SFG3575 V2

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

Constructing

R2 Water Reservoir Complex

World Bank Group

ESIA and ESMP Report – August, 2017

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List of Acronyms and Abbreviations

°C	Degree Celsius
a.s.l	above sea level
AADD	Annual Average Daily Demand
ACGIH	American Conference of Governmental Industrial Hygienists
ACP	Asbestos Cement Pipes
Ag	Silver
Al	Aluminum
APC	Aerobic Plate Count
APHA	American Public Health Association
ARAP	Abbreviated Resettlement Action Plan
As	Arsenic
AWWA	American Water Works Association
B	Boron
Ba	Barium
BCM	Billion Cubic Meter
BMP	Best Management Practices
BOD	Biochemical Oxygen Demand
BOQs	Bill of Quantities
Bq	Becquerel
Br_2	Bromine
BSA	Baghdad Sewerage Authority
BWA	Baghdad Water Authority
BWSIP	Baghdad Water Supply and Sewerage Improvement Project
CaC	Calcium Carbide
Cd	Cadmium
CEMP	Construction Environmental Management Plan
CFU	Colony Forming Unit
CH4	Methane
CIP	Cast Iron Pipes
Cl	Chloride
Cl2	Free Chlorine
CN	Cyanide
CO	Carbon monoxide
Co	Cobalt
CO2	Carbon dioxide
COD	Chemical Oxygen Demand
CPS	Country Partnership Strategy
Cr	Chromium
Cu	Cupper
dB(A)	A-weighted decibels
DDT	Dichlorophyneltrichloroethane
Dept.	Department
KPI	Key Performance Indicator
KVA	Kilo-volt-ampere
kW	Kilowatt
L	Liter
M	Meter
M&E	Monitoring and Evaluation
MCM	Million Cubic Meter
MIGA	Multilateral Investment Guarantee Agency
min	Minute
MIS	Management Information System
ML	Million Liters
MLD	Million Liter per Day
mm	Millimeter
Mn	Manganese
MOB	Mayoralty of Baghdad
MOE	Ministry of Environment
MPN	Most Probable Number
MTR	mid-term review
MWth	Megawatt thermal
N/A	Not Applicable
NH4	Ammonium
Ni	Nickel
NO_2	Nitrogen dioxide
NO_3	Nitrate
NO_x	Nitrogen Oxides
NRW	Non-Revenue Water
NTU	Nephelometric Turbidity Unit
O_2	Oxygen
OH	Occupational Health
OHS	Occupational Health and Safety
OP/BP	Operational Procedure/ Bank Policy
PAPs	Project Affected Persons
Pb	Lead
PCN	Project Concept Note
PDO	Project Development Objective
PEP	Polyethylene Pipes
PH	Public Health
pH	Used to express acidity
PIC	Project Implementation Consultant
PID	Project Information Document
PM	Particulate Matter (sizes: 2.5 micrometer, 10 micrometer)
PMT	Project Management Team

DIP	Ductile Iron Pipes
DN	Nominal size
DO	Dissolve Oxygen
E. coli	Escherichia coli
EA	Environmental Assessment
EH	Environmental Health
EHS	Environmental Health and Safety
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
ESHS	Environmental and Social Health and Safety
ESIA	Environmental and Social Impact Assessment
ESMF	Environmental and Social Management Framework
ESMM	Environmental and Social Monitoring Matrices
ESMP	Environmental and Social Management Plan
ESO	Environmental and Social Officer
F	Fluoride
FC	Fecal Coliform
Fe	Iron
FS	Fecal Streptococci
GDP	Gross Domestic Product
GH	Ghazaliya
GHGs	Green House Gases
GIS	Geographic Information System
GRC	Grievance Redress Committee
GRM	Grievance Redress Mechanism
GRP	Glass Reinforced Plastic
GSP	Galvanized Steel Pipes
H2S	Hydrogen Sulfide
ha	Hectare
Hg	Mercury
hr	Hour
HSE-MP	Health, Safety and Environment Management Plan
Hz	Hertz
IBA	Important Birds Area
ID	Iraqi Dinar
IDP	Internally Displaced People
IFC	International Funding Corporation
IQD	Iraqi dinar
ISIS	Islamic State in Iraq and Syria
IT	Information Technology
JICA	Japan International Cooperation Agency
Km	Kilometer
PMU	Project Management Unit
PO_4	Phosphate
PPE	Personal Protective Equipment
PVC	Poly Vinyl Chloride
QA/QC	Quality Assurance/ Quality Control
RAP	Resettlement Action Plan
RES	UN Resolution
RPF	Resettlement Policy Framework
S	Second
S^{2-}	Sulfide
SCADA	Supervisory Control And Data Acquisition
Se	Selenium
Sec	Second
SO_2	Sulfur dioxide
SO_4	Sulfate
SOP	Standard Operating Procedure
SPD	Standard Procurement Document
SS	Suspended solids
TC	Total Coliform
TDS	Total Dissolved Solids
TLVs	Threshold Limit Values
TOR	Terms of Reference
TPC	Total Plate Count
TSP	Total Suspended Particles
TSS	Total Suspended Solids
UN	United Nations
UNECE	United Nations Economic Commission for Europe
US$	United States Dollars
USD	United States Dollar
USGS	United States Geological Survey
V	Volt
VOCs	Volatile Organic Compounds
WB	World Bank
WBG	World Bank Group
WEF	Water Environment Federation
WHO	World Health Organization
WRI	World Resources Institute
WSZ	Water Supply Zones
WTP	Water Treatment Plant
WWTP	Waste Water Treatment Plant
Zn	Zinc

EXECUTIVE SUMMARY

0.1. 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^2 and are administered by the Mayoralty 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 BWA currently operates 11 water treatment plants where an estimated 3.5 Million Cubic Meter (MCM) of finished water is produced per day (6 percent of the average annual flow of the Tigris) with a planned increase to 6 MCM by 2030. There are 13 reservoirs providing a total storage capacity of about 1,058,000 m3. About 53 percent of storage capacity is located on the Rusafa (east) side of the city, while 47 percent of storage capacity is located on the Karkh (west) side. The number of service reservoirs is inadequate and the present storage capacity is insufficient. The water supply system on the Rusafa side is facing particularly severe shortages.

In Al-Sha'ab sub-district, water distribution needs high pumping pressures at the source in order to convey water to remote areas without interruptions. The pumping pressure is considerably irregular due to the direct pumping from the network, and flows do not meet peak demands during the day due to lacking water backups/ storage at some point on the network. This situation has led to many

operational problems, and already caused service intermittence. In addition, there is a possibility of polluting the system when the pressure drops. The water storage (the R2 reservoir) will provide more stability to the supply system by minimizing high pressures and securing enough water for end users.

R2 water reservoir complex is a subproject of The Baghdad Water Supply and Sewerage Improvement Project (BWSIP). The 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. BWSIP 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.

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.

0.2. Project Description

The Project will comprise of constructing a new water reservoir complex in Al-Sha'ab Sub-district, including all associated civil works, and institutional and capacity building.

The new water reservoir and all associated structures will be constructed on a land plot that has an area of 67,919 sq metric meters. The land plot is now owned by BWA. Field surveys conducted have revealed that R2 land plot include the following features:

1. Buildings and service structures (caravans) that belong to Al-Imam Al-Kadhum for Islamic Sciences College (governmental institute). These structures comprise almost one quarter of the total area.

Figure A. Aerial photo of the R2 site

Recent correspondence between the university management and the BWA indicated that the land will be freed up before the start of the project

2. An open area that is located in front of University caravans and used as a free parking for university students. Recent visits to the site showed that the area is fenced at the side with the University, and closed with concrete blocks at the other sides.

Construction work is anticipated to span 30 calendar months. While a pre-construction stage of 9 months will be dedicated for contract award process. However, institutional and capacity building assistance will be offered for a comparatively longer time, 6 years, before, during construction, and even while operating the Project.

The new reservoir lies in Al-Sha'ab sub-district. It is a two-compartment closed structure that will be built 3.5m under the ground level, and provided with a cover slab of about 3m above the ground. The reservoir design will provide a storage of 135 ML (163m X 140m X 6m) withdrawn from the existing potable water network, and pumped back to the same network. Nevertheless, the Project will neither utilize additional water source(s), nor will it increase abstraction from natural resources. Other parts of the Project will include: Overflow system; Pumping station; Standby power generation room; Fuel tank; Chlorination station; Service pumping station; Valve chambers and connecting pipes; Pipework; Warehouse; Guard room; Parking; and Site roads and landscaping.

Prior to Construction, a working area will be utilized within the R2 land plot, with no planned expansion to any of the adjacent areas. It is expected that the Contractor will utilize part of the R2 site for work preparation and management of daily workforce. The size of the working area will be determined by the contractor and approved accordingly. Heavy machinery will be mobilized to the site for clearing land, excavation and lifting different materials and parts. The Contractor will partly use warehouses of BWA for storing sophisticated equipment and machinery, which will afterward be retrieved when needed onsite, while construction materials will be injected into the site in quantities relevant to work loads. Storage in the site will be pursuit at minimum due to security precautions. In terms of workforce, this will be pursuit from local market as much as possible. However, daily number of workers can range from 40 – 50 depending on the amount of activities required at that day, noting that no accommodation is offered onsite for non-skilled workers, except for resident engineers, few people from the contractor side, and service men and site guards. Expected workforce includes:

- Civil work: 100 – 150 workers, throughout construction time;
- Electrical work: 10 – 20 workers, as required;
- Mechanical work: 20 – 25 workers, as required;
- Pipework: 20 – 30 workers, as required

Excavation work will include – but not limited to – site clearance; general excavation, trenching; backfilling; placing compacting fill for embankments and other areas where filling is required.

The Contractor will use local road network to transfer equipment and machinery shipments to the working site, as well as rubbles resulted from site clearance to the place(s) designated and approved

by the MOB. Moreover, the contractor is expected to use large amounts of water for construction, washing, flushing, cleaning, etc. and for office purposes onsite. The supply and discharge of these amounts of water are the responsibility of the contractor, which must be closely coordinated with MOB and BWA.

0.3. 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^3/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^3/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.

Baghdad's population is estimated at 8,765,000 in 2016. And has a growth rate of 2.3% (in 2010 – 2015). The majority of population lies in the age category 64 – 50. In 2013, Gross Domestic Product (GDP) per capita in Iraq was estimated at 16,500 USD using purchasing power parity method (The World Factbook, 2017).

In Iraq, access to improved water supply and sanitation is relatively high, but the quality of service is often low. In 2012, 95 percent of the households in Baghdad used piped water compared to 99 percent in 2007. However, many households experienced regular and lengthy service interruptions in 2012 and beyond; due to the lack of maintenance and interruptions in water supply. 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 a future expansion.

0.4. 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 Iraqi's and WB's environmental assessment requirements can agree or disagree in some cases. However, the following is a closer look at 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:

<u>Environmental Assessment OP/BP 4.01</u>

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).

<u>Involuntary Resettlement OP/BP 4.12</u>

Around one quarter of the project land is temporarily utilized by the adjacent Al-Imam Al-Kadhum College, by the time of this report. These are caravans which have been established in prior agreement with BWA until main buildings of the university are fully established (located outside R2 land). Otherwise, the R2 land is free from other individual or group encroachments. Nevertheless, minor social, economic, and educational interruptions might be encountered during construction phase. Therefore, the WB's **Involuntary Resettlement OP/BP 4.12** is triggered as a precautionary measure, thus, the project has prepared a Resettlement Policy Framework (RPF) in order to establish a reference for addressing any socio-economic and educational impacts that could arise by implementing and operating the project.

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[1], 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:

[1] 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

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).

