in pre-construction, during construction, or operation phases).

Human resources: 500 USD per each round of testing.

Overhead: estimated at 400 USD per each round.

Total cost: 6,100 USD per each round of testing (4 suggested locations)

### 10.2.3. Proposed monitoring plan

Table 28: Monitoring plan per one site – Construction phase

#	Parameter to be monitored	Target KPI/limit	Monitoring requirements	Monitoring Responsibility	Frequency	location	Cost estimate
1	Health issues linked to nature of work	<ul style="list-style-type: none"> <li>Zero medical complaint/ assistance,</li> <li>100% clear inspection report</li> </ul>	<ul style="list-style-type: none"> <li>Contractors' incident records</li> <li>Keeping records at medical care centers</li> </ul>	<ul style="list-style-type: none"> <li>Resident engineer of PIC</li> <li>Resident engineer of BSA</li> <li>ESO- BSA</li> </ul>	Monthly, Annual review	Construction site	<ul style="list-style-type: none"> <li>PIC's budget.</li> <li>BSA's resident engineer daily rate (approx. 50 USD/day)</li> <li>ESO-BSA's daily rate (approx. 50 USD/day)</li> </ul>
2	Training effectiveness	<ul style="list-style-type: none"> <li>Zero incident reports related to training,</li> <li>100% clear inspection report</li> </ul>	<ul style="list-style-type: none"> <li>Contractor's incident reports</li> </ul>	<ul style="list-style-type: none"> <li>Resident engineer of PIC</li> <li>Resident engineer of BSA</li> <li>ESO- BSA</li> </ul>	Monthly, Annual review	Construction site	<ul style="list-style-type: none"> <li>PIC's budget.</li> <li>BSA's resident engineer daily rate (approx.. 50 USD/day)</li> <li>ESO-BSA's daily rate (approx. 50 USD/day)</li> </ul>
3	Housekeeping in-situ	<ul style="list-style-type: none"> <li>Zero incident reports,</li> <li>Zero complaints,</li> <li>100% clear inspection report</li> </ul>	<ul style="list-style-type: none"> <li>Contractor's incident records,</li> <li>Contractor's complaining system,</li> <li>Site engineer's reporting</li> </ul>	<ul style="list-style-type: none"> <li>Resident engineer of PIC</li> <li>Resident engineer of BSA</li> </ul>	Bi-weekly, Monthly, Annual review	Construction site	<ul style="list-style-type: none"> <li>PIC's budget.</li> <li>BSA's resident engineer daily rate (approx. 50 USD/day)</li> <li>ESO-BSA's daily rate (approx. 50 USD/day)</li> </ul>
4	Right expertise	<ul style="list-style-type: none"> <li>Zero incident reports related to failure testing,</li> <li>100% clear inspection report</li> </ul>	Mechanical and electrical testing records, Site engineer's reporting	<ul style="list-style-type: none"> <li>Resident engineer of PIC</li> <li>Resident engineer of BSA</li> </ul>	Quarterly	Construction site	<ul style="list-style-type: none"> <li>PIC's budget.</li> <li>BSA's resident engineer daily rate (approx. 50 USD/day)</li> </ul>
5	PPE effective usage	<ul style="list-style-type: none"> <li>Zero incident reports related to misusing PPE,</li> <li>100% clear inspection report,</li> <li>100% clear OH report</li> </ul>	<ul style="list-style-type: none"> <li>Contractor's incident records,</li> <li>Contractor's complaining system,</li> <li>Site engineer's reporting,</li> <li>OH inspection system</li> </ul>	<ul style="list-style-type: none"> <li>Contractor</li> <li>Resident engineer of PIC</li> <li>Resident engineer of BSA</li> </ul>	Monthly	Construction site	<ul style="list-style-type: none"> <li>Contractor's budget</li> <li>PIC's budget.</li> <li>BSA's resident engineer daily rate (approx. 50 USD/day)</li> </ul>
6	Site hygiene	<ul style="list-style-type: none"> <li>Zero incident reports related to waste mismanagement,</li> <li>100% clear inspection report,</li> <li>100% clear PH report</li> </ul>	<ul style="list-style-type: none"> <li>Contractor's incident records,</li> <li>Contractor's complaining system,</li> </ul>	<ul style="list-style-type: none"> <li>Contractor</li> <li>Resident engineer of PIC</li> <li>Resident</li> </ul>	Monthly, Quarterly, Annual review.	Construction site	<ul style="list-style-type: none"> <li>Contractor's budget</li> <li>PIC's budget.</li> <li>BSA's resident engineer daily rate (approx. 50</li> </ul>

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#	Parameter to be monitored	Target KPI/limit	Monitoring requirements	Monitoring Responsibility	Frequency	location	Cost estimate
			<ul style="list-style-type: none"> <li>Site engineer's reporting,</li> <li>PH inspection system</li> </ul>	engineer of BSA			USD/day)
7	Off-site hygiene	<ul style="list-style-type: none"> <li>Zero complaints related to illegal dumping off-site,</li> <li>100% clear PH report</li> </ul>	<ul style="list-style-type: none"> <li>BSA's complaining system,</li> <li>PH inspection system</li> </ul>	<ul style="list-style-type: none"> <li>Resident engineer of PIC</li> <li>MOB</li> </ul>	Monthly, Quarterly, Annual review	Transporting routes	<ul style="list-style-type: none"> <li>PIC's budget.</li> <li>MOB budget (daily rates of field inspectors approx. 50 USD/day)</li> </ul>
8	Ambient air quality and noise	<ul style="list-style-type: none"> <li>Zero complaints related to air and noise nuisance,</li> <li>100% clear Environmental Health (EH) report,</li> <li>Thresholds are fully complied with.</li> </ul>	<ul style="list-style-type: none"> <li>BSA's complaining system,</li> <li>EH. inspection system,</li> <li>Air and noise monitoring equipment, measurements and analyses.</li> </ul>	<ul style="list-style-type: none"> <li>Resident engineer of PIC</li> <li>Resident engineer of BSA</li> <li>ESO- BSA</li> </ul>	Quarterly, Annual review.	Site vicinity	<ul style="list-style-type: none"> <li>PIC's budget (monitoring cost estimated at 10,000 USD quarterly).</li> <li>BSA's resident engineer daily rate (approx. 50 USD/day)</li> <li>ESO-BSA's daily rate (approx. 50 USD/day)</li> </ul>
9	Surface and groundwater quality	<ul style="list-style-type: none"> <li>Physical, chemical, and bacteriological parameters are within national limits</li> </ul>	<ul style="list-style-type: none"> <li>Water quality monitoring services</li> </ul>	<ul style="list-style-type: none"> <li>Resident engineer of PIC</li> <li>ESO-BSA for final reporting</li> </ul>	Quarterly	<ul style="list-style-type: none"> <li>Intake points from Tigris,</li> <li>Discharge points of untreated sewage,</li> <li>Groundwater wells within 1km of point of discharge into Tigris, and</li> <li>Groundwater wells within 1 km distance along open canals of untreated sewage.</li> </ul>	<ul style="list-style-type: none"> <li>6,100 USD per each round of testing from 4 locations</li> <li>ESO-BSA's daily rate (approx. 50 USD/day)</li> </ul>
10	Public health	<ul style="list-style-type: none"> <li>Zero complaints related to vector nuisance and communicable diseases,</li> <li>Zero incidents of Project related infections/diseases.</li> </ul>	<ul style="list-style-type: none"> <li>Immunization program,</li> <li>Records of BSA's complaining system,</li> <li>Records of Health inspection system,</li> <li>Records of Health care systems.</li> </ul>	<ul style="list-style-type: none"> <li>Health care provider</li> <li>Resident engineer of PIC</li> <li>MOB</li> <li>ESO-BSA for final reporting</li> </ul>	Monthly, Annual review.	On-site, localities	<ul style="list-style-type: none"> <li>Cost of health care program included in the contractor's budget (estimate: 200 USD/worker/year),</li> <li>Cost of MOB's complaining system included in MOB's budget,</li> <li>PIC's budget</li> <li>ESO-BSA's daily rate (approx. 50 USD/day)</li> </ul>
11	Traffic safety	<ul style="list-style-type: none"> <li>Zero traffic accident reports</li> </ul>	<ul style="list-style-type: none"> <li>Traffic dept records,</li> </ul>	<ul style="list-style-type: none"> <li>Traffic dept,</li> </ul>	Monthly,	Public road network	<ul style="list-style-type: none"> <li>Costs of accidents recording</li> </ul>

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#	Parameter to be monitored	Target KPI/limit	Monitoring requirements	Monitoring Responsibility	Frequency	location	Cost estimate
		related to the Project, <ul style="list-style-type: none"> <li>Zero complaints of project related traffic accidents</li> </ul>	<ul style="list-style-type: none"> <li>Records of BSA's complaining system,</li> <li>Contractor's record.</li> </ul>	<ul style="list-style-type: none"> <li>MOB</li> <li>Resident engineer of PIC for reporting</li> <li>ESO-BSA for final reporting</li> </ul>	Annual review		included in Traffic Department's budget, <ul style="list-style-type: none"> <li>Cost of MOB's complaining system included in MOB's budget,</li> <li>PIC's budget</li> <li>ESO-BSA's daily rate (approx. 50 USD/day)</li> </ul>
12	Natural life (flora & fauna)	<ul style="list-style-type: none"> <li>Zero incident reports related to altering/ endangering natural life</li> </ul>	<ul style="list-style-type: none"> <li>Environmental inspection system,</li> <li>Incident records.</li> </ul>	<ul style="list-style-type: none"> <li>Environmental dept at MOB</li> <li>Resident engineer of PIC for reporting</li> <li>ESO-BSA for final reporting</li> </ul>	Monthly, Annual review	Natural life in vicinity and downstream	<ul style="list-style-type: none"> <li>Costs of environmental monitoring included in environmental dept's budget,</li> <li>PIC's budget</li> <li>ESO-BSA's daily rate (approx. 50 USD/day)</li> </ul>
13	Cultural heritage and chance finds	<ul style="list-style-type: none"> <li>Incident reports of chance finds are fully addressed to responsible authorities</li> <li>No activity has resulted in any archaeological/cultural heritage damage during construction</li> </ul>	<ul style="list-style-type: none"> <li>Incident reports,</li> <li>Site surveillance during work</li> <li>Open reporting channels with responsible authorities (dept. of antiquities and MOB)</li> </ul>	<ul style="list-style-type: none"> <li>Antiquities dept.</li> <li>Resident engineer of PIC for reporting</li> <li>ESO-BSA for final reporting</li> </ul>	Daily, quarterly review	Alongside roads that will have excavations	<ul style="list-style-type: none"> <li>Antiquities Department monitoring budget,</li> <li>PIC's budget</li> <li>ESO-BSA's daily rate (approx. 50 USD/day)</li> </ul>

Table 29: Monitoring plan per one site – Operation phase

#	Parameter to be monitored	Target KPI/limit	Monitoring requirements	Monitoring Responsibility	Frequency	location	Cost estimate
1	Water quality	<ul style="list-style-type: none"> <li>River water quality within thresholds,</li> <li>Zero complaints related to overflows</li> </ul>	<ul style="list-style-type: none"> <li>Water quality monitoring services</li> </ul>	<ul style="list-style-type: none"> <li>MOB for complaining</li> <li>BWA's central labs</li> <li>ESO-BSA</li> </ul>	Semiannual	<ul style="list-style-type: none"> <li>Intake points from Tigris,</li> <li>Discharge points of untreated sewage,</li> <li>Groundwater wells within 1km of point of discharge into Tigris, and</li> <li>Groundwater wells within</li> </ul>	<ul style="list-style-type: none"> <li>MOB's budget for running complaining system,</li> <li>6,100 USD per each round of testing from 4 locations</li> <li>ESO-BSA's daily rate (approx. 50 USD/day)</li> </ul>

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#	Parameter to be monitored	Target KPI/limit	Monitoring requirements	Monitoring Responsibility	Frequency	location	Cost estimate
						1 km distance along open canals of untreated sewage.	
2	Land and soil quality	<ul style="list-style-type: none"> <li>Land and soil quality within thresholds,</li> <li>Zero complaints related to overflows</li> </ul>	<ul style="list-style-type: none"> <li>MOB/BSA's complaining system,</li> <li>Land and soil monitoring equipment, measurements, and analyses.</li> </ul>	<ul style="list-style-type: none"> <li>MOB's Environmental Health dept.</li> <li>ESO-BSA</li> </ul>	Monthly, Annually.	SPS vicinity, Downstream	<ul style="list-style-type: none"> <li>MOB/BSA's budget for running complaining and inspection,</li> <li>MOB/BSA's budget for running soil monitoring</li> <li>ESO-BSA's daily rate (approx. 50 USD/day)</li> </ul>
3	Ambient air quality and noise	<ul style="list-style-type: none"> <li>Zero complaints related to air and noise nuisance,</li> <li>100% clear EH report,</li> <li>Thresholds not exceeded.</li> </ul>	<ul style="list-style-type: none"> <li>MOB/BSA's complaining system,</li> <li>Air and noise monitoring measurements and analyses</li> </ul>	<ul style="list-style-type: none"> <li>MOB</li> <li>ESO-BSA</li> </ul>	Monthly, Annually.	SPS vicinity	<ul style="list-style-type: none"> <li>MOB/BSA's budget for running complaining and inspection,</li> <li>MOB/BSA's budget for running air and noise monitoring</li> <li>ESO-BSA's daily rate (approx. 50 USD/day)</li> </ul>
4	Public health related to overflows	<ul style="list-style-type: none"> <li>Zero complaints of operation-related public health,</li> <li>Zero incidents of Project related infections/diseases.</li> </ul>	<ul style="list-style-type: none"> <li>Records of BSA's complaining system,</li> <li>Records of Health inspection system,</li> <li>Records of Health care systems.</li> </ul>	<ul style="list-style-type: none"> <li>MOB</li> <li>ESO-BSA</li> </ul>	Monthly, Annual review.	localities	<ul style="list-style-type: none"> <li>MOB/BSA's budget for running complaining and inspection,</li> <li>ESO-BSA's daily rate (approx. 50 USD/day)</li> </ul>
5	Health issues linked to nature of work	<ul style="list-style-type: none"> <li>Zero medical complaint/ assistance,</li> <li>Zero incident reports</li> </ul>	<ul style="list-style-type: none"> <li>Incidents records,</li> <li>Records at medical care centers</li> </ul>	<ul style="list-style-type: none"> <li>SPS operator,</li> <li>BSA</li> <li>ESO-BSA</li> </ul>	Monthly, Annual review	SPSs	<ul style="list-style-type: none"> <li>Costs of medical care included in BSA's budget (estimate: 200 USD/personnel/month)</li> <li>ESO-BSA's daily rate (approx. 50 USD/day)</li> </ul>
6	Capacity building	<ul style="list-style-type: none"> <li>Zero incident reports related to operational and maintenance activities,</li> <li>Staff evaluation (highest score)</li> </ul>	Human resources system	<ul style="list-style-type: none"> <li>HR at MOB/BSA</li> <li>ESO-BSA</li> </ul>	Semi-annual Annual review	SPSs	<ul style="list-style-type: none"> <li>Costs of capacity building and training included in MOB/BSA's budget (estimate: 1,000 USD/worker/year)</li> <li>Costs of staff evaluation included in MOB/BSA's HR budget.</li> </ul>
7	Housekeeping in-situ	Zero incident reports related to operational and maintenance activities,	Site inspection system and records	<ul style="list-style-type: none"> <li>SPS operator,</li> <li>ESO-BSA</li> </ul>	Bi-weekly, Monthly, Annual review	SPSs	<ul style="list-style-type: none"> <li>Costs of inspection and incidents record keeping included in the SPS's and MOB/BSA's budget (estimate: 2,000 USD/year)</li> <li>ESO-BSA's daily rate (approx. 50</li> </ul>



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#	Parameter to be monitored	Target KPI/limit	Monitoring requirements	Monitoring Responsibility	Frequency	location	Cost estimate
							USD/day)
8	PPE effective usage	Zero incident reports related to misusing PPE,	Site inspection system and records	<ul style="list-style-type: none"> <li>SPS operator,</li> <li>ESO-BSA</li> </ul>	Monthly	SPSs	<ul style="list-style-type: none"> <li>Costs of inspection and incidents record keeping included in the SPS's and MOB/BSA's budget (estimate: 2,000 USD/year)</li> <li>ESO-BSA's daily rate (approx. 50 USD/day)</li> </ul>
9	Site hygiene	Zero incident reports related to waste mismanagement.	Site inspection system and records	<ul style="list-style-type: none"> <li>SPS operator,</li> <li>ESO-BSA</li> </ul>	Monthly, Quarterly, Annual review.	SPSs	<ul style="list-style-type: none"> <li>Costs of inspection and incidents record keeping included in the SPS's and MOB/BSA's budget (estimate: 2,000 USD/year)</li> <li>ESO-BSA's daily rate (approx. 50 USD/day)</li> </ul>

#### 10.2.4. Site visits and reporting

For construction phase, the BSA should put in place a communication and reporting system in order to achieve provisions of the Environmental Safeguards Monitoring Plan. The contractor should follow reporting requirements set forth in the contract according to the Standard Procurement Document – Appendix C (WB, 2017). The reporting system should also outline frequency of field visits, communication pathways, and content of reporting at a minimum. During construction phase, the Project proponent (through a supervision contract) is required to monitor all key environmental social, cultural indicators on the ground as outlined above. It is advisable to jointly conduct site visits to the Project site by the Project proponent (BSA) and representatives from Al-Doura, Al-Sha'ab, Al-Ghazaliya, and Al-Shu'la municipalities and the Contractor's environmental safeguard specialist. These visiting and reporting shall be part of the whole monitoring plan and must include at least the following functions:

1. Conduct one site visit to the Project site prior to starting constructions. This site visit will aim to depict any new environmental and/ or social development on the ground, upon which the Environmental Management Plan to be especially updated. This site visit should result in preparing a site visit report, which would include: date of visit, participants, specifics of the visit, observations, photos, names of interviewees, conclusions, and recommendations. The site report will then be submitted to the higher management (BSA/ MOB and WB) through a supervision contractor, for approval, and for EMP further amendment if any.
2. Similarly, conduct another one visit to the site (in liaison with the supervision contractor) after civil works have started already. This study will aim to ensure the Contractor understands required safeguards in the site and his obligations towards full implementation. The participants of the visit should make sure the Contractor has hired a safeguard specialist within his team capacity to handle all related monitoring tasks. The visiting team should report this visit to the higher management (BSA/ MOB). Reporting information should include at a minimum: date of visit, participants, visit's specifics, observation, photos, names of interviewees, conclusions, and recommendations.
3. Reporting constantly (on daily basis) on safeguards implementation by the Contractor's environmental engineer. Reporting should be made to BSA (through a supervision contractor) for approval and comments. Then reporting back to the Contractor for further actions. See Annex II for a sample Checklist.
4. Reporting quarterly on safeguards implementation by the Contractor's environmental engineer. Reporting should be made to BSA (through a supervision contractor) for approval and comments. Then reporting back to the Contractor for further actions. Finalized quarterly reports should be submitted to the higher management (MOB) and the World Bank.
5. Monitoring process has to include consulting/ interviewing PAPs (recommended quarterly) throughout construction. This exercise aims to collect feedback from the surrounding communities on effectiveness of Environmental and Social Safeguards monitoring. This measure would be important to ground-truth actual and effectiveness of implementation of social mitigation measures, and the Grievance Redress Mechanism set forth is effective. All

feedback/ complaints should be documented in a site visit report and submitted to the higher management (BSA/ MOB). A full inventory of interviewees should be included in such report, which may include, among others, the following:

- Name, age, profession, educational level, place of residence, contact information,
- Daily observations by the interviewee on: dust, noise, air quality, traffic, waste releases, workforce interference with daily/ natural life, ability to integrate job opportunities, cases of communicable diseases, etc.
- Specific complaints and/or concerns about the Project,
- Photos if available,

The following table gives more insight to the visiting and reporting process.

Table 30: Monitoring and reporting schedule during construction phase

#	Type of reporting	Timing	Reporting (from whom to whom)	Description
1	Monitoring Project site before starting civil work	Once before start of civil works	<b>From</b> Representatives of BSA, Al-Doura, Al-Sha'ab, Al-Ghazaliya, and Al-Shu'la municipalities, and Contractor's environmental engineer <b>To</b> the higher management of BSA, MOB, and WB	This stems from BSA's responsibility to ensure preparedness of the Project site to receive the new interventions (environmentally, socially, etc.). This site report is a descriptive one, and should contain expert observations and feedback from surrounding people.
2	Monitoring Contractor's obligation towards EMP	Once upon starting the Project	<b>From</b> Representatives of BSA, Al-Doura, Al-Sha'ab, Al-Ghazaliya, and Al-Shu'la municipalities, and Contractor's environmental engineer <b>To</b> the higher management of BSA and MOB Then <b>From</b> BSA <b>To</b> Contractor for action	This stems from BSA's responsibility to ensure Contractor's full compliance to EMP. This visit report is a qualitative and quantitative one on the Contractor's environmental and social provisions (for example. Handheld monitoring devices, spill containment, workforce training records, etc.)
3	Monitoring safeguards	On daily basis	<b>From</b> the Contractor's environmental engineer <b>To</b> the BSA 's supervision team, Then <b>From</b> BSA <b>To</b> Contractor for action (through supervision contractor)	This is to ensure full compliance to environmental and social safeguards by the Contractor throughout Project construction. This report is essentially technical in heart, which should include figures and trend analyses for key environmental and social parameters.
4	Monitoring safeguards	Quarterly progress reporting	<b>From</b> the Contractor's environmental engineer <b>To</b> the BSA 's supervision team, <b>To</b> the higher management at BSA / MOB and WB Then <b>From</b> BSA <b>To</b> the Contractor for action (through supervision contractor)	Aims to engage higher management in monitoring progress, and to ensure their buy-in. This report should include summary information on parameters above limits and how they were rectified, and other issues and challenges and responses thereto.

#	Type of reporting	Timing	Reporting (from whom to whom)	Description
5	Monitoring complaints/concerns of local community	Quarterly from starting constructions	<b>From</b> Representatives of BSA, Al-Doura, Al-Sha'ab, Al-Ghazaliya, and Al-Shu'la municipalities, and Contractor's environmental engineer <b>To</b> the higher management of BSA and MOB, Then <b>From</b> BSA <b>To</b> Contractor for action (through supervision contractor)	Aims to rectify proceedings of the Project for healthier environmental and social aspects during construction, in addition to measure local community's satisfaction/ concerns. This reporting could be integrated within the same quarterly report (as in # 4).

During operation phase, the site management should constantly report on social and environmental impacts to their BSA's relevant environmental department on their daily management. Then feedback should be sought from BSA to the site management for further improvements. BSA should report to the higher management (MOB and WB) on a quarterly basis for quality-checks and areas for improvement.

10.2.5. Monitoring timeline

Table 31: Monitoring timeline for construction phase

#	Parameter	Year 1					Year 2										Year 3												
<b>Al-Doura 1 SPS</b>																													
1	Occupational health & safety	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x							
2	Training effectiveness	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x						
3	Housekeeping in-situ	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx						
4	Right expertise			x																									
5	PPE effective usage	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x						
6	Site hygiene	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x						
7	Off-site hygiene	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x						
8	Ambient air quality and noise	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx						
9	Public health & safety	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x						
10	Traffic safety	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x						
11	Natural life (flora & fauna)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x						
<b>Al-Habibiya SPS</b>																													
1	Occupational health & safety													x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
2	Training effectiveness													x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
3	Housekeeping in-situ													xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx
4	Right expertise															x													
5	PPE effective usage													x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
6	Site hygiene													x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
7	Off-site hygiene													x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
8	Ambient air quality and noise													xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx
9	Public health & safety													x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
10	Traffic safety													x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
11	Natural life (flora & fauna)													x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
<b>Al-Ghazaliya subprojects (5 pumping stations and trunk mains)</b>																													
1	Occupational health & safety													x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
2	Training effectiveness													x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
3	Housekeeping in-situ													xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx
4	Right expertise															x													
5	PPE effective usage													x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
6	Site hygiene													x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
7	Off-site hygiene													x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
8	Ambient air quality and noise													xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx
9	Public health & safety													x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
10	Traffic safety													x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
11	Natural life (flora & fauna)													x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
12	Cultural heritage & chance finds															x													

## 10.3. Institutional Arrangements and Training Requirements

### 10.3.1. Institutional Arrangements

The project will be implemented by the Mayorality of Baghdad, which should allow for a smooth flow of information among Contractors, Supervision, and higher managements at BSA/MOB. Therefore, a Project Management Unit/Project Management Team (PMU/PMT) is foreseen important to ensure prompt response, liaison, and on-the-spot guidance. The PMU should be given a direct communication and reporting line to the Mayor and relevant higher management. The PMU will closely coordinate its daily activities with the different departments of the MOB, particularly with BWA and BSA. The PMU will also be held responsible for daily activities with different departments of MOB. As a minimum, the PMU should be responsible for ensuring adherence to Project tasks and time schedules, issuing approvals on deliverables, and authorizing/releasing installments according to payment schedules. However, full Roles and Responsibilities should be defined at early stages of the Project. The PMU will include nominated experienced staff seconded from existing technical and financial units (or a new hire if not available internally). Specifically, PMU should include two **Environmental and Social Officers (ESOs)**, one each for the R2 reservoir construction and for the sewerage pumping stations rehabilitation. The ESO is basically a focal point between the office and the field in matters concerning environmental and social requirements of the project. S/he reports to the Head of the PMU, and both office and field work are assigned to him/her. See Annex III for the Terms of Reference for this position. Every ESO will have the opportunity to represent his/her relevant department (BSA or BWA) through all stages of the Project, as well as participate in other projects within the MOB's development program.

Additionally, both the BWA and the BSA will appoint one Resident Engineer, to be supported by a team of mechanical engineers, electrical engineers, and other junior technical staff, who will be responsible for overall supervision and monitoring on both contractors and Project Implementation Consulting (PIC) firms. The Resident Engineer will be responsible for:

1. Quality control of the civil works;
2. On-site occupational health and safety; and
3. All other on-site aspects of environmental safeguards compliance.

The PMU's Resident Engineer will supervise the work of the PIC firm's Resident Engineers. The PMU's Resident Engineer is required to liaise with the two ESOs for environmental and social issues and will report directly to the Head of the PMU.

Both BWA and BSA have well-functioning Health and Safety units with written protocols for worker and equipment safety, as well as for worker injury. These Health and Safety units receive ongoing support from the General Association of Iraq for Health and Safety, located within the Ministry of Environment and Health. The General Association runs trainings on occupational health and safety, pesticide storage, fire safety, etc. and provides certification for Ministry and other government agency health and safety units. The BWA and BSA Health and Safety units are General Association certified. As these two Health and Safety units are understaffed per the workload of the two agencies, they will benefit from having the Resident Engineers provide additional oversight of occupational health and safety compliance at the World Bank financed sites.

The Project Implementation Consulting (PIC) firm will include an Environmental Safeguard Specialist (supervisor's engineer).