0.5. Public Consultation

Public Meetings

The meeting was held in Mahalla 317/ Al-Sha'ab sub-district, on the 7th of January 2016. 27 people participated. 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). A power point presentation was provided on the Project objectives and components. The audience had the following distributions:

- **Gender**: Male: 26 (96.3%), Female: 1 (3.7%)
- **Age category:** 15 – 49: 16 (59.3%), 50 – 64: 7 (25.9%), 65+: 2 (7.4%), not answered: 2 (7.4%)
- **Education level**: Literate: 2 (7.4%), Basic school: 13 (48.2%), Diploma: 5 (18.5%), First degree: 5 (18.5%), not answered: 2 (7.4%)

Queries and concerns included the following:

Table A: Feedback collected from public consultation – Al-Sha'ab, 7 January, 2016

#	Queries/ Areas of concern	Feedback
1	**Reasons behind selecting the reservoir site**	According to BWA's master plan objectives, three pillars dealt with: WTPs, networks, and reservoirs, Water projects were accompanied with distribution networks and water reservoirs, one of which is R2, Piping and closing valves have been set up, and location cannot be changed.
2	**Why not establishing these projects outside residential areas (as in other countries)**	Basically, infrastructural projects are planned in proximity to target people. In particular, water reservoirs are built close to citizens; for public health and easiness of service.
3	**The water source for the Tank, and validity for human consumption**	Water reservoirs in Baghdad are supplied with finished water from big water treatment plants, which afterward is pumped through main trunks.
4	**Planning the Project according to actual needs**	Water master plan has resulted in zoning the city according to water needs. Each zone is supplied by a water reservoir (Tank). Some Tanks were built already, others are underway. Al-Sha'ab area receives intermittent supply, which urges the construction of R2.
5	**Retrieving R2 land plot from other users (Imam Al-Kadhum College)**	Meetings were started with the University to retrieve and evacuate the R2 land at the earliest convenience
6	**The possibility of disturbing the University's activities and services**	The Project will cause no obstruction to the University. The Project will readily supply the University with water.
7	**Progress and implementation schedule**	BOQs and layouts already prepared. Currently working on the Bank's requirements, after which the Project will be approved. The Project will span 2 years.
8	**The status of the Project's tendering process**	No Project tender posted for bidding yet.
9	**Effects on the residential road network during**	The Contractor will be obliged to a set of measures.

#	Queries/ Areas of concern	Feedback
	construction	
10	**Creating job opportunities**	The Project will help create job opportunities at the local level.
11	**Dust agitation**	Stringent conditions will be imposed on Contractors, with respect to maintaining public health and the environment.
12	**Chlorine leakage**	New technologies will be applied. Chlorine leaks, if occurred, will be dragged into a special system for treatment rather than washing out by scrubbers.

Annex VII of main report provided a copy of the attendees' sheets

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's 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.

0.6. 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[2]) and those of the

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

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 B: 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 these are summarized as follows:

No Project Alternative

Table C: Impact assessment of "No-Project" alternative

Area of concern	Impact	Sensitive receptor(s)	Level of significance
Water supply system (infrastructure)	System failure due to elevated pumping pressures at the source plant	Water supply system	H
	Poor maintenance due to aging pipework and lack of water storage	Water supply system	H
	Palatability issues due to insufficient chlorination	Water supply system	M
BWA's technical staff	Overburdening maintenance staff in response to service-related complaints	Maintenance staff in the field Supervisors,	M
	Overburdening financial resources in response to service-related complaints	BWA's financial management system	H
Water supply service (local community)	Intermittent service due to pumping failure	All consumers/ end users	M
	Insufficient supply due to storage issues	All consumers/ end	H

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(s)	Level of significance
		users	
Community Health and safety	Various health issues of direct and indirect contact with waterborne pathogens (diarrhea cases) and contaminants due to leakage	All consumers/ end users	H
	Various health issues of direct and indirect contact with waterborne pathogens due to inadequate disinfection	All consumers/ end users	H

Project's Positive Impacts

The new Project is expected to have a range of positive impacts on Al-Sha'ab sub-district in particular, and on the regime of the Baghdad Water Authority in general. The new reservoir will minimize high pumping requirements of energy at the source through providing intermediate storage and pumping, which comparatively requires much less energy for pumping at the source. The Project will not require increasing water abstraction from Tigris River, or utilizing new resources; since the Project is entirely established for storage purposes and not for production. However, introducing new technologies would always decrease losses throughout the supply system. Most important, people will enjoy receiving a continuous water supply, especially in hot seasons, where water shortage is common. This would also reduce financial burdens for purchasing private water from shops and tankers.

The area is highly urbanized and intensively shifted for land use. However the project will have some slight and indirect enhancement to the natural life in the long run. That could be best reflected on the water basin from which water is being abstracted and biological life therein.

The new Project will provide all means of Occupational Health and safety (OHS) during normal operations and maintenance through using PPE. The project design will provide enough ventilation and access points for maintenance. Safety measures will include galvanized ladders to enter and exit, and to be used for lowering equipment and maintenance materials. The floors of the two compartments are designed with a slight slope to facilitate drainage, cleaning and maintenance.

Chlorination rooms will be provided with enough safety measures for ventilation; entrance and exit; exhaust air cleaning; chlorine detection and alarming system, and a suitable technology for treating leaks. The floor will also be elevated above ground level in order to withstand flooding conditions. Generator rooms will be provided with sufficient gravel-filled sump to contain the oil capacity of a transformer in the event of failure.

At the institutional level, number of complaints and fixing orders requested by the service subscribers would be less. Financial capabilities of BWA will be further relaxed, allowing for further development, equipment purchasing and training. The Project is also expected to enhance education and awareness on best management practices.

If the Project is implemented as planned, citizens of the Al-Sha'ab will enjoy more equalized flows, less supply interruptions, secured amounts of water in cases of system failure, and safer drinking water at the user tap. This would also boost the service to include new subscribers. Of much importance is protecting public health through ensuring the safer level of chlorine residual until

reaching the tap. In general, there would be more positive impacts on the water service, as detailed in the main report.

0.7. Environmental and Social Impact Assessment/ Environmental and Social Management Plan

Expected Negative Impacts and Proposed Management Plan

The Project of the new water reservoir complex will include site clearance and carrying out civil works as well as installing new equipment and electrical devices. This type of construction has a strong interaction with working personnel on-site and interference with public daily life while mobilizing construction materials and workforce to the construction site (people affected are collectively referred to as Project Affected Persons "PAPs"). Releases to the surrounding environment are expected to occur if not managed properly.

On another hand, the Project land as found being utilized by other parties (the University's caravans) could have minor socio-economic impacts. A Grievance Redress Mechanism (GRM) should be setup in early stages of the Project (as described above) in order to help addressing grievances in a timely manner.

The two tables below provide, in more detail, other expected impacts during construction and operation phases. The tables also include proposed mitigation measures; responsible parties; and requirements, as well as time for implementation.

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

#	Area	Impact	Ranking	Mitigation	Roles & Responsibilities	Requirements	Time/frequency
1	**Occupational Health and Safety**	Health issues related to over-exertion and ergonomic injuries and illnesses	M	• Prevent and control through training of workers in lifting and material handling techniques, • 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, • Implement administrative controls into work processes	• Contractor to implement, • BWA to assist and supervise	• Training on OHS, • The best design of work station, • Personnel rotation system, • First aid.	• Prior to construction for training and work station, • Weekly for rotation, • Daily for others
2		Health issues related to accidental slips and falls	H	• Implement good house-keeping practices, • Clean up excessive waste debris and liquid spills regularly, • Locate electrical cords and ropes in common areas and marked corridors, • Use slip retardant footwear.	• Contractor to implement, • Supervision contract, • BWA to follow up	• Housekeeping practices, • Cleanup kits, • First aid, • PPE.	On daily basis
3		Health issues related to working in heights	H	• Train and use temporary fall prevention devices, • Train and use personal fall arrest systems, • Use control zones and safety monitoring systems	• Contractor to implement, • Supervision contract, • BWA to follow up	• Education, • Acquisition of right expertise, • Provision of safety devices, • Provision of safety monitoring systems, • PPE, • First aid,	• Prior to construction for "Education" and employing "right expertise", • Daily for other provisions
4		Health issues related to getting struck by objects	H	• Use a designated and restricted waste drop or discharge zones, • Conduct sawing, cutting, grinding, sanding, chipping or chiseling with proper guards and anchoring as applicable, • Maintain clear traffic ways, • Use temporary fall protection measures, • Wear appropriate PPE.	• Contractor to implement, • Supervision contract, • BWA to follow up	• Education, • Acquisition of right expertise, • Provision of safety devices, • First aid, • PPE	• Prior to construction for "Education" and "right expertise", • Daily for other provisions
5		Health and accidental issues related to	M	• Ensure the visibility of personnel through	• Contractor to	• Provision of safety	• Prior to construction

#	Area	Impact	Ranking	Mitigation	Roles & Responsibilities	Requirements	Time/frequency
		exposing to moving machinery		their use of high-visibility vests, • Ensure moving equipment is outfitted with audible back-up alarms, • Use inspected and well-maintained lifting devices.	implement, • Supervision contract, • BWA to follow up	devices, • Provision of safety monitoring systems, • Provision of suitable equipment, • First aid, • PPE.	for devices and systems, • Daily for other provisions
6		Health issues related to working with exposed electrical parts	H	• Conduct detailed identification and marking of all buried electrical wiring, • Lock out and tag-out devices during dismantling and maintenance, • Check all electrical cords, cables, and hand power tools for frayed or exposed cords, • Use electricity-specific PPE,	• Contractor to implement, • Supervision contract, • BWA to follow up	• Education, • Acquisition of right expertise • Provision of safety devices, • PPE, • First aid,	• Prior to construction for "Education" and "right expertise", • Daily for safety devices and PPE
7		health issues related to respiratory hazards mismanagement	H	• Minimize dust from material handling sources, • Minimize dust from open area sources (stockpiles), • Use dust suppression techniques to minimize dust from vehicle movements • Use PPE, such as dust masks, where dust levels are excessive, • Avoid burning of solid wastes.	• Contractor to implement, • Supervision contract, • BWA to follow up	• Provision of respiratory controls, • PPE, • Best management practices.	• Daily for controls, • Weekly for local communication
8		Health issues related to working in confined places	M	• Provide safe means of access and egress from confined places, • Avoid operating combustion equipment for prolonged periods, • Use special PPE.	• Contractor to implement, • Supervision contract, • BWA to follow up	• Education, • Provision of safety devices, • Ventilation system,	• Prior to construction for education, • Daily for safety devices, ventilation, and PPE

#	Area	Impact	Ranking	Mitigation	Roles & Responsibilities	Requirements	Time/frequency
						• PPE, • First aid.	
9		hazardous solid and liquid materials mismanagement	H	• Provide adequate secondary containment for lubricating oils and hydraulic fluids, • Provide adequate ventilation, • Use impervious surfaces for refueling 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, • Provide awareness to workers on EHS related risks, • Identify types and quantities of hazardous waste expected, • Identify available collection and treatment programs and infrastructure, • Put procedures and operational controls for on-site storage.	• Contractor to implement, • Supervision contract, • BWA to follow up, • MOB to approve final treatment.	• Education, • Secondary containment, • Ventilation, • Refueling areas, • Spill and cleanup, • Waste management plan, • Material storage plan	• Prior to construction for education, • Daily for management
10		health issues related to noise and vibration mismanagement	H	• 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.	• Contractor to implement, • Supervision contract, • BWA to follow up	• Education to workers, • Preventive and corrective Maintenance, • PPE,	• Prior to construction for education, • Daily for management

#	Area	Impact	Ranking	Mitigation	Roles & Responsibilities	Requirements	Time/frequency
11	**Public health and & safety**	Spread of communicable and vector-borne diseases	H	• Provide surveillance and active screening and treatment of workers, • Prevent illness among workers in local communities, • Train health workers in disease treatment, • Conduct immunization programs, • Provide treatment on-site or in community health care facilities, *vector-borne diseases* • Eliminate unusable impounded water, • Implement integrated vector control programs, • Promote use of personal protective means and barriers, • Communicate with public health officials, • Educate project personnel and area residents on risks, prevention, and available treatment, • Monitor communities during high-risk seasons, • Follow safety guidelines for the storage, transport, and distribution of pesticides.	• Contractor to implement, • Contractor to implement, • Supervision contract, • Health centers to immunize, • Municipalities to apply controls (in liaison with the environmental dept of MOB), • BWA to follow up,	• Immunization programs, • Municipalities to apply pest control programs	• Prior to construction for immunization • monthly for pest management
12		public safety issues due to unauthorized access to working sites	H	• Restrict access to the working site, (institutional and administrative controls, fencing, signage, and communication of risks), • 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.	• Contractor to implement, • BWA to supervise,	• Education, • Acquisition of right expertise, • Collection and disposal plan, • Provision of safety devices, • PPE, • First aid, • Site security.	• Prior to construction for "Education" and "right expertise", • Daily for other provisions
13		Traffic safety	M	• Emphasize safety aspects among drivers, • Avoid or minimize driving through community areas and dangerous routes and times of day, • Alert drivers on local speed limits, and	• Contractor to implement, • Supervision contract, • BWA to follow up, • Traffic department to	• Education, • Provisions of suitable means of transportation, • Best management	• Daily for education, • Weekly for traffic communication, • Weekly for local communication,