**Basic Requirements – Environmental Safeguard Specialist (PIC's Engineer)**

*The Environmental Safeguard Specialist should have a bachelor or higher degree in environmental engineering/science/management and at least 10 years of Middle East based relevant experience in water and wastewater treatment projects. Previous experience in sewerage pumping station rehabilitation is highly desirable. The Specialist must be fluent in Arabic and in English. The Specialist will assist in the following, but not limited to:*

- 1. Review contractor implementation of the mitigating measures and monitoring program as detailed in the three ESMPs, noting areas of good practice, and areas for improvement;*
- 2. Review contractor safety permits and records to be kept, to ensure that the contractor is fully in compliance with written documentation needed;*
- 3. Supervise and report the progress of implementation of the ESMPs to MOB and the World Bank twice a year (through PMU);*
- 4. Report any violation of environmental standards and the measures taken to restore compliance twice a year to MOB and World Bank (through PMU);*
- 5. Assist the two ESOs, as well as the Resident Engineering team and contractor staff, by providing capacity building on environmental safeguards. This consultancy requires that the PIC Environmental Safeguards Specialist give two trainings per year to all relevant staff as noted above. The subject and outline of the training should be shared with the MOB and World Bank at least two months in advance, and the detailed content of the training should be shared with the MOB and World Bank one month prior to the training date.*

The following flow chart would explain the above institutional arrangement.

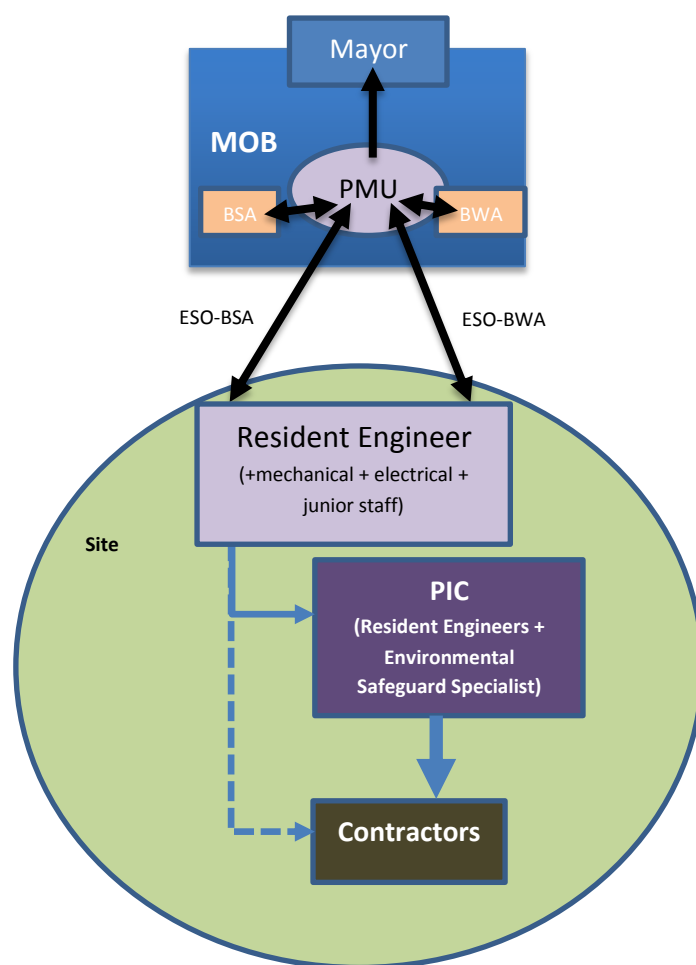


Figure 27: Institutional arrangement relationship

### 10.3.2. Training Requirements

The organization, on another hand, should provide enough training, and capacity building for the team responsible for monitoring implementation, after mapping needs prior to Project commencement. Training needs could include topics on: risk management, environmental management systems, environmental and social impact assessment, public outreach, documentation and record keeping, financial management, occupational health and safety measures, etc. The following table would provide examples on training workshops/sessions, and anticipated costs.

Table 32: Proposed training workshops and courses

Target Group	Workshop/ Training Sessions	Training Provider	Costs (USD)
Coordinators and Project Officers (MOB, BSA)	- Training session on planning and design of ESIA/ESMPs.	BSA's E&S Safeguards Specialist	7,000



<b>Target Group</b>	<b>Workshop/ Training Sessions</b>	<b>Training Provider</b>	<b>Costs (USD)</b>
Project Beneficiaries and Stakeholders	- Consultation sessions on potential environmental and social impacts of the Project.	Project Unit with assistance from the E&S Safeguards Specialist	10,000
Project Proponent (BSA), Site personnel, OHS dept.	- Training session on planning and design of ESIA/ESMPs. - The design and implementation of mitigation measures. - Occupational health and safety guidelines.	Project Unit with assistance from the E&S Safeguards Specialist, External training provider for OHS	18,000
<b>Specialized training</b>			
BSA operational staff	- Contingency planning	Department of civil defense	5,000
Technical staff at the site	- Water and Wastewater monitoring and testing	Central laboratories	10,000
<b>Sub Total (USD)</b>			<b>50,000</b>
<b>Environmental and Social Officer Salary*</b>			<b>40,000</b>
<b>Total (USD)</b>			<b>90,000</b>

\* The Environmental and Social Officer (ESO) will be involved in all the above training topics, in addition to his/her daily duties set out in Annex III. Monthly rate of the ESO is expected at 3,000 USD, inclusive of social charges and taxes.

Upon accomplishment of new interventions (post-construction), the Unit/team should have the full capacity and knowledge on the residual impacts left behind in the site. The unit/team has to be familiar with the contract's provisions and penalties, should the obligations toward restoring working environment unfulfilled.

Upon operating the newly rehabilitated pumping stations, new professional challenges may arise. New challenges may include running and operating new equipment and facilities, performing maintenance and troubleshooting according to manufacturers' instructions, referring to manuals for replacing parts and troubleshooting, and many others. The Project was planned in such a way to fulfil training and capacity building requirements.

Special training for monitoring levels of pollutants (air, noise, vibration, land/soil, water, wastewater) would entail providing special training courses on operating, servicing, and calibrating testing apparatus (portable/handheld, and stationary) in the field. Training should also include sampling and sample storage techniques against internationally followed testing and sampling

procedures (examples include WHO and USGS methods, as well as Standard Methods for the Examination of Water and Wastewater by APHA, AWWA, WEF)

As mentioned above in the public consultation chapter and suggested GRM, a well-established complaining system at BSA level or at a higher level (MOB) has to be activated to receive and address complaints from the communities under the Project influence. A secure and accessible hot line (or alternatively other written formats) should be dedicated. Anonymity/ Confidentiality and adequate responses should be maintained. A well-trained staff should be commissioned to manage the system who have to be acquainted with the local community needs and concerns. Special communication with the local community must include local representatives' engagement. This could be performed directly by BSA/MOB or by relevant municipalities through continuous meetings and workshops.

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## ANNEXES

### ***Annex I: Contingency Plan Template – emergency discharge***

#### **I. Document Quality Assurance**

Revision no. -----	Date issued. -----
Prepared by. -----	Approved by. -----
Next revision due date. -----	Document is available in the following places. -----

II. **Scope:** This Plan should be followed and further reviewed upon emergency cases of overflow of sewage from Al-Habibiya, Al-Doura 1, and 5 of Al-Ghazaliya Sewerage Pumping Stations in Al-Sha'ab, Al-Doura and Al-Ghazaliya districts, respectively. Applicable emergencies include:

1. Pumping failure, including: accidental blockage, mechanical and electrical failure, power shortage/cut;
2. Overflows during wet weather conditions;
3. A major public health outbreak occurred upstream and downstream according to authorities.

III. **Receiving water bodies:** Al-Jaish (Army), Al-Shorta (Police), and Al-Saqlawiya Canals eventually drain into Tigris River.

IV. **Problem Indicators:** receiving and/or pumping/lifting sewage capabilities have been compromised due to either one or part of the following indicators:

- Control panels have shown beyond-design-capacities inflows {yes, No},
- Malfunctioning of pumps was evident {yes, No}
- Leakage of sewage was evident in-door {yes, No}, outdoor {yes, No},
- Out-of-control alarm has been triggered by working personnel {yes, No},
- Serious stoppage at the receiving treatment plant has been announced {yes, No}
- Unusual stormwater conditions have been announced by state authorities {yes, No}

#### **V. Specific Actions:**

1. Site management to communicate the problem with BSA,
2. Operate standby pumps immediately,
3. Bypass inflows through the emergency discharge pipe to the pre-designated discharge channel,
4. Apply safety working measures,
5. Drain leakages from the facility,
6. Fix the problem(s) in case of malfunction,
7. Evacuate the site in extreme cases,

8. Return inflows and pumping capacities ASAP,
9. Announce the situation is "Back to normal".

**VI. Responsibilities:**

- Site management to announce emergency discharge,
- Maintenance personnel to perform stoppage, checks, and re-pumping,
- BSA to liaise with other departments and reach out the public.

**VII. Emergency contacts**

1. Site management:  Name: -----, Land line: -----, mobile: -----
2. Maintenance personnel:  Name: -----, Land line: -----, mobile: -----
3. BSA inspection department:  Name: -----, Land line: -----, mobile: -----
4. MOB's Mayor Office:  Name: -----, Land line: -----, mobile: -----
5. Testing laboratory (land contamination):  Name: -----, Land line: -----, mobile: -----

**VIII. Laboratory checks**

<b>Water quality</b>	<b>Test</b>
Chemical	Heavy metals, organic matter, chlorinated phenols, Polycyclic Aromatic Hydrocarbons (PAHs)
Microbiological	Total plate counts, T. coliforms, Fecal coliforms, E. Coli, protozoa, Clostridium, as required by the national wastewater standards
References	WHO and USGS methods, as well as Standard Methods for the Examination of Water and Wastewater by APHA, AWWA, WEF

**Annex II: Sample checklist for construction phase ESMP**

<b>Project Proponent:</b> .....				
<b>Project Name:</b> .....				
<b>Visit Date:</b> .....				
<b>Participants:</b> .....				
Impact to check	Yes	No	Remarks	Safeguards/ Mitigation measures carried on
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
Additional Impact (please add here) ..... .....				
<b>20. Comments:</b> .....				
<b>21. Recommendations:</b> .....				
<b>Environmental and Social Officer's Signature</b> .....				
<b>Date</b> .....				

### ***Annex III: Terms of Reference – BSA's Environmental & Social Officer***

The Environmental and Social Officer (ESO) is expected to be internally assigned from BSA, or acquired externally if not available. ESO's duty station will be within the Project Management Unit (PMU)/ Project Management Team (PMT). Accordingly the ESO will be a staff member to whom the following main tasks are attached:

#### **I. Scope of Work**

- Serve as focal point between PMU and work personnel in the field, and report directly to the Head of the PMU;
- Liaise environmental and social-related tasks and issues with the PMU's Resident Engineer;
- Serve as a BSA liaison to the MOB as well as to the World Bank Group environmental safeguards team member assigned to the Project;
- Contribute to the preparation and execution of the Project monitoring and evaluation framework, which covers environmental and social safeguards monitoring, as well as medium-term results monitoring and evaluation in line with BSA's responsibilities;
- Monitor socio-economic impacts on PAPs, especially affected businesses and/or land related impacts, and assist in reporting grievances and provide guidance through GRM;
- Contribute to the Project's monthly, quarterly, and annual progress report documentation;
- Support the BSA in designing, facilitating, and documenting Project's specific stakeholder meetings and public consultations and formulating environmental safeguards and social specific annual work plans in agreement with Project legal documents;
- Screen, plan, prepare and support potential entities to implement other projects within the BSA 's infrastructure development program;
- Support the execution (including implementation, supervision, monitoring, and reporting) of the Project's safeguards instruments, including the Project's Environmental and Social Impact Assessments (ESIAs) and Environmental and Social Management Plan (ESMPs), as applicable; the incumbent is expected to conduct site visits to the Project location whenever required;
- Support the implementation and reporting functions of the Project-related Grievance Redress Mechanism specific to inquiries related to environmental and social aspects;
- Deliver training and capacity building programs to relevant Project's participants on OP/BP 4.01 Environmental Assessment; Social Risk issues; relevant Performance Standards; ESIA/ESMP contents, implementation, and compliance; and
- Prepare/update ESIA/ESMP; Project construction- and operational-phase ESMP supervision and monitoring; and other subject matter as needed;

#### **II. Minimum Requirements**

The BSA's Environmental and Social Officer would need to have:

- An advanced degree in environmental and social related sciences; and at least 10 years of experience in environmental impact assessment, with 2 years in implementing ESIA and ESMPs;

- A demonstrated field experience in supervising and monitoring projects; and
- An experience in preparing and conducting environmental impact assessment training.

S/he will be familiar with the environmental safeguards policies of the World Bank and those of the Iraqi Government, and will be responsible to assess the extent of the Project's compliance with relevant national and international laws and regulations. Experience with work related to wastewater infrastructure would be of advantage.



## ***Annex IV: Environmental Requirements for Contractors***

### **General**

1. A specific Environmental and Social Management Plan (ESMP) has been prepared to address the above-mentioned specific issues. The Contractor shall be informed about such an ESMP for construction site of this Project, and prepare his work strategy and plan to fully take into account relevant provisions of that ESMP.
2. If the Contractor fails to implement the approved ESMP to fulfill his obligation within the requested time, the Client reserves the right to arrange for execution of the missing action by a third party on account of the Contractor.
3. The Contractor shall implement all measures necessary to avoid undesirable adverse environmental and social impacts wherever possible, restore work sites to acceptable standards, and abide by the ESMP.
4. These provisions also apply to any sub-contractors present on Project work sites.

### **General Environmental Protection Measures**

5. In general, environmental protection measures to be taken at any work site shall include:
  - 5.1. Minimize the effect of dust on the environment resulting from earth mixing sites, vibrating equipment, construction related traffic on temporary or existing access roads, etc.
  - 5.2. Ensure that noise levels emanating from machinery, vehicles and noisy construction activities (e.g. excavation, blasting) comply with Iraqi standards.
  - 5.3. Ensure that existing water flow regimes in rivers, streams and other natural or irrigation channels are maintained and/or re-established where they are disrupted due to works being carried out.
  - 5.4. Prevent any substances, including bitumen, oils, lubricants and waste water used or produced, from entering into rivers, streams, irrigation channels, and natural water bodies/reservoirs.
  - 5.5. Avoid or minimize the occurrence of standing water in holes, trenches, borrow areas, etc.
  - 5.6. Upon discovery of remains of archeological or historical importance during work, immediately report to the Client (BSA and MOB).
  - 5.7. Prohibit workers from exploiting natural resources: hunting, fishing, etc.
  - 5.8. Prohibit the transport of firearms and/or third parties in Project-related vehicles.
  - 5.9. Implement soil erosion control measures.
  - 5.10. Ensure garbage, sanitation and drinking water facilities are provided in construction areas.
  - 5.11. Ensure that, local materials are used in lieu of transporting foreign materials, whenever possible.
  - 5.12. Ensure public safety and avoid traffic accidents, and comply with speed limits.
  - 5.13. Ensure enough demarcation to any trench, pit, excavation, hole or other hazardous feature.
  - 5.14. Ensure hiring from neighboring communities if unskilled daily-hired workforce is necessary.
6. Besides the regular inspection of the sites by the supervisor appointed by the Client for ensuring adherence, the Client may appoint an Environmental and Social Officer (ESO) to oversee the compliance with these environmental conditions and any proposed mitigation measures.

### **Pipelines**

7. No trench shall be left open for more than 7 days, unless duly authorized by the supervisor upon Contractor's request. Provided enough demarcation
8. General conditions related with topsoil stripping, storage and restoration apply.

9. The Contractor shall dispose of water of pressure tests in a way not affecting neighboring settlements

### **Waste Management**

10. All drums, containers, bags, etc. containing oil/fuel/surfacing materials and other hazardous chemicals (including oils from maintenance) shall be stored on a sealed and/or bonded area. All waste containers litter and any other wastes shall be disposed of at designated disposal sites as approved by MOB.
11. All drainage and effluent from storage areas, workshops, and working sites shall be captured and treated before being discharged into the drainage system, in line with water pollution control regulations.
12. Entry of runoff into construction sites, and working sites, shall be restricted by constructing diversion channels or holding structures such as berms, drains, dams, etc.
13. Construction waste shall not be left in stockpiles along the road, but removed and reused or disposed of on a daily basis.
14. Areas for temporary storage of hazardous materials such as contaminated liquid and solid materials shall be approved by the supervisor and appropriate local and/or relevant national or local authorities before the commencement of work. Disposal of such waste shall be in existing, approved sites.

### **Rehabilitation of Work and Preparation Sites**

15. Topsoil shall be stripped, removed and stored for subsequent rehabilitation. Soils shall not be stripped when wet, and not stored in large or high heaps.
16. Reinstatement natural drainage patterns where they have been altered or impaired.
17. Remove toxic materials and dispose of in designated sites. Backfill with soils free of foreign material.
18. Ensure reshaped land is returned stable, and adequately drained.
19. Minimize erosion by wind and water both during and after the process of reinstatement.
20. Compacted surfaces shall be deep ripped to relieve compaction unless dictated otherwise.

### **Management of Water Needed for Construction Purposes**

21. The Contractor shall at all costs avoid conflicting with water needs of local communities. Any temporary water abstraction for construction needs shall be consulted with community. No abstraction to be made before obtaining a permit from MOB.
22. No construction water containing spoils or site effluent, especially cement and oil, shall be allowed to flow into natural water drainage courses, including wash water.
23. Site spoils/temporary stockpiles shall be located away from the drainage system and surface run off.

### **Traffic Management and Community Safety**

24. Location of temporary access roads shall be done in consultation with the local community especially in important or sensitive environments. Access roads shall not traverse wetlands/ecologically sensitive areas. Consultations shall be documented.
25. Upon the completion of civil works, all temporary access roads shall be ripped and rehabilitated.

26. Measures shall be taken to suppress dust emissions generated by Project traffic.
27. Maximum speed limits for any construction-related traffic shall not exceed 50km/h in inhabited areas.

### **Salvaging and Disposal of Obsolete Components Found by Rehabilitation Works**

28. Obsolete materials and construction elements such as electro-mechanical equipment, pipes, accessories and demolished structures shall be salvaged and disposed of in a manner approved by the supervisor. The Contractor has to agree with the supervisor which elements are to be surrendered to the Client's premises, which will be recycled or reused, and which will be disposed of at approved landfill sites.
29. Any asbestos cement material that might be uncovered when performing rehabilitation works will be considered as hazardous material and disposed of in a designated facility.