#	Area	Impact	Ranking	Mitigation	Roles & Responsibilities	Requirements	Time/frequency
				monitor implementation, • Apply regular maintenance of vehicles, • Collaborate with local communities and responsible authorities to improve signage and visibility, • Minimize traffic by purchasing from the local markets.	advise, • Local representatives to get in touch	practices, • Provision of regular maintenance, • Provisions of traffic safety measures, • Considering local market	• Periodically for local market inclusion.
14	**Waste Management**	solid waste mismanagement	M	• Identify types and estimate quantities of waste; • Identify available collection and treatment programs and; • Establish collection and treatment priorities; • Identify opportunities for reduce, reuse, and recycle; • Put procedures and operational controls for on-site storage.	• Contractor to implement, • Supervision contract, • BWA to follow up, • MOB to approve dumpsite.	• Waste management plan, • Material storage plan	• Prior to construction for plans, • Daily for management
15		domestic wastewater mismanagement	H	• Identify types and estimate quantities of wastewater, • Segregate wastewater streams, • Segregate and pre-treat oil and grease containing effluents, • Discharge to sanitary network only after confirming compliance, • Contain in septic tanks if discharge to sanitary sewer network is not possible, • 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.	• Contractor to implement, • Supervision contract, • BWA to follow up, • MOB to approve dumpsite.	• Waste management plan, • Storage plan, • Quality testing for groundwater resources • Provisions for on-site treatment	• Prior to construction for plans, • Daily for management • Quarterly for water quality monitoring

#	Area	Impact	Ranking	Mitigation	Roles & Responsibilities	Requirements	Time/frequency
16	**Physical environment**	soil erosion and sediment mobilization	M	• Schedule to avoid heavy rainfall periods, • Minimize steepness of slopes, • Re-vegetate if applicable, • Design channels and ditches for expected flows, • Reduce or prevent off-site sediment transport, • Modify/ suspend activities during extreme rainfall and high winds, • Segregate or divert clean runoffs from water containing high solids content, • Provide adequate drainage system onsite. • Monitor groundwater quality that could exist close to the working areas to ensure compliance.	• Contractor to implement, • Supervision contract, • BWA to follow up, • Meteorological department for weather forecast	• Best management practices, • Provision of drainage/ segregation systems, • Weather forecast • Quality testing for groundwater resources	• Daily for best practices, • Seasonally for rainfall seasons • Quarterly for water quality monitoring
17	**Biotic environment**	altering/ endangering biological life	L	• Ensure full adherence to the zero-discharge criterion, • 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.	• Contractor to implement, • Supervision contract, • BWA to follow up, • MOB to designate and approve dumpsite, • Environment department to advise,	• Best management practices, • Provisions of off-site cleanup, • Waste and spill management plan, • Flora and fauna mapping, • Awareness on natural life	• Prior to construction for flora and fauna mapping, • Daily for zero-discharge, driving routes, • Weekly for awareness, • Continuously for contact with environment dept.

#	Area	Impact	Ranking	Mitigation	Roles & Responsibilities	Requirements	Time/frequency
18	**Cultural heritage and chance finds**	Possible damage to objects of historical/ cultural value	H	• Educate site workers on possibilities of unearthing objects, • Make workers aware of the significance and legal liabilities, • Put simple and clear instructions for workers in response chance finds, • Liaise with responsible authorities, • Suspend excavation work and promptly communicate any chance finds to the responsible authorities.	• Contractor to implement, • Supervision contract, • BWA to follow up, • Dept. of antiquities to approve chance finds procedures,	• Education & awareness, • Procedures for chance finds, • Well-defined communication channels,	• Prior to excavation for "education", • Prior to excavation for "chance finds procedures", • On daily basis during excavation works
19	**Socio-economic**	Temporary loss of livelihood, Temporary interruption of social, economic, and educational activities	L	• Conduct site survey in order to provide full inventory of PAPs and their activities and asset before commencement of construction, • Update and apply the BWSIP's Resettlement Policy Framework, • Ensure and apply a grievance redress mechanism (GRM) at early stages, • Engage affected people in the project if possible	• The Project team/ BWA to conduct a site survey, • MOB to establish a GRM, • The Contractor to engage affected people.	RPF/RAP/ARAP	Prior to construction

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

#	Area	Impact	Ranking	Mitigation	Responsibility	Requirement	Frequency
1	**Water Quality**	Public health issues due to poor quality of water	M	• Avoid prolonged periods of storage, • Monitor residual chlorine levels at the inlet and at the outlet, • Ensure level of capacity to handle sampling and testing, • Apply preventive checks on chlorination facilities, • Maintain a communication channel with higher management for arising issues.	• Reservoir management to report water issues • BWA to provide means for testing water quality, • BWA to provide needed capacity building.	• Procedures put in place to carry out water monitoring, • Water safety plan, • Testing equipment, • Training courses on monitoring of water quality.	• Daily for applying procedures and monitoring, • Monthly for reporting to BWA's higher managemen t, • Annually for training on water quality
2		Public health issues due to water contamination	L	• Ensure proper closure of hatches by applying daily surveillance, • Check integrity of coating on the interior walls of the reservoir, • Fix poorly-closing hatches and provide more coating when necessary, • Test water for microbiological parameters at the outlet, • Maintain a communication channel with higher management for arising issues.	• Site management to report water issues • BWA to provide means for testing water quality, • BWA to provide needed capacity building.	• Procedures put in place to carry out water monitoring, • Water safety plan, • Contingency plan, • Testing equipment, • Training courses on monitoring of water quality.	• Daily for applying procedures and monitoring, • Monthly for reporting to BWA's higher managemen t, • Annually for training on water quality
3	**OHS**	Health issues related to accidental slips, trips, and falls	H	• Implement good house-keeping practices, • Clean up excessive waste debris and liquid spills regularly, • Locate electrical cords and ropes in common areas and marked corridors, • Use slip retardant footwear, when using stairs to access underground facilities.	• Working personnel to implement, • BWA to provide medical insurance, monitor implementation, and provide education.	• Capacity building, • Best practices, • Cleanup kits, • First aid and medical insurance, • PPE,	• Daily for best practices, medical care, and PPE, • Periodically for capacity building and job rotation,

#	Area	Impact	Ranking	Mitigation	Responsibility	Requirement	Frequency
4		Health issues related to working in heights	H	• Train and use temporary fall prevention devices, • Train and use personal fall arrest systems, • Use control zones and safety monitoring systems and secure, mark, and label covers for openings.	• Working personnel to implement, • BWA to provide medical insurance, monitor implementation, and provide training.	• Capacity building, • Best practices, • Provision of safety devices, • Provision of monitoring systems, • First aid and medical insurance, • PPE,	• Daily for best practices, medical care, safety devices, monitoring systems PPE, • Periodically for capacity building,
5		Health issues related to risk of drowning in the reservoir	H	• Schedule a full drainage of water from the compartment under maintenance, • Take necessary precautions inside places with high risk of drowning, by ensuring enough ventilation and/or using appropriate respiratory apparatus, life vests, and danger signage. • Educate workers on first aid procedures in case of drowning.	• Site management to provide reservoir cleaning procedures, PPE, ensure ventilation, and signage, • BWA to provide training.	• Safety and cleaning equipment, • Danger signage, • Training courses.	• Periodically for cleaning and safety equipment, • Annually for training.
6		Health issues related to working with electrical equipment and control panels	H	• Identify and mark all electrical connections prior to maintenance, • Lock out and tag-out devices during demounting for maintenance, • Ensure circuit breaking before starting work on electrical parts, • Use electricity-specific PPE, • Use specially trained personnel to demount electrical parts.	• Working personnel to implement, • BWA to provide medical insurance, monitor implementation, and provide training.	• Capacity building, • Best practices, • Acquisition of right expertise, • Provision of safety devices, • Provision of monitoring systems, • First aid and medical insurance, • PPE,	• Daily for best practices, medical care, safety devices, monitoring systems PPE, • Periodically for capacity building and "right expertise"
7		Health issues related to working in confined places	H	• Provide safe means of access and egress from confined places, • Avoid operating combustion equipment for prolonged periods without ventilation, • Use special PPE (respirators, protective suits, gloves, and eye protection), • Minimize exposure period.	• Working personnel to implement, • BWA to provide medical insurance, monitor implementation, and provide training.	• Education, • Provision of safety devices, • Ventilation system, • PPE, • First aid.	• Daily for best practices, medical care, safety devices, PPE, • Periodically for capacity building

#	Area	Impact	Ranking	Mitigation	Responsibility	Requirement	Frequency
8		Health and stress issues due to noise and vibration in work environment	L	• Insulate the control room against noise and vibration, • Avoid prolonged exposure beyond permissible times, • Avoid exposure to excessive levels beyond permissible limits, • Monitor noise and vibration following (SOPs) and using appropriate instrumentation, • Use noise and vibration protecting gear and clothing, • Keep records of breaching incidents, and report to the higher management.	• Working personnel to implement, • BWA to provide medical insurance, monitor implementation, and provide training.	• Education, • Provision of insulation, • Provision of monitoring devices and programs, • PPE, • Medical insurance, • Record keeping	• Daily for best practices, medical care, PPE, • Weekly and monthly for monitoring, • Periodically for capacity building
9	**Releases to the environment**	Public health issues and contamination of environment due to mismanagement of hazardous waste and materials	H	• Train operators on release prevention, including drills specific to hazardous materials, • Implement inspection on pressure vessels, tanks, piping, valves, containment, emergency shutdown, controls and pumps, and associated equipment, • Prepare SOPs for filling containers/equipment, and for transfer operations, • Apply SOPs for managing secondary containment structures, • Identify locations of hazardous materials and associated activities, • Make available specific PPE and training, • Make available spill response equipment with a list of possible interventions.	• Working personnel to implement, • BWA to monitor, • Environment dept to advise, • Local representatives to assist.	• Capacity building, • Inspection programs, • Documented procedures, • Best management practices, • Legal and approved dumpsite, • Provision of PPE, • Provision of spill equipment.	On daily basis
10		Public health issues and contamination of environment due to releases by natural disasters	H	• Ensure the full implementation of safety measures set out by the final design, • Ensure adequate planning for contingency in case of natural disasters, • Train workers on safety measures and ensure adherence, • Provide special training and drills on emergency, evacuation, and recovery.	• Site management to implement safety measures, and contingency planning, • BWA to provide emergency and evacuation drills.	• Safety measures, • Contingency plan, • Emergency and evacuation drills.	Annually for amending safety measures and providing emergency and evacuation drills.
11		Public health issues and contamination of environment due to releases by abnormal operations	M	• Develop and implement protocols to reduce risks to safety, public health, and environment, • Develop a site-specific contingency plan in case of overflows, • Respond to overflows by preventing, containing, and minimizing overflow, • Notify responsible parties, which include BWA in this case.	• Site management to implement, • BWA to monitor, • Environment dept to monitor, • Local representatives to	• Contingency plan, • Public health standards, • Maintenance plans, • Community outreach	• Daily for contingency, and maintenance, • Seasonally for

#	Area	Impact	Ranking	Mitigation	Responsibility	Requirement	Frequency
					assist.		community outreach

0.8. Monitoring Plan

Table F: 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	• Zero medical complaint/ assistance, • 100% clear inspection report	• Contractors' incident records • Keeping records at medical care centers	• Resident engineer of PIC • Resident engineer of BWA • ESO- BWA	Monthly, Annual review	Construction site	• PIC's budget. • BWA's resident engineer daily rate (approx. 50 USD/day) • ESO-BWA's daily rate (approx. 50 USD/day)
2	Training effectiveness	• Zero incident reports related to training, • 100% clear inspection report	• Contractor's incident reports	• Resident engineer of PIC • Resident engineer of BWA • ESO- BWA	Monthly, Annual review	Construction site	• PIC's budget. • BWA's resident engineer daily rate (approx.. 50 USD/day) • ESO-BWA's daily rate (approx. 50 USD/day)
3	Housekeeping in-situ	• Zero incident reports, • Zero complaints, • 100% clear inspection report	• Contractor's incident records, • Contractor's complaining system, • Contractor's environmental engineer reporting	• Resident engineer of PIC • Resident engineer of BWA	Bi-weekly, Monthly, Annual review	Construction site	• PIC's budget. • BWA's resident engineer daily rate (approx. 50 USD/day) • ESO-BWA's daily rate (approx. 50 USD/day)
4	PPE effective usage	• Zero incident reports related to misusing PPE, • 100% clear inspection report, • 100% clear Occupational Health (OH) report	• Contractor's incident records, • Contractor's complaining system, • Site engineer's reporting,	• Contractor • Resident engineer of PIC • Resident engineer of BWA	Monthly	Construction site	• Contractor's budget • PIC's budget. • BWA's resident engineer daily rate (approx. 50 USD/day)

#	Parameter to be monitored	Target KPI/limit	Monitoring requirements	Monitoring Responsibility	Frequency	location	Cost estimate
			• OH inspection system				
5	Site hygiene	• Zero incident reports related to waste mismanagement, • 100% clear inspection report, • 100% clear PH report	• Contractor's incident records, • Contractor's complaining system, • Site engineer's reporting, • PH inspection system	• Contractor • Resident engineer of PIC • Resident engineer of BWA	Monthly, Quarterly, Annual review.	Construction site	• Contractor's budget • PIC's budget. • BWA's resident engineer daily rate (approx. 50 USD/day)
6	Off-site hygiene	• Zero complaints related to illegal dumping off-site, • 100% clear PH report	• BWA's complaining system, • PH inspection system	• Resident engineer of PIC • MOB	Monthly, Quarterly, Annual review	Transporting routes	• PIC's budget. • MOB budget (daily rates of field inspectors approx. 50 USD/day)
7	Ambient air quality and noise	• Zero complaints related to air and noise nuisance, • 100% clear Environmental Health (EH) report, • Thresholds are fully complied with.	• BWA's complaining system, • EH. inspection system, • Air and noise monitoring equipment, measurements and analyses.	• Resident engineer of PIC • Resident engineer of BWA • ESO- BWA	Quarterly, Annual review.	Site vicinity	• PIC's budget (monitoring cost estimated at 10,000 USD quarterly). • BWA's resident engineer daily rate (approx. 50 USD/day) • ESO-BWA's daily rate (approx. 50 USD/day)
8	Surface and groundwater quality	• Physical, chemical, and bacteriological parameters are within national limits	• Water quality monitoring services	• Resident engineer of PIC • ESO-BWA for final reporting	Quarterly	• Intake points from Tigris, • Discharge points of untreated sewage, • Groundwater wells within 1km of point of discharge into Tigris, and • Groundwater wells within 1 km distance along open canals of untreated sewage.	• 6,100 USD per each round of testing from 4 locations • ESO-BWA's daily rate (approx. 50 USD/day)
9	Public health and safety	• Zero complaints related to vector nuisance and communicable diseases, • Zero incidents of Project related infections/diseases.	• Immunization program, • Records of BWA's complaining system, • Records of Health inspection system,	• Health care provider • Resident engineer of PIC • MOB	Monthly, Annual review.	On-site, localities	• Cost of health care program included in the contractor's budget (estimate: 200 USD/worker/year), • Cost of MOB's complaining system included in MOB's

#	Parameter to be monitored	Target KPI/limit	Monitoring requirements	Monitoring Responsibility	Frequency	location	Cost estimate
			• Records of Health care systems.	• ESO-BWA for final reporting			budget, • PIC's budget • ESO-BWA's daily rate (approx. 50 USD/day)
10	Traffic safety	• Zero traffic accident reports related to the Project, • Zero complaints of project related traffic accidents	• Traffic dept records, • Records of BWA's complaining system, • Contractor's record.	• Traffic dept, • MOB • Resident engineer of PIC for reporting • ESO-BWA for final reporting	Monthly, Annual review	Public road network	• Costs of accidents recording included in Traffic Department's budget, • Cost of MOB's complaining system included in MOB's budget, • PIC's budget • ESO-BWA's daily rate (approx. 50 USD/day)
11	Natural life (flora & fauna)	• Zero incident reports related to altering/ endangering natural life	• Environmental inspection system, • Incident records.	• Environmental dept at MOB • Resident engineer of PIC for reporting • ESO-BWA for final reporting	Monthly, Annual review	Natural life in vicinity and downstream	• Costs of environmental monitoring included in environmental dept's budget, • PIC's budget • ESO-BWA's daily rate (approx. 50 USD/day)
12	Cultural heritage and chance finds	• Incident reports of chance finds are fully addressed to responsible authorities • No activity has resulted in any archaeological/cultural heritage damage during construction	• Incident reports, • Site surveillance during work • Open reporting channels with responsible authorities (dept. of antiquities and MOB)	• Antiquities dept. • Resident engineer of PIC for reporting • ESO-BWA for final reporting	Daily, quarterly review	Site location	• Antiquities Department monitoring budget, • PIC's budget • ESO-BWA's daily rate (approx. 50 USD/day)

Table G: Environmental and Social Monitoring Plan – Operation

#	Parameter to be monitored	Target KPI/limit	Monitoring requirements	Monitoring Responsibility	Frequency	location	Cost estimate
1	Water quality	• River water quality within thresholds,	• Water quality monitoring	• MOB for complaining	Semiannual	• Intake points from Tigris, • Discharge points of	• MOB's budget for running complaining system,

#	Parameter to be monitored	Target KPI/limit	Monitoring requirements	Monitoring Responsibility	Frequency	location	Cost estimate
		• Zero complaints related to overflows	services	• BWA's central labs • ESO-BWA		untreated sewage, • Groundwater wells within 1km of point of discharge into Tigris, and • Groundwater wells within 1 km distance along open canals of untreated sewage.	• 6,100 USD per each round of testing from 4 locations • ESO-BWA's daily rate (approx. 50 USD/day)
2	Health issues linked to nature of work	• Zero medical complaint/ assistance, • Zero incident reports	• Incidents records, • Records at medical care centers	• Site management, • BWA's OHS dept.	Monthly, Annual review	Water reservoir complex	• Costs of medical care included in BWA's budget (estimate: 200 USD/personnel/month)
3	Housekeeping in-situ	Zero incident reports related to operational and maintenance activities,	Site inspection system and records	• Site management, • ESO-BWA	Bi-weekly, Monthly, Annual review	Water reservoir complex	• Costs of inspection and incidents record keeping included in the site's and MOB/BWA's budgets (estimate: 2,000 USD/year) • ESO-BWA's daily rate (approx. 50 USD/day)
4	PPE effective usage	Zero incident reports related to misusing PPE,	Site inspection system and records	• Site management, • ESO-BWA.	Monthly	Water reservoir complex	• Costs of inspection and incidents record keeping included in the site's and MOB/BWA's budgets (estimate: 2,000 USD/year) • ESO-BWA's daily rate (approx. 50 USD/day)
5	Site hygiene	Zero incident reports related to waste mismanagement.	Site inspection system and records	• Site management, • ESO-BWA.	Monthly, Quarterly, Annual review.	Water reservoir complex	• Costs of inspection and incidents record keeping included in the site's and MOB/BWA's budgets (estimate: 2,000 USD/year) • ESO-BWA's daily rate (approx. 50 USD/day)
6	Public health related to natural disasters	• Zero complaints of operation-related public health, • Zero incidents of Project related infections/diseases.	• Records of BWA's complaining system, • Records of Health inspection	• Site management, • ESO-BWA, • Health dept. • Health care centers.	Monthly, Annual review.	Nearby residential areas	• Costs incurred by Health inspector included in Health dept's budget (estimate: 100 USD/day), • Costs of running complaining system included in BWA's budget,

#	Parameter to be monitored	Target KPI/limit	Monitoring requirements	Monitoring Responsibility	Frequency	location	Cost estimate
			system, • Records of Health care systems.				
7	Capacity building	• Zero incident reports related to operational and maintenance activities, • Staff evaluation (highest score)	Human resources system	• HR at MOB/BWA • ESO-BWA	Semi-annual Annual review	Water reservoir complex	• Costs of capacity building and training included in BWA's budget (estimate: 1,000 USD/worker/year) • Costs of staff evaluation included in BWA's HR budget.

Site visits and reporting

Table H: 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	**From** Representatives of BWA (ESO-BWA), Al-Sha'ab Municipality, and Contractor's environmental engineer **To** the higher management of BWA, MOB, and WB	This stems from BWA'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 ESMP	Once upon starting the Project	**From** Representatives of BWA (ESO-BWA), Al-Sha'ab Municipality, and Contractor's environmental engineer **To** the higher management of BWA and MOB Then **from** BWA **to** Contractor for action	This stems from BWA'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	**From** the Contractor's environmental engineer **to** the BWA's supervision team, Then **from** BWA **to** 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	**From** the Contractor's environmental engineer **to** the BWA's supervision team, **to** the higher management at BWA/ MOB and WB Then **from** BWA **to** 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 actions responded.
5	Monitoring complaints/concerns of local community	Quarterly from starting constructions	**From** Representatives of BWA (ESO-BWA), Al-Sha'ab Municipality, and Contractor's environmental engineer **to** the higher management of BWA and MOB, Then **from** BWA **to** 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 I: Training requirements for MOB's/BWA's working staff

Target Group	Workshop/ Training Sessions	Training Provider	Costs (USD)
Coordinators and Project Officers (MOB, BWA)	- Training session on planning and design of ESIAs/ESMPs.	ESO-BWA	7,000
Project Beneficiaries and Stakeholders	- Consultation sessions on potential environmental and social impacts of the Project.	Project Unit with assistance from the ESO-BWA	10,000
Project Proponent (BWA), Site personnel, OHS dept.	- Training session on planning and design of ESIAs/ESMPs. - The design and implementation of mitigation measures. - Occupational health and safety guidelines.	Project Unit with assistance from the ESO-BWA, External training provider for OHS	18,000
Specialized training			
BWA 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
		Sub Total (USD)	**50,000**
		Environmental and Social Officer Salary	**40,000**
		Total (USD)	**90,000**

0.9. Conclusions and Additional Information

In conclusion, the Project if implemented as planned will have great positive impacts on the water 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 – drinking water contamination

1. INTRODUCTION

The city of Baghdad and its suburbs cover 950 km^2 and are administered by the Mayoralty 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.

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 BWA currently operates 11 water treatment plants where an estimated 3.5 Million Cubic Meter (MCM) of finished water is produced per day (6 percent of the average annual flow of the Tigris) with a planned increase to 6 MCM by 2030. There are 13 reservoirs providing a total storage capacity of about 1,058,000 m3. About 53 percent of storage capacity is located on the Rusafa (east) side of the city, while 47 percent of storage capacity is located on the Karkh (west) side. The number of service reservoirs is inadequate and the present storage capacity is insufficient. The water supply system on the Rusafa side is facing particularly severe shortages.

Before private sector engagement can be considered in Iraq's water supply and sanitation sector, and before there is a chance of achieving cost-recovery, fundamental improvements in performance, institutional development, and revenue cycle management will need to be implemented. In the short term the GoI will need to work within its existing structures to reduce losses, improve revenue flows, improve management and financial information systems, modernize water laws and regulations, and meet minimum levels of commercial performance. The Bank's "Doing Business" report of 2016 ranked Iraq still as very low in "ease of doing business", with a regulatory environment that is still not favorable to the private sector.

Conflict-related damages to water and sanitation services have further affected 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, which greatly affected BWA's water plans and end service delivery. Water prices in Baghdad are subsidized and based on a volumetric block tariff. For example, domestic subscribers are charged 7 IQD for consuming 1 – 30m^3, 17 IQD for 31 – 60m^3, 30 IQD for 61 – 90m^3, and 55 IQD for consuming more than 91m^3. However, the commercial sector is charged 100 IQD for each 1 m^3, while the governmental sector is

charged 80 IQD for each 1 m^3. However, final prices do not match actual cost of production, which is estimated at 155 IQD per cubic meter excluding transportation cost. It is worth mentioning that the project will neither increase water abstraction from natural resources, nor will it increase tariffs, though, some slight increase is expected due to the annual inflation rate.

Al-Sha'ab sub-district, where the Project lies, is mostly flat, which does not require a sophisticated pumping system. However, water delivered via the existing network needs high pumping pressures at the source in order to convey water to remote areas without interruptions. Pumping pressure is considerably irregular due to the direct pumping from the network, and flows do not meet peak demands during the day due to lacking water backups/ storage at some point on the network. This situation leads to many operational problems, and would cause service intermittence. In addition to the possibility of pollutants (due to seepage) to ingress the system when the pressure drops.

The water storage (the reservoir) will provide more stability to the supply system by minimizing high pressures needed at the treatment plant upstream, in addition to securing water of required quantities and qualities for the end users, in case of any system failure or maintenance time at the source. Accordingly, the Project will be able to reserve 135 ML of chlorinated potable water, to be readily received from the existing network, then to be pumped back to end users in Al-Sha'ab municipality via the same network.