### **Damage to Property**

30. In case of damages to property, the Contractor shall repair to the owner's satisfaction and at his own cost. A certificate from the owner/user shall be obtained for each repair.
31. For each repair, the Contractor shall obtain from the owner/user a certificate that the damage has been made good satisfactorily in order to indemnify the Client from subsequent claims.

### **Contractor's Health, Safety and Environment Management Plan (HSE-MP or CEMP)**

32. The Contractor shall prepare an HSE-MP or CEMP within 6 weeks of signing the Contract. The Contractor's EHS-MP/ CEMP shall provide:
  - 32.1. a description of procedures and methods for complying with environmental management conditions, and any specific conditions specified in an ESMP;
  - 32.2. a description of specific mitigation measures that will be implemented in order to minimize adverse impacts;
  - 32.3. a description of all planned monitoring activities and the reporting thereof;
  - 32.4. the internal organizational, management and reporting mechanisms put in place for such.
33. The Contractor's HSE-MP/ CEMP will be reviewed and approved by BSA before start of the works.

### **HSE Reporting**

34. The Contractor shall prepare bi-monthly progress reports to the Client on compliance with these general conditions, the project ESMP, and his own HSE-MP/ CEMP. These to include:
  - 34.1. HSE management actions/measures taken, including approvals sought from local or national authorities;
  - 34.2. Problems encountered in relation to HSE aspects (incidents, including delays, cost consequences, etc. as a result thereof);
  - 34.3. Non-compliance with contract requirements on the part of the Contractor;
  - 34.4. Changes of assumptions, conditions, measures, designs and actual works in relation to HSE aspects; and
  - 34.5. Observations, concerns raised and/or decisions taken with regard to HSE management during site meetings.
35. The reporting of any significant HSE incidents shall be done as soon as practicable, within an incident report. Records shall be kept. They could also be attached to progress reports.

### **Training of Contractor’s Personnel**

36. The Contractor shall provide sufficient training to his own personnel to ensure awareness on aspects of these general conditions, any project ESMP, and his own HSE-MP/ CEMP. Specific training will be provided to those Employees that have particular responsibilities associated with the implementation of the HSE-MP/ CEMP. Training activities will be documented for potential review by the BSA.

## ***Annex V: Environmental and Social Liabilities of BWSIP Contractors***

Further to enforcing the compliance of environmental management, contractors are responsible for complying with health and safety requirements where they are to provide insurance for construction laborers, staff attending to the construction site, and citizens for each sub-project. The insurance requirements and clauses are stated in the procurement manual and reflected in the bidding documents complying to the Iraqi labor law. Monitoring of these components is integrated in bidding evaluation, and site visits reports.

Implementation of BWSIP program provides some short-term and fewer long-term job opportunities for local community; this information is cited from BWSIP baseline section.

The environmental and social management of the construction works becomes essential parts of a works contract upon its conclusion and their implementation is mandatory for a contractor. The MOB, as an owner of construction works, will be responsible for enforcing compliance of contractor with the terms of the contract, including adherence to the ESMPs.

The following procedures prevail, in addition to the supervisor engineer judgment:

- Deduction of environmental noncompliance will be added as a clause in the Bill of Quantities (BOQs) section, referring to annex in the bidding document detailing the deduction procedures;
- Environmental penalties shall be calculated and deductions are to be included in each submitted invoice;
- Mitigation measures in Environmental and Social Monitoring Matrices (ESMM) annexed to the relevant ESMP is the reference for environmental notes and penalties;
- Each impact depicted in the ESMM if not properly mitigated to be counted an environmental/social note;
- For minor infringements and social complaints, an incident which causes temporary but reversible damage, the contractor will be given environmental and social note/ stop and alert to remedy the problem and to restore the environment. If reviewing the action by the Environmental and Social Officer (ESO) showed that restoration is done satisfactorily no further actions will be taken;
- For social notes: the ESO will stop and alert the contractor to remedy the social impact, the ESO will follow the issue until solved. If contractor didn't comply to remediation request, stop will be considered under no excused delay;
- If the contractor hasn't remedied the environmental impact during this given time, the ESO/supervisor engineer in cooperation with Local Technical Consultant will:
  - Stop the work and give the contractor an environmental and social note correlated to financial penalty according to the non-complied mitigation measure depicted in the bidding document and the following procedures for National Competitive Bids and Shopping Bidding Documents;
  - The ESO after the given time frame are to review the action, if ESO sees that restoration is done satisfactorily no further actions will be taken, otherwise and if Contractor hasn't remedied the situation within 1 day any additional days of stopping work will be considered no excused delay;
- When ESO issue an environmental/social note, it might depict one or more environmental penalty; and
- If repeating the noncompliance to ESMP penalties approached (3-5) % of the contract value, the ESO will raise the formal recorded environmental and social notes and the deduction history to MOB in order to take a legal action. Considering that bidding document include environmental penalty in the BOQ, the ESMP and deduction procedures in annexes and referred to in particular conditions.

The following form will be used for the environmental/ social note:

---

Environmental and Social Note No ( )	
Municipality	Date
Project Name	
Site Location	
Contractor	
The Environmental Note	
Municipality Supervisor /Engineer	
Local Technical Consultant	
Contractor Representative on time of note	
Submitted to Contractor Representative	
Copy Submitted to MOB on	
Hour	
Date	

Procedures for National Competitive Bids and Shopping Bidding Documents:

As mentioned above, environmental and social notes might contain one or more environmental penalty applicable for deduction.

- For social notes: stop and alert the contractor to remedy the action;
- For environmental notes: refer to the ESMP for the note to verify how many notes illustrated in the note;
- Deduction rate starts with 0.1% of contract value; and
- Deduction rate increase by 0.05% of the contract amount after each fifth note.

For National Competitive Bids:

ESMP Compliance Penalty for National Completeive Bids

ESMF Compliance Penalty		
No.	Environmental and Social Note	Penalty

**ESIA and ESMP – Doura, Habibiya and Ghazaliya sub-projects**  
 Baghdad Water Supply and Sewerage Improvement Project

1	1	Stop and alert
2	2+3+4+5+6	Stop and deduct 0.1% of the contract amount for each mitigation measure in the environmental note. Minimum amount of deduction is 150 Euro
3	7+8+10+11+12	Stop and deduct 0.15% of the contract amount for each mitigation measure in the environmental note Minimum amount of deduction is 225 Euro
3+1	Next five notes	Each 5 notes + deduction would be: N= percentage of deduction of (N-1) + (0.5* percentage of deduction of (N-1)) For example: Stop /Deduct 0.1%+0.05(0.1%) of the contract amount for each mitigation measure in the environmental note. Minimum amount of deduction is 300 Euro
5	Note +1	If penalty rate approach 5% of contract cost it is recommended to stop work and send official request to MOB of the proposed action according to bidding documents and procurement manual

Deduction is to be calculated by the relevant BSA/BWA Engineer (ESO) and to be reviewed by the supervisor engineer where he is to consider the environmental Note (N), and the deduction for N.

Deduction for N= [percentage of deduction of (N-1) + (0.5\* percentage of deduction of (N-1))\* contract Amount.

If Penalties Rate approach 5% of Contract cost its recommended to stop work, and send official request to MOB of the proposed action according to bidding documents and procurement manual.

Municipality can decide if a mitigation measure has a significant impact and might require setting its noncompliance penalty rate based on its significance.

For Shopping Bidding Documents:

- For social notes: stop and alert the contractor to remedy the action;
- For environmental notes: refer to the ESMP for the note to verify how many notes illustrated in the note;
- Deduction rate starts with 0.1% of contract value; and
- Deduction rate increase by 0.05% of the contract amount after each fifth note.

ESMP Compliance Penalty for Shopping Bidding Documents

<b>ESMF Compliance Penalty</b>		
No.	Environmental and Social Note	Penalty
1	1	Stop and alert
2	2+3+4+5+6	Stop and deduct 0.1% of the contract amount for each mitigation measure in the environmental note. Minimum amount of deduction is 40 Euro
3	7+8+10+11+12	Stop and deduct 0.15% of the contract amount for each mitigation measure in the environmental note Minimum amount of deduction is 60 Euro
3+1	Next five notes	Each 5 notes + deduction would be: N= percentage of deduction of (N-1) + (0.5* percentage of deduction of (N-1))

		For example: Stop /Deduct 0.1%+0.05(0.1%) of the contract amount for each mitigation measure in the environmental note. Minimum amount of deduction is 80 Euro
5	Note +1	If penalty rate approach 3% of contract cost it is recommended to stop work and send official request to MOB of the proposed action according to bidding documents and procurement manual

Deduction is to be calculated by the BWA/BSA (ESO) and to be reviewed by the Supervisor Engineer where he is to consider the environmental Note (N), and the deduction for N.

Deduction for N= [percentage of deduction of (N-1) + (0.5\* percentage of deduction of (N-1))\* contract Amount.

If Penalties Rate approach 3% of Contract cost its recommended to stop work, and send official request to MOB of the proposed action according to bidding documents and procurement manual.

BWA/BSA (ESO) can decide if a mitigation measure has a significant impact and might require setting its noncompliance penalty rate based on its significance.



## **Annex VI: Pesticides Use and Management**

### **Chemical Methods for Controlling Urban Vectors**

#### **Cockroaches**

#### **Commonly used pesticide products for cockroaches and uses**

*Insecticides carrying a CAUTION label, in formulations that reduce potential for exposure.*

<b>Active ingredient</b>	<b>Example Products</b>	<b>WHO Classification</b>	<b>Uses</b>
Disodium octaborate tetrahydrate	Ant Cafe® RTU 73766-2	Class 3	Pre-manufactured enclosed bait station that can be placed in inaccessible areas.  Solution, paste or gel that can be applied as drops in accessible areas. Gel can be applied in small amounts to cracks, crevices and other areas where bait stations cannot be used.
Boric acid	Drax® Roach Assault PGF 9444-193	Class 3	
Hydramethylnon	Maxforce® Professional Insect Control Roach Killer Bait Gel 432-1254	Class 2	
Indoxacarb	Advion® Cockroach Gel Bait 352-652	Class 2	

**Class 1A = Extremely Hazardous, Class 1B = Highly Hazardous; H = Moderately Hazardous; Class 3 = Slightly Hazardous; U = Unlikely to present acute hazard in normal use; FM = Fumigant, not classified, O = obsolete as pesticide, not classified.**

*Insecticides carrying a CAUTION label, in formulations with a greater potential for exposure*

<b>Active ingredient</b>	<b>Example Products</b>	<b>WHO Classification</b>	<b>Uses</b>
Fipronil	Maxforce® Professional Insect Control Roach Bait Station 432-1257	Class 2	Volatile active ingredient in pre-manufactured enclosed bait station. Use alternative non-volatile products.
Boric acid	Borid® 9444-133	Class 3	
Diatomaceous earth	Eaton's KIO System 56-67	U	Dust formulation. To reduce exposure hazard, use only in voids that will be sealed after use. Wipe up over-application.
Disodium octaborate tetrahydrate	67 Boracide® 64405-7	Class 3	
Limestone	NIC 325 Pro Organic®	U	
Boric acid	ECO 2000-GR® 1677-191 Niban® FG 64405-2	Class 3	Granular formulations. To reduce exposure hazard,

Xanthine	Ecologix® Cockroach Bait 1001-13	U	use only in voids that will be sealed after use.
Oxypurinol orthoboric acid	Intice™ Ant Granules 73079-2	Class 3	
Boric acid	PT 240 Permadust® 499-384	Class 3	Pressurized aerosol. Mint oil formulations must be applied directly to insects, no residual activity.
Mint oil	Earthcare® Naturals Ant & Roach Killer	U	

**Class 1A = Extremely Hazardous, Class 1B = Highly Hazardous; H = Moderately Hazardous; Class 3 = Slightly Hazardous; U = Unlikely to present acute hazard in normal use; FM = Fumigant, not classified, O = obsolete as pesticide, not classified.**

*Insecticides carrying a CAUTION label, in formulations with greater potential for toxicity and/or exposure*

Active ingredient	Example Products	WHO Classification	Uses
Bifenthrin	Talstar® 279-3225	Class 2	Liquids sprayed or otherwise applied to exposed interior and/or exterior surfaces. Spray applications can contaminate an area and make baiting ineffective until the residue degrades. To reduce exposure hazard and avoid contamination, use alternative formulations and/or limit applications to non-volatile active ingredients applied to non-human contact surfaces in inaccessible areas.
Chlorfenapyr	Phantom® 241-392	Class 2	
<b>Cyfluthrin</b>	<b>Tempo® SC Ultra 11556-124</b>	<b>Class 1B (cannot be financed by BWSIP)</b>	
Cypermethrin	Demon® EC 100-1004	Class 2	
Deltamethrin	Suspend® SC 432-763	Class 2	
Lambda Cyhalothrin	Demand® CS 100-1066	Class 2	
Disodium Octaborate Tetrahydrate	Mop Up® 9444-132	Class 3	Liquid, mop-applied to exposed interior surfaces, e.g., floors, will leave dust residual. To reduce exposure hazard and avoid contamination, use alternative formulations

**Class 1A = Extremely Hazardous, Class 1B = Highly Hazardous; H = Moderately Hazardous; Class 3 = Slightly Hazardous; U = Unlikely to present acute hazard in normal use; FM = Fumigant, not classified, O = obsolete as pesticide, not classified.**

#### Rats and Mice

**Commonly used pesticide products for rodents and mice**

*(As all of the below are WHO Classified 1A and 1B, they cannot be financed by BWSIP)*

Active ingredient	WHO Classification	Example Products
Brodifacoum 0.005(waxblocks)	Class 1A	Bro bait, Nofar
Bromadilone 0.005 (bait)	Class 1A	Acilone, Garden top fresh
Bromadilone 0.25 (L)	Class 1A	Bromac-c
Bromadilone 0.1 (TP)	Class 1A	Bromalone
Coumatetrayl 0.75 (TP)	Class 1B	Racumin, Ratryl
Flocoumafen 0.005 (wax block bait)	Class 1A	Storm, Murdex

**Class 1A = Extremely Hazardous, Class 1B = Highly Hazardous; H = Moderately Hazardous; Class 3 = Slightly Hazardous; U = Unlikely to present acute hazard in normal use; FM = Fumigant, not classified, O = obsolete as pesticide, not classified.**

As all of the commonly used rodenticides in Jordan and WHO classified 1A and 1B and therefore cannot be financed by the World Bank, it is recommended that **calciferols (vitamins D)**, including cholecalciferol (vitamin D<sub>3</sub>) and ergocalciferol (vitamin D<sub>2</sub>), be considered as possible rodenticides. It is considered to be single-dose, cumulative (depending on concentration used; the common 0.075% bait concentration is lethal to most rodents after a single intake of larger portions of the bait) or sub-chronic (death occurring usually within days to one week after ingestion of the bait). Applied concentrations are 0.075% cholecalciferol and 0.1% ergocalciferol when used alone.

### **Annex VII: Sample Grievance Registration Form**

The \_\_\_\_\_ Project welcomes complaints, suggestions, queries and comments regarding project implementation. We encourage persons with grievance to provide their name and contact information to enable us to get in touch with you for clarification and feedback.

Should you choose to include your personal details but want that information to remain confidential, please inform us by writing/typing *\*(CONFIDENTIAL)\** above your name. Thank you.

<b>Date</b>	<b>Place of Registration</b>				
<b>Contact Information/Personal Details</b>					
<b>Name</b>		<b>Gender</b>	* Male * Female	<b>Age</b>	
<b>Home Address</b>					
<b>Place</b>					
<b>Phone no.</b>					
<b>E-mail</b>					
<b>Complaint/Suggestion/Comment/Question</b> Please provide the details (who, what, where, and how) of your grievance below:					
If included as attachment/note/letter, please tick here:					
<b>How do you want us to reach you for feedback or update on your comment/grievance?</b>					

#### **FOR OFFICIAL USE ONLY**

<b>Registered by:</b> (Name of Official Registering Grievance)	
<b>Mode of Communication:</b> Note/Letter E-mail Verbal/Telephonic	
<b>Reviewed by:</b> (Names/Positions of Officials Reviewing Grievance)	
<b>Action Taken:</b>	
<b>Whether Action Taken Disclosed:</b>	Yes No
<b>Means of Disclosure:</b>	

Arabic form

يرحب المشروع بأية استفسارات، أو اقتراحات، أو ملاحظات، أو شكاوى تتعلق بتنفيذ المشروع. ننصح المراجعين بذكر الاسم ومعلومات الاتصال ليتسنى لنا التواصل معهم بهدف الايضاح أو الرد على القضية المطروحة. أما في حالة اختار ابقاء المعلومات الشخصية سرية، فيجب كتابة عبارة "سري" فوق الاسم مباشرة، مع جزيل الشكر.

التاريخ		مكان تسجيل الشكوى	
معلومات عامة/ التفاصيل الشخصية			
الاسم	الجنس	ذكر انثى	السن
عنوان الإقامة			
المكان			
رقم الهاتف			
البريد الإلكتروني			
الشكوى/ الاقتراح/ الملاحظة/ الاستفسار. يرجى تزويدنا بالمزيد من المعلومات (من، ماذا، أين، وكيف؟) الخاصة بالشكوى:			
ضع اشارة هنا، إن كانت التفاصيل على شكل رسالة أو مرفق <input type="checkbox"/>			
كيف ترغب بالحصول على الرد على هذه الشكوى/ الملاحظة أو التطورات المتعلقة بها؟			
للاستخدام الرسمي فقط			
سجلت الشكوى/ الملاحظة بواسطة: (اسم الموظف المسؤول عن تسجيل الشكوى)			
طريقة الاتصال: ملاحظة/ رسالة بريد الكتروني مشافهة/ هاتفية			
تمت المراجعة بواسطة: (اسماء الاشخاص/ وظيفتهم الذين قاموا بمراجعة الشكوى)			
الاجراء المتخذ:			
هل تمت مكاشفة الاجراء المتخذ:		نعم لا	
طرق المكاشفة			