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 MOB 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.

The Project of R2 Water Reservoir Complex in Al-Sha'ab Sub-district (the subject of this study) will be financed by the World Bank Group. The Project was classified as environmental category "B – partial assessment" which requires the preparation of Environmental and Social Impact Assessment (ESIA) inclusive of an Environmental and Social Management Plan (ESMP), according to the provisions of "OP/BP 4.01: Environmental Assessment". All project activities will be within exiting footprint or on land owned by the project entity, land acquisition will not be required. However, the operational policies of the OP/BP 4.12 on Involuntary Resettlement is applied for precautionary purpose and a resettlement policy framework will be prepared.

1.2. ESIA Objectives

The Project activities could create adverse impacts 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.

1.3. Institutional Arrangements in Mayoralty of Baghdad

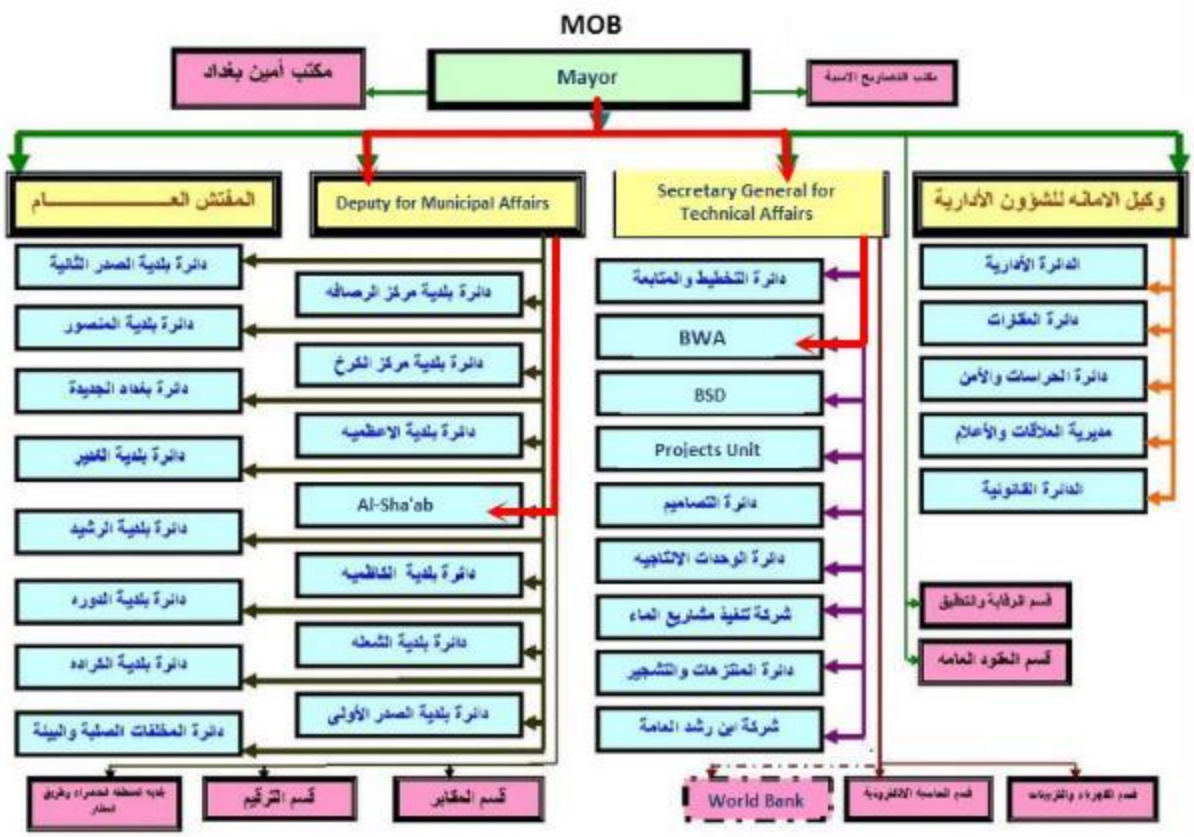


Figure 1: MOB organizational chart

Baghdad Water Authority is one department of MOB, which take responsibilities of drinking water services in Baghdad. The Following figure shows organizational structure of BWA.

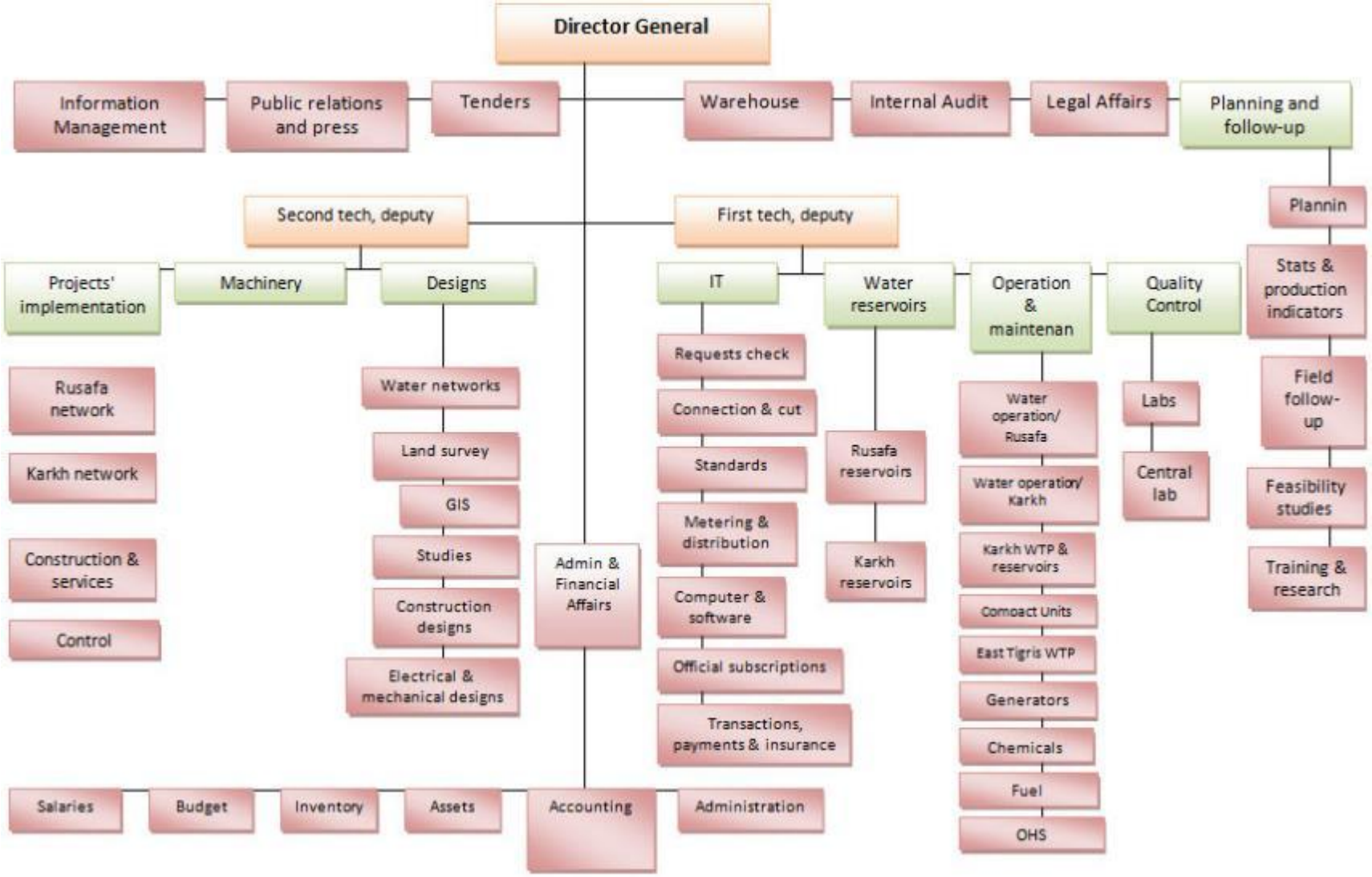


Figure 2: BWA's organizational chart

2. BACKGROUND INFORMATION

2.1. Water Service in Al-Sha'ab/ Rusafa

The Baghdad Water Authority (BWA) is one department of the Mayoral of Baghdad (MOB), which is responsible for providing and maintaining water services in adequate quantities and sound quality in Baghdad city.

Baghdad is subdivided into 25 Water Supply Zones (WSZ). It was planned to have 14 WSZs in Rusafa side, one of which is R2. However, only 8 WSZs were having reservoirs, while one reservoir (R3) was under construction at the date of this report. The R2 WSZ is administered by Al-Sha'ab Municipality, and covers a total area of 30.74 sq km. In 2005, R2 WSZ was used to provide potable water to about 363,437 people in Al-Sha'ab municipality, through the existing network. That number has increased to more than 550,000 people, at the time of preparing this report. However, Al-Sha'ab population is expected to increase to 750,000 by year 2030, and so is the number of subscribers to the service. Noteworthy mentioning that, users who are not recorded by the Water Authority would greatly add up to the number.

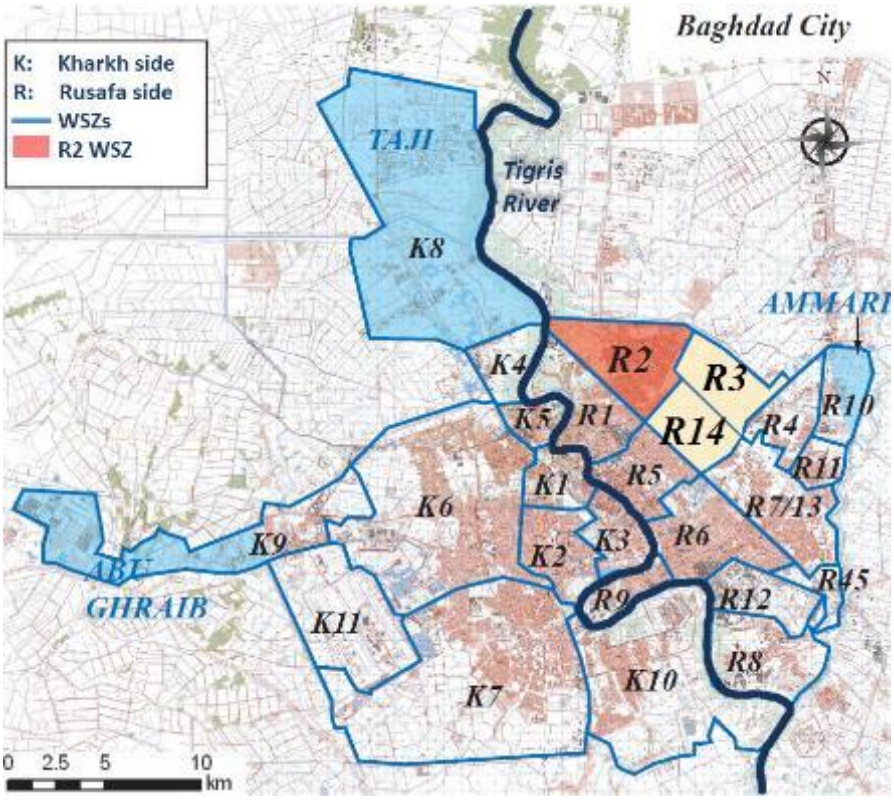


Figure 3: Water supply zoning in Baghdad – R2 location

Adapted from report: "Feasibility Study on Baghdad Water Supply System Improvement Project – JICA, 2006"

Water prices in Baghdad are based on a volumetric block tariff. Domestic subscribers are billed to pay 7 IQD for consuming 1 – 30m^3, 17 IQD for 31 – 60m^3, 30 IQD for 61 – 90m^3, and 55 IQD for consuming more than 91m^3. Non-domestic subscribers include the governmental and commercial sectors. Those are billed to pay 80 IQD and 100 IQD per cubic meter, respectively. Water prices are

subsidized, and inconsistent with actual water production cost, which is estimated at 155 IQD per cubic meter. However, BWA does not have authority to set water tariffs.

There are many types of treated water that actually does not reach intended users, collectively referred to as "Unaccounted-for Water (UFW)". These include – *inter-alia*, water lost by leakage, by lack of maintenance, and by illegal connections and unmetered waters. Consequently, the UFW has led to a water deficit of almost 35% (BWA, 2015). It is worth mentioning that the project will neither increase water abstraction from natural resources, nor will it increase tariffs of service, though, some slight increase in prices is expected due to the annual inflation rate.

2.2. Water Infrastructure – Current situation

Tigris basin is the only source for water in Baghdad. In 2005, the water demand for R2 WSZ was estimated at 165,727 m^3/day in average. Whereas, in 2014/2015, it was estimated at 199,057 m^3/day in average.

Sharq Dijla WTP, along with 4 other reservoirs, is the supplier of treated water to a range of distribution areas in Rusafa comprising a total of 8 WSZs (R5, R7, R9, R10, R11, R13, R14, and R45), and R3, which was under construction as of the date of this report. The whole system was planned to accommodate R2 in Al-Sha'ab municipality as well, which receive treated water directly from this WTP. Sharq Dijla WTP is also one of the 11 biggest water treatment projects in Baghdad. It is situated on the eastern bank of Tigris River, close to Al-Muthanna Bridge, in Al-Adhamyia District. The WTP receives raw water directly from Tigris River. However, this project is further supplemented with finished water from Al-Karkh project (west of river), in order to fulfil increased demands, through two transition mains, with diameters of 1,600mm and 1,400mm. The original design capacity of this WTP was 455 ML/day, and then it was adjusted to 540 ML/day. The first expansion has added 225 ML/day to the Sharq Dijla water project, while a second expansion project for this WTP was built to increase production capacity for another 180 ML.

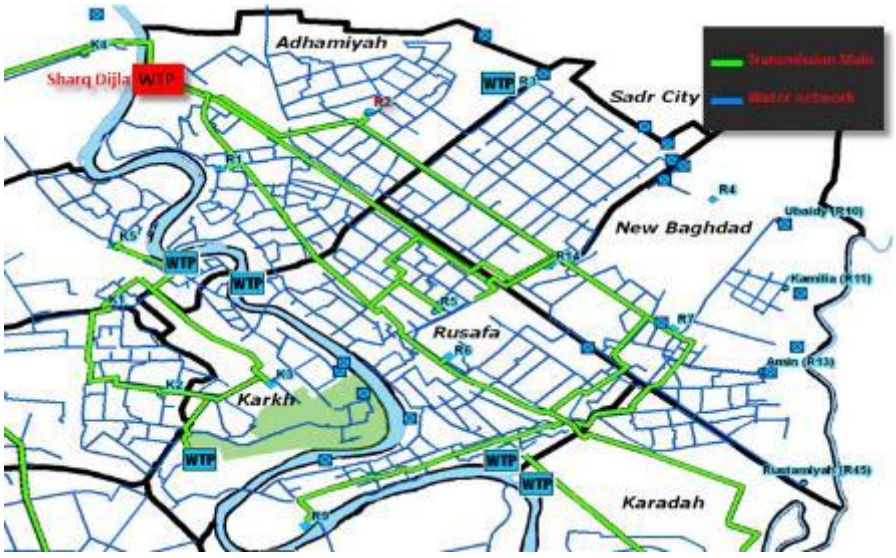


Figure 4: Water distribution network

Water is delivered to house connections via tertiary pipelines of less than 300mm in diameter. These pipelines are manufactured from various materials, including: Asbestos Cement Pipes (ACP), Cast Iron Pipes (CIP), Ductile Iron Pipes (DIP), and Polyvinyl Chloride Pipes (PVC). Water is delivered to individual premises using Polyethylene Pipes (PEP), while inside premises, consumers use Galvanized Steel Pipes (GSP).

With respect to quality, monthly monitoring is performed on water treatment projects in Baghdad. The following table provides some chemical and bacteriological testing results done in December 2013 at three water locations close to the Project's network.

Table 1: Water quality at three selected water treatment projects

Chemical characteristics									
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	14	7.53	0.9	114	0.97	0.001	0.01	0.04
East Tigris (Sharq Dijla)	<5	20	7.63	4.0	264	0.98	0.001	0.01	0.01
Sadr	<5	17	7.61	1.5	190	0.52	0.001	0.07	0.01
Microbiological characteristics (low/high limits)									
	Plate Count (CFU/1 ml)			**Total Coliform (MPN/100 ml)**			**E. Coli (MPN/100 ml)**		
Al-Karkh	120 – 1,670			220 – 5,400			78 – 2,400		
East Tigris (Sharq Dijla)	600 – 3,000			700 – 16,000			700 – 16,000		
Sadr	450 – 1,400			470 – 5,400			390 – 5,400		

Source: Baghdad Water Authority – December 2013

Baghdad Water Authority is continuously performing improvement works to the distribution networks and expanding service coverage. These efforts include maintenance and replacement of aging and damaged pipelines, for the sake of decreasing leakage rates in the supply network. As well as replacing defect metering devices and enhancing billing and collection systems.

2.3. Reasons for Improvement (the Rationale)

Water distribution needs high pumping pressures at the source in order to convey water to remote areas without interruptions. The pumping pressure is currently very irregular due to the direct pumping from the network, and flows do not meet peak demands during the day due to lacking water backups/storage at some point on the network. This situation is leading to operational problems and service interruptions. The “R2” reservoir, to be built on the Rusafa (east) side of Baghdad, with a capacity of 135,000 m^3 will provide more stability to the supply system by minimizing high pressures, securing enough water for end users. Building the R2 complex will help eliminate direct pumping into the distribution network which currently generates high pressure variations. It will ensure improved quality and reliability of the water supply services in the area served by the reservoir complex, which will serve more than 550,000 people in the Al Sha'ab district. The reservoir will also benefit the larger Baghdad water supply system as it will alleviate pressure on adjacent pressure zones, and hence benefit people living in areas adjacent to the Sha’ab district with

improvements in the reliability of their service. The Project will be able to reserve 135 ML of chlorinated potable water, to be readily received from the existing network, then to be pumped back to end users in Al-Sha'ab municipality via the same network.

2.4. Proposed Location for R2 Reservoir

The Project is located in Baghdad, the capital city of Iraq. The new water reservoir will be constructed in Al-Sha'ab sub-district, in Al-Rusafa side. The Project lies about 5km to the northeast of Tigris River, and 2km to the northeast of the Al-Jaish Canal (Army Canal). And is bordered by two residential and commercial areas Al-Bunuk, and Aur to the north, west, and east.

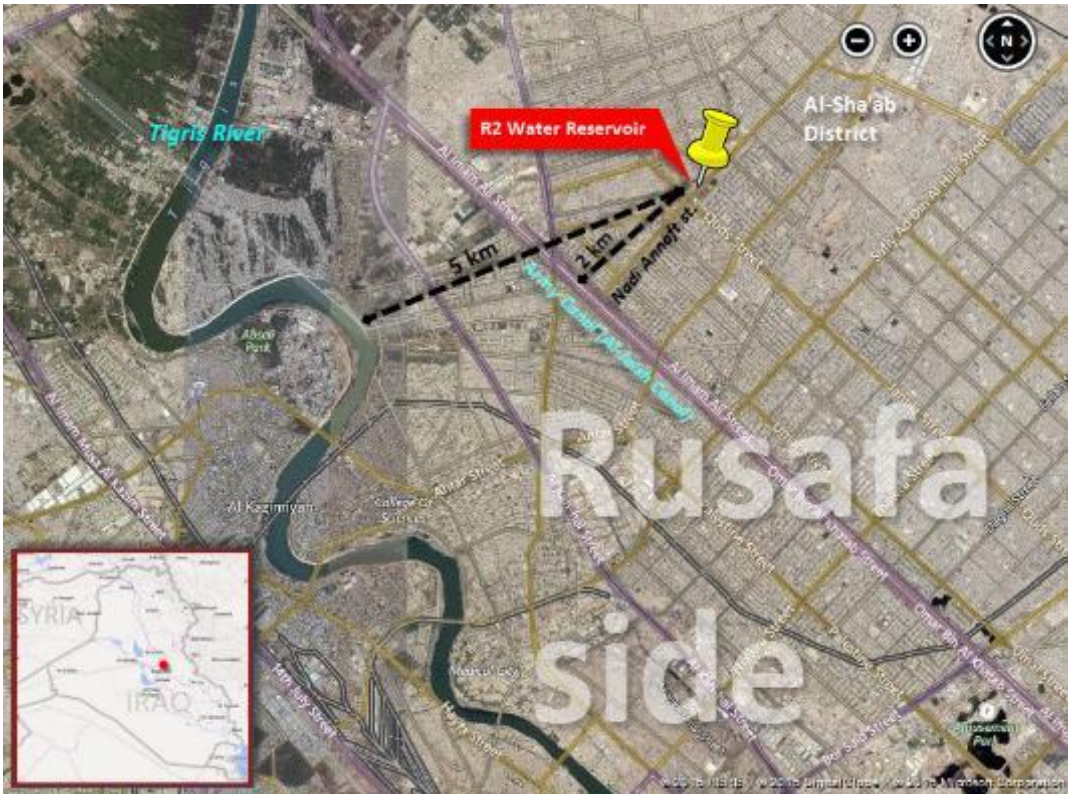


Figure 5: Location of the new water reservoir complex

2.5. Existing Features

The new water reservoir and all associated structures will be constructed on a land plot that has an area of 27 Iraqi dunums, 4 olks and 19 sq meters (which is equivalent to 67,919 sq metric meters). The land plot was owned by MOB, and has been transferred to BWA since 27th of October 2007 (see Annex VI for legal transfer documents and official record for the land plot). Field surveys conducted in February 2017 have revealed that R2 land plot include the following features:

3. Buildings and service structures (caravans) that belong to Al-Imam Al-Kadhum for Islamic Sciences College (the University). These structures comprise almost one quarter of the total area. This temporary utilization came in prior agreement between the college management and BAW until university premises have been fully established (see Annex VI). However, recent correspondence between the university management and the BWA indicated that the

land will be freed up before the start of the project (see Annex VI for the official correspondence);

4. An open area that is located in front of University caravans. This area is used as a free parking lot for university students, which is not run for business. Recent visits to the site showed that the area is fenced at the side with the University, and closed with concrete blocks at the other sides.

The R2 land is considered free from other forms of private individual or group activities or encroachments. OP/BP 4.12 is triggered and RPF is prepared for precautionary purposes.

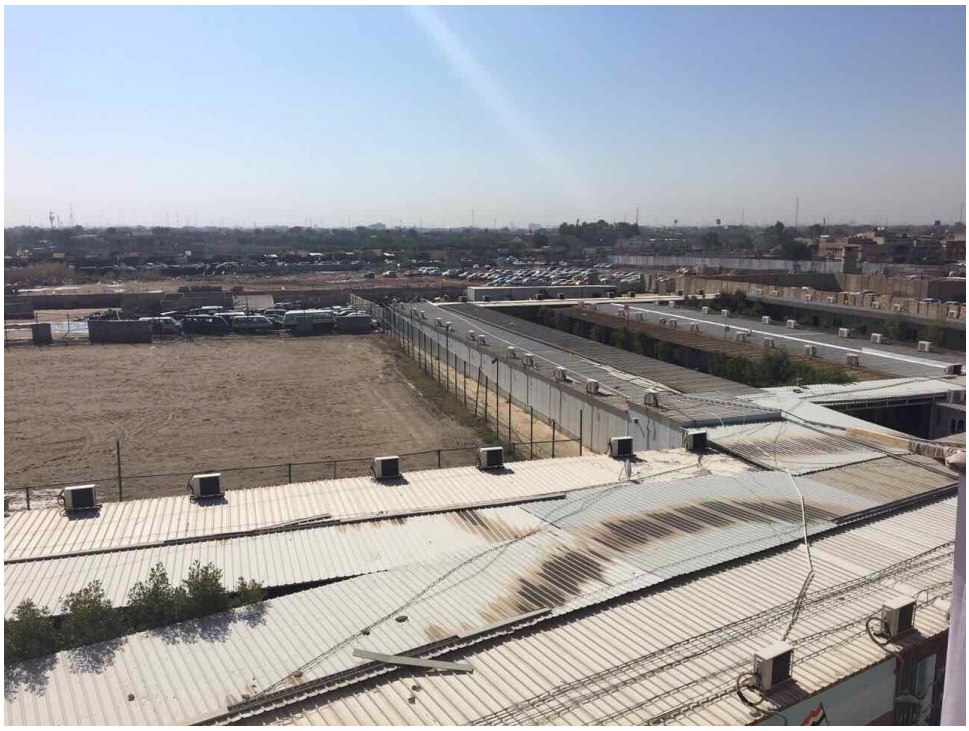


Figure 6: Existing features within R2 land

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.