**Annex VIII: Public Consultation – Attendees’ Lists & Questionnaire Template**

A. Public meeting at Al-Habibiya SPS – 15 November, 2015

**اسم المشروع/ تاهيل محطة الحبيبية**

ت	الاسم	التحصيل الدراسي	رقم الهاتف	البريد الالكتروني
١	نعيم فخرية عليوي	خريج ليسانس لمؤرخة	٧٧٠٩٢٠٥٥٧٦	/
٢	ابو جواد محمد مكي	خريج الدراسة الابتدائية	/	/
٣	المرحوم سينا كاظم	خريج الدراسة الابتدائية	٧٧١٨٩٧١٢-٩	/
٤	محمد محمد علي محمد	خريج الدراسة الابتدائية	٧٧٠٦٢٨٩٧-٥	/
٥	ميرتضيا جاسم اجيب	خريج الدراسة الابتدائية	٧٧٠٩٩٨٤٣٦	/
٦	كاظم محمد نزار	خريج الدراسة الابتدائية	٧٧٤٨١٩٠٦	/
٧	ياسين محمد محمود	اقتصاد وادارة	/	/
٨	ميرتضيا فخرية عليوي	خريج الدراسة الابتدائية	٧٧٠٩٢٠٥٥٧٦	/
٩	رعد محمد خلفه سعادي	خريج الدراسة الابتدائية	/	/
١٠	فوقل عزيز انور فوزي	خريج الدراسة الابتدائية	/	/
١١	عمار ديار محمد	خريج الدراسة المتوسطة	٧٧١١٠٥٨٩٤٤	/
١٢	ساحر فتيان العتيبي	خريج الدراسة الابتدائية	/	/
١٣	م. ا. م. م. اسمعيل محمد	تكنولوجيا المعلومات	٧٧٠٦٠٤٩٤٥٩	/
١٤	آمال محمد نوري محمد	ادارة التكنولوجيا تكنولوجيا المعلومات	٧٧١٥٥٥٩١٥٩	Amaal.Sharara@yahoo.com
١٥	كامله مناهج محمد	تكنولوجيا المعلومات	٧٧٠٠٦٤٦٤٥٤٨	Kameela19@gmail.com
١٦	فادي ريان	تكنولوجيا المعلومات	٧٩٠١٦٢١٨٦٧	/
١٧	فادي محمد	الفرق	٧٨٠١٩٧٤٥٥٨	wasanEngineer@yahoo.com
١٨	عيسى رزاق سلمان	تكنولوجيا المعلومات	٧٧٠١٤٥٨٨٧١٥	/

جمعية مهنة المحاسبين

اسم المشروع / تاهيل محطة الحبيبية

ت	الاسم	التخصص الدراسي	رقم الهاتف	البريد الإلكتروني
1	موسى م. مزور (مفتي)	تكنولوجيا المعلومات	07801934559	Woson.Engineer@yahoo.com
2	كريمة ناصر (مفتي)	تكنولوجيا المعلومات	07700747408	Kawaleh19@gmail.com
3	صباح رهن (مفتي)	تكنولوجيا المعلومات	07901741877	
4	حكيم رشيد ناصر	تكنولوجيا المعلومات		
5	نوال محمد حادي	الهندسة		
6	جانم تاسم محمد	الهندسة الصناعية		
7	شيماء محمد محمود	علوم الحاسب		
8	لمياء من	تكنولوجيا المعلومات	07801044796	
9	امير ماسم	تكنولوجيا المعلومات		
10	مسير موصات علي	علوم الحاسب (تكنولوجيا المعلومات)		
11	زينب موصات علي	تكنولوجيا المعلومات		
12	محمد موصات علي	تكنولوجيا المعلومات		
13	عنين عادل تاسم	تكنولوجيا المعلومات	07715776679	HaneenAlhasany@gmail.com
14	احمد كاظم عطيه	تكنولوجيا المعلومات	07700071501	ahmedhilla@gmail.com
15	رضا محمد ابراهيم	تكنولوجيا المعلومات		
16	فرقة كاظم عطيه	تكنولوجيا المعلومات	07705747127	Farked.Kal@yahoo.com
17	مها محمد حسن	تكنولوجيا المعلومات		

B. Public meeting at Al-Doura 1 SPS – 16 December, 2015

اسم المشروع/ تاهيل محطة الدورة

ت	الاسم	التحصيل الدراسي	رقم الهاتف	البريد الإلكتروني
١-	م. د. حسن	بكالوريوس	٠٧٩٠٤١٨٩٩٥٩	
٢	مستشار محمد الوصل	اعداديه	٠٧٧١٧٨٤٤٩٩٥	
٣	مهندس هادي محمد	اعداديه	٠٧٧١٥٤٦٠٧	
٤	مؤتمن م. اسامه	مهندس/ دبلوم	٠٧٨١٤٤٤٨١٩٤	
٥	مستشار عبد الكاظم	اعداديه	/	
٦	قاسم م. م. م. م.	ابتدائيه	/	
٧	سلام منصور علوي	اعداديه	/	
٨	عليه عبد كميال	دكتوراه خارجيه	/	
٩	سالم م. م. م. م.	متوسطة	٠٧٧١٠٠٦٦٦٠٩	
١٠	اسماء م. م. م. م.	مهندس/ دبلوم	٠٧٧٢٨٦٤٩٠٧٦	
١١	زارق م. م. م. م.	بكالوريوس	٠٧٩٠٦٧٤٧٦٩	
١٢	ياسر م. م. م. م.	متوسطة	٠٧٥٠٤٩٤٩١٨	
١٣	مير حيا م. م. م. م.	متوسطة	٠٧٨٤٠٤٧٢١	
١٤	زهراء علي م. م. م. م.	ابتدائيه	٠٧٧٤٤٦٦٧٤	
١٥	لينا م. م. م. م.	ابتدائيه	/	
١٦	ملاح ابو م. م. م. م.	متوسطة	٠٧٧٠٤٨٤٤٤	
١٧	علياء م. م. م. م.	متوسطة	٠٧٧١٥١٦١٢٧٦	
١٨	عبد م. م. م. م.	تفكير	/	
١٩	خديجة م. م. م. م.	ادبيات	٠٧٧١٧١٨٨٢٩	
٢٠	م. م. م. م.	متوسطة	/	
٢١	عصام م. م. م. م.	ابتدائيه	/	
٢٢	سامر م. م. م. م.	ابتدائيه	/	
٢٣	فلاح ابو م. م. م. م.	ابتدائيه	/	
٢٤	زهير م. م. م. م.	ابتدائيه	/	
٢٥	فؤاد م. م. م. م.	متوسطة	/	
٢٦	سالم م. م. م. م.	ابتدائيه	/	



C. Public meeting at Al-Ghazaliya SPS (GH6) – 30 January, 2017

اسم المشروع/ تأهيل وتنفيذ خط الغزالية مع خمس محطات

ت	الإسم	التخصص الدراسي	رقم الهاتف	البريد الإلكتروني
١	إيمان علي حسين	بكالوريوس اوراق		
٢	انوار حسن محسن	اعدادية		
٣	سلطان هاشم	اعدادية		
٤	مهدي ابراهيم	متوسطة		
٥	اميد حواد علي	بكالوريوس علوم		
٦	علي يوسف محمد	ابتدائية	٠٧٩٠١٦٧٠٠٦٠	
٧	رؤف عبد الزينات	بكالوريوس قانون	٠٧٨٠١٥٨٦٥٣١	
٨	يوسف خليل ابراهيم	بكالوريوس علوم طبيا	٠٧٨٠١٥٤٣٧٩٤	
٩	علي احمد محمود	ديبلوم فني	٠٧٧٣١٥١٨٩٠١	
١٠	احمد وليد عبد الله	ديبلوم اداري		
١١	مهنر عادل	بكالوريوس ادارة واقتصاد		
١٢	عبد الرحمن عبد الله	بكالوريوس قانون		
١٣	عدنان هادي احمد	متوسطة		
١٤	مبار محمد علي	اعدادية		
١٥	هشام هيثم طالب	بكالوريوس ادارة اموال		
١٦	جواد سمير نجم	ابتدائية		
١٧	ايش عاشر	بكالوريوس		
١٨	شيماء محمد	بكالوريوس تربية		
١٩	احمد لاه	اعدادية		
٢٠	عنتية محمد واسم	ديبلوم فني		
٢١	نورين صباح خليل	بكالوريوس علوم طبيا		
٢٢	بشار احمد هادي	متوسطة		
٢٣	سيف احمد عبد	بكالوريوس علوم طبيا	٠٧٧١٧٧٥١٨٤	

D. Questionnaire template – Al-Habibiya, Al-Doura and Al-Ghazaliya public meetings

**Al-Habibiya SPS Rehabilitation Project**

**Public Consultation Questionnaire**

Name: \_\_\_\_\_

Educational level: \_\_\_\_\_

Work place: \_\_\_\_\_

Email:  Phone:

1. Are you impacted by noise when operating pumps, motors, and other parts of the SPS?

Yes  No

2. Are you impacted by odors and fumes generating from the SPS?

Yes  No

3. Do you have any health problems connected to emissions from the SPS?

Yes  No

4. Do you expect the rehabilitation work will provide job opportunities in your neighborhood?

Yes  No

5. Do you think installing fumes and odor scrubbers in the SPS will help reduce risk of harmful emissions?

Yes  No

6. What do you expect as a result of accomplishing rehabilitation work?

7. Suggestions