Water prices in Baghdad are subsidized and based on a volumetric block tariff. For example, domestic subscribers are charged 7 IQD for consuming 1 – 30m^3, 17 IQD for 31 – 60m^3, 30 IQD for 61 – 90m^3, and 55 IQD for consuming more than 91m^3. However, final prices do not match actual cost of production, which is estimated at 155 IQD per cubic meter, which basically include sub-costs of maintenance, energy for treatment and pumping, as well as costs of monitoring, however, it does not include cost of transportation. The Project of R2 will neither abstract more quantities of water from natural resources, nor will it increase water tariff, however, it is expected that water prices will be subject to an incremental increase because of annual inflation rate. Costs incurred by the government (will be recovered to a good extent) by reducing electricity bill for pumping and central treatment, as well as by minimizing cases of leakage and reducing costs of network maintenance.

The following sections describe interventions for constructing the Baghdad R2 water reservoir.

3.1. The Project Components

The subproject of R2 water reservoir complex – under this ESIA/ESMP study – is part of the biggest BWSIP, and comes under component 2 "Investment In drinking water supply and wastewater infrastructure."

Additionally, R2 subproject 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

Construction work is anticipated to span 30 calendar months. While a pre-construction stage of 9 months will be dedicated for contract award process. However, institutional and capacity building assistance will be offered for a comparatively longer time, 6 years, before, during construction, and even while operating the Project. See the below figure for timeline.

Figure 7: Project implementation timeline

3.2. The Project Major Works

The new reservoir lies in Al-Sha'ab sub-district. It is a two-compartment closed structure that will be built 3.5m under the ground, and provided with a cover slab of about 3m above the ground. The reservoir dimensions suggested by the final design are (163m X 140m X 6m). These were the design dimensions suggested to provide a water storage capacity of 135 ML withdrawn from the existing potable water network, and pumped back to the same network. Nevertheless, the Project will neither utilize additional water source(s), nor will it increase abstraction from natural resources. However, and if implemented as planned, the Project would provide balance to the pumping pressure through the domestic network, and would secure the needed amounts of safe and clean water for use during system failure or maintenance time at the source. The figure below shows major components in the design.

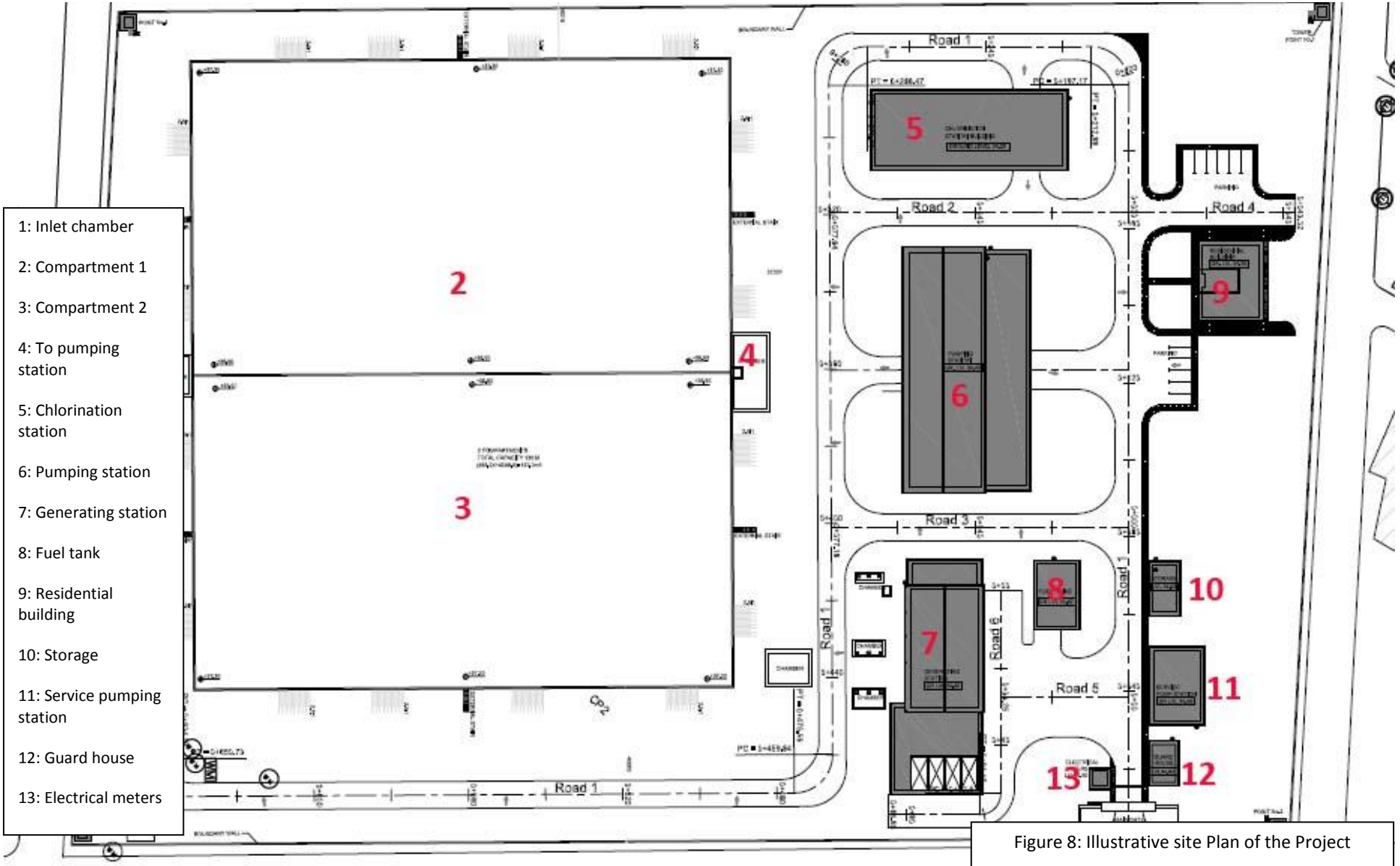


Figure 8: Illustrative site Plan of the Project

A Jordanian consultancy firm, "Engicon", was commissioned by the MOB to prepare the needed designs and Bill of Quantities (BOQ's). According to that agreement, a final Design for the R2 water complex was developed in 2015. The final Design report has suggested the following components and interventions:

1. Reservoir

The water storage reservoir (tank) is a closed rectangular-shape structure that will mainly be constructed using reinforced concrete, and structural steel, as well as other materials for finishing and waterproofing. The structure will have the diminutions (163m X 140m X 6m). The Tank will be settled below the ground level, and will rise no more than 2.0m above the finished ground level. A system of expansion joints will be used approximately every 20m for raft, walls, and top slab. The reservoir will consist of twin compartments equipped with inlet and outlet structures (pipe works and chambers), and reservoir overflow system. The following figure shows section and 3D views.

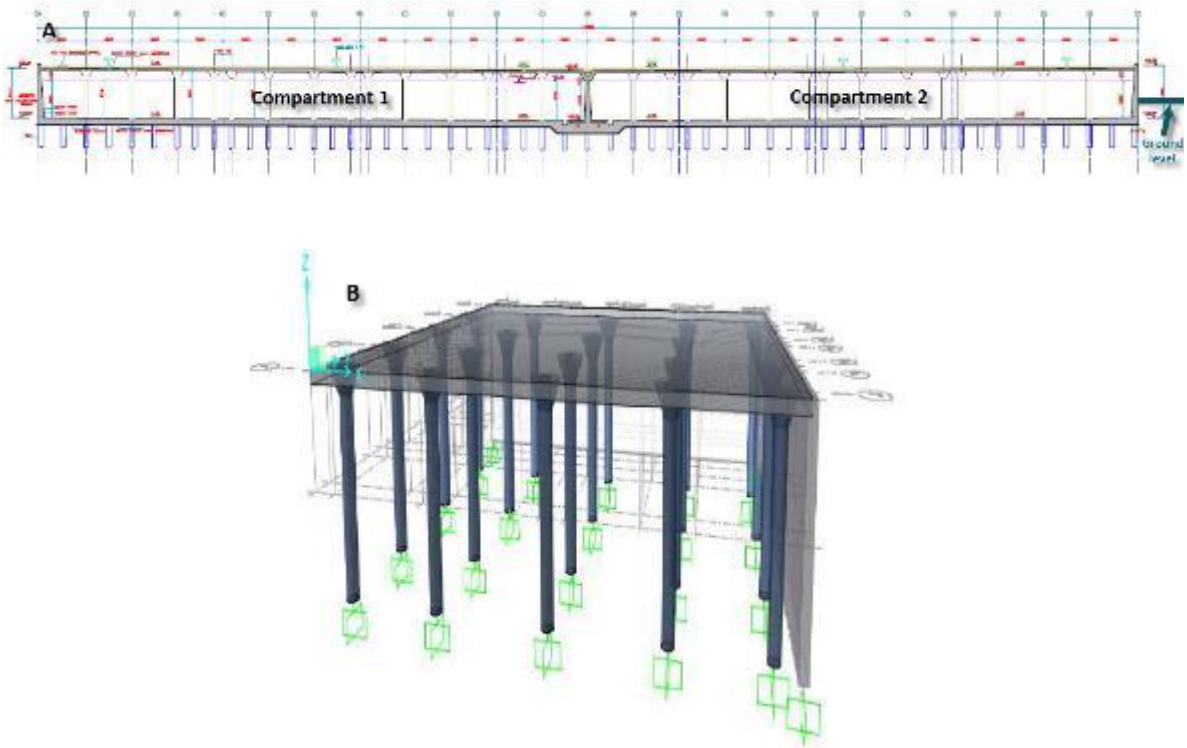


Figure 9: Views of the reservoir – Section (A), and 3D (B)

The structure will be provided with a system of expansion joints through all roofs, walls and floor slabs in order to allow some differential movement between sections and to minimize temperature effects, and to enable the structure as a whole to maintain its integrity during seismic shocks. All painting and waterproofing materials applied to the interior will be tested for non-metallic materials for use in contact with potable water.

Water received into the reservoir will be chlorinated before entering the tank. Another dose of chlorine will also be provided upon pumping back to the network. Inflows to the water complex are estimated at 230 ML/day. However, initial studies done for the Project (by BINNIE & PARTNERS, 1983) has provided the following flow values:

- Annual Average Daily Demand (AADD): 210 Mld,
- Minimum flow: 0.15 x AADD = 32.0 Mld , and
- Peak flow: 2.25 x AADD = 472.0 Mld (which is the maximum design output).

Valves at the inlet and outlet will be electrically operated and will be placed in chambers above the ground level in order to protect against malfunctioning due to flooding.

Additionally, the design has taken into account possibility of water deterioration due to stagnant storages. That was handled in the design by means of a circulation system (baffle walls). In addition to providing roof ventilators for a better air circulation.

For the purpose of cleaning and maintaining the reservoir, the roof of the reservoir will be provided with ventilated access at each corner of each compartment. One of these access openings will be of sufficient size to allow equipment to be lowered into the reservoir for maintenance and repair purposes. Fixed galvanized ladders will also be provided below each roof opening. Floors to reservoir will have a fall of 0.5% towards drainage channels to facilitate cleaning out and emptying. Roof shall also have a fall to 0.5% towards the outlet ends of the structure.

2. Overflow system

The water reservoir will be equipped with an overflow system at the outlet chamber to convey overflows safely to a discharge point off-site, which will also be used to drain water from the two compartments in maintenance events. Pipework off-site will be supplied in such a way as to withstand loads where intersecting with roads and railways occurs.

3. Pumping station

This facility will include pumps and their associated motors, valves, and piping network system. Pumps will be of a vertical spindle split casing type, which will be installed in the basement and will be completely isolated from water (dry well). Motors will also be housed above ground level enough to avoid flooding levels. Water will be pumped from feed reservoirs through 2 pipelines to an inlet pipe manifold. Discharge will comprise a single pipeline equipped with central valves. The facility will be in flexible operating mode to accommodate emergency loads and to cater for drainage and maintenance works. That would include access ladders and openings into the motor room/ basement. (See below for sectional view).

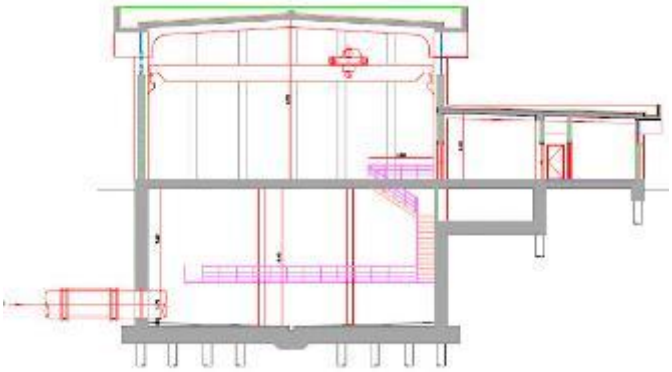


Figure 10: Section view of the pump station

4. Power transformers

The electro-mechanical equipment at Reservoir R2 pump station will be supplied with electrical power from oil filled, naturally air cooled and outdoor two power transformers (3200KVA,11/3.45 KV) each. These two transformers will be located in open front bays and stand on concrete plinth.

5. Standby power generation room

The Reservoir R2 pump station will have two standby diesel generator sets with (3200KVA, 3.3KV) each.

However, the generating room will house sufficient diesel generators and associated control equipment to maintain the ultimate peak output from the reservoir works, and an annex for administration rooms. Transformers will be located on one side of the building within uncovered compounds. This structure was designed to withstand seismic shocks as well. The location will incorporate sufficient gravel filled sump to contain the oil capacity of a transformer in the event of failure.

6. Fuel tank

This will be built to provide storage of 7 days fuel supply for continuous generator running at ultimate requirements. The facility is an underground chamber containing fuel storage adjacent to the power generating station. The chamber will be constructed of re-enforced concrete floors and walls and will be supported in piles. Access from the above ground house and a system for forced ventilation will be provided as well.

7. Chlorination station

This component aims to ensure adequate level of residual chlorine at the farthest point in the network. Chlorine doses will be injected in water pipes both at the inlet and outlet facilities of the water complex proportional to flow. However, the design will provide independent maximum dosage of 5 mg/l. the chlorination system will comprise of a drum store, chlorination room, motive water pump room, monitoring room, switchgear room, toilets and self-contained room housing an exhaust air cleaning system. For this component, the following safety features will be incorporated:

- Forced ventilation,
- Emergency doors,
- Drum submersion systems,
- Exhaust air cleaning system,
- Chlorine detection and alarm system.

8. Irrigation pumping station

This is an ancillary facility and will comprise a drum store, chlorinating room, motive water pump room, monitoring room, switchgear room, toilets and a self-contained room housing an exhaust air cleaning system;

9. Valve chambers and connecting pipework

The Project will also include miscellaneous chambers for flow metering, chlorine injection, and sampling. Necessary chambers will be provided with sufficient air valves, washouts, valves, valve chambers and cross connection pipework. This combination will enable receiving inflows from trunk pipelines, then discharging them into either compartment of the service reservoirs, in addition to drawing off water from any of the reservoir compartments to either pumping station inlet pipe manifold.

10. Pipework

In general, these will consist of the incoming trunk pipelines, the reservoir bypass pipework, as well as outgoing delivery pipelines. Pipes will be made of ductile iron with cement mortar lining. Flow meters, valves, and washouts will also be installed on the site pipework. A washout will be provided on any length of pipe between two stop valves. Flow meter chambers will be provided with natural drainage where possible and will have high level alarms connected to the pump station control panel. Self-priming hand operated pumps will be provided to chambers as well.

11. Warehouse store

This facility was proposed for the accommodation of spare parts and other material that are needed in the maintenance of electromechanical equipment.

12. Guard room

This guard house will comprise a reception/ office area, a rest area, and a washroom/ toilet, which is a single story structure.

13. Parking

Parking canopies will be made out of reinforced concrete, with a secondary system of precast concrete or aluminum lightweight roof, for car parking. Enough room will be made to host six cars. The canopies will be designed to be compatible and complimentary with the main building and finished to an equivalent standard.

14. Site roads and landscaping

This includes paved areas, guard house, fencing landscaping, walls, and railing and other miscellaneous works, like reservoir overflow systems comprising control chamber, overflow pipeline and outfall works.

The Project comes as part of the Baghdad water improvement program, which aims to increase water supply for the city of Baghdad. The new reservoir will receive potable water from Sharq Dijlah water project and further from Rusafa water project once made available, using a network of mains.

The final design has adopted the following environmental sustainability concepts:

- Carbon emissions reduction, and utilization of on-site renewable energy sources,
- Minimization of water consumption through conservation and recycling,
- Minimization of production and exportation of waste materials,
- Preservation and enhancement of landscape and biodiversity,

- Preservation of any existing forestry and fauna,
- Preparation of a detailed landscape,
- Minimization of carbon emissions from transportation,
- Using energy efficient lighting controls and fixtures, and
- Insulation of exterior cavity walls, to protect against deterioration and corrosion. That includes thermal insulation, and insulation for water retaining structures.
- Installation of noise silencers, and smoke, fire, moisture dampers for ductworks, according to applicable codes,
- Installation of sewerage collection and disposal, and storm water drainage systems,
- Installation of firefighting systems and applying proper fencing and guarding to the whole site.

3.3. Expected Activities in Construction Phase

Prior to Construction, a working area will be utilized within the R2 land plot, with no planned expansion to any of the adjacent areas. It is expected that the Contractor will utilize part of the R2 site for work preparation and management of daily workforce. The size of the working area will be determined by the contractor and approved accordingly. Heavy machinery will be mobilized to the site for clearing land, excavation and lifting different materials and parts. The Contractor will partly use warehouses of BWA for storing sophisticated equipment and machinery, which will afterward be retrieved when needed onsite, while construction materials will be injected into the site in quantities relevant to work loads. Storage in the site will be pursuit at minimum due to security precautions. In terms of workforce, this will be pursuit from local market as much as possible. However, daily number of workers can range from 40 – 50 depending on the amount of activities required at that day. More workers will temporarily enter the work site – for instance, for excavation and concrete works. No accommodation is offered onsite for non-skilled workers, except for resident engineers, few people from the contractor side, and service men and site guards. Expected workforce includes:

- Civil work: 100 – 150 workers, throughout construction time;
- Electrical work: 10 – 20 workers, as required;
- Mechanical work: 20 – 25 workers, as required;
- Pipework: 20 – 30 workers, as required

In the site, excavation works will include, but not limited to: site clearance; general excavation, trench excavation; backfilling; placing compacting fill for embankments and other areas where filling is required.

On another hand, the Contractor will use local road network to transfer equipment and machinery shipments to the working site, as well as to transfer rubbles resulted from site clearance to the place(s) designated and approved by the MOB. These activities and alike are expected to have close coordination between the Contractor and the MOB (through a Project Implementation Consultancy (PIC) for supervision) on one side, and between MOB and other responsible departments – for instance, public security and traffic depts. – on another side.

Moreover, the contractor is expected to use large amounts of water for construction, washing, flushing, cleaning, etc. and for office purposes onsite. The supply and discharge of these amounts of water are the responsibility of the contractor, which must be closely coordinated with MOB and BWA.

4. BASELINE INFORMATION

4.1. Physiochemical Environment

4.1.1. Climate

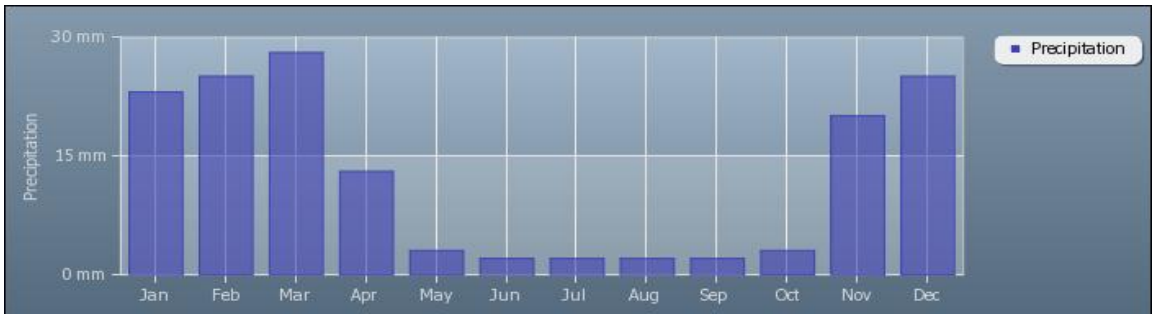
The climate in Baghdad is arid subtropical continental with very hot and completely dry summers and cold winters having some rain. The mean maximum temperature in July and August is about 43°C, but during heat waves the temperature shoots up to 49°C. Dust storms are common in summer. High temperature 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 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 2: 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^2)	30	31	29	18

Source: Central Statistical Organization of Iraq – Climate

A typical year in Baghdad shows the following monthly precipitation and temperature trends (Fig. 11).



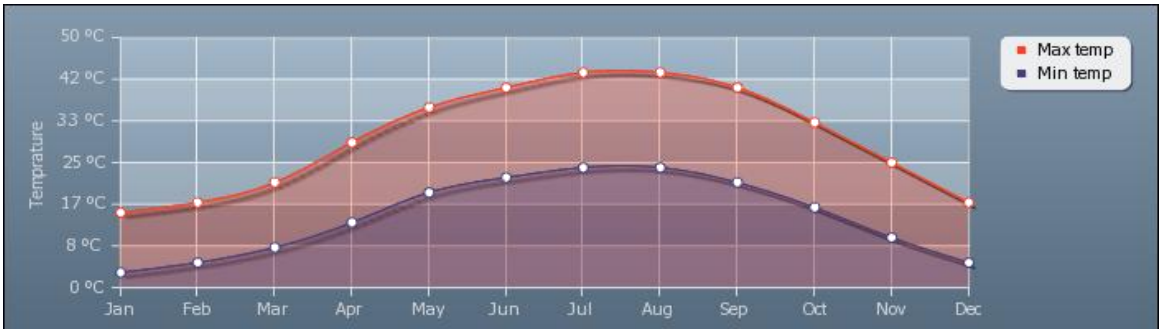


Figure 11: Typical yearly precipitation and temperature trends in Baghdad

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 (Fig. 12).

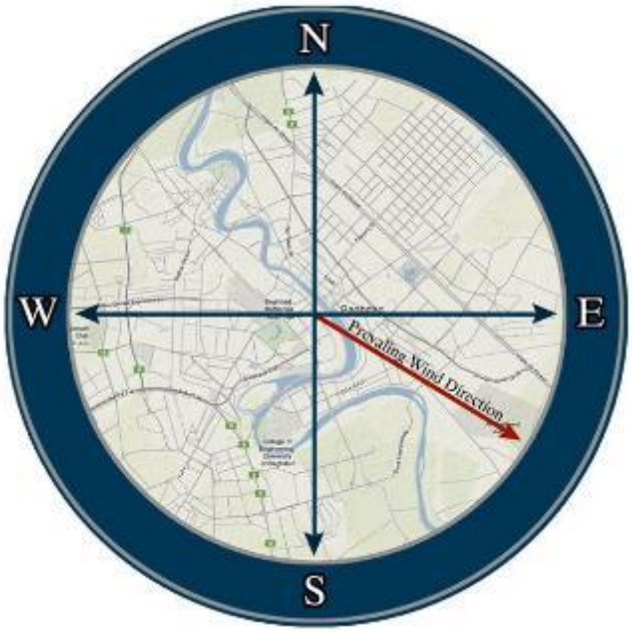


Figure 12: Prevailing wind direction in Baghdad

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. Dust is even more

agitated by the northwesterly winds that characterize the semi-arid conditions of central Iraq region. 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 µg/m^3 at 20 feet of altitude, while PM2.5 was estimated 10,410 µg/m^3 at 20 feet (Khanjer et. al, 2014). The table below shows some results at the Sadr and Doura meteorological stations.

Table 3: Concentrations of major air pollutants in Baghdad (Jan – Mar 2014)

Name of station	Type of station	CO (ppm)	CO_2 (ppm)	TSP (µg/m^3)	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^2. The area where R2 water complex 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 Udhaim, which drains an area of 13,000 km^2 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^3/s at the confluence with Tigris. In Baghdad, the mean annual flow of Tigris drops to 1,140 m^3/s due to water withdrawal for irrigation. Water quality of the Tigris is poor due to the return flows from irrigation projects. 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^3/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. BWA performs continuous water quality monitoring at Baghdad's water projects. The following show some selected parameter that could reflect chemical characteristics at 7 water projects.

Table 4: 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 5: 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

Dams also constitute another water source in Iraq. Although initially constructed for protecting against floods that have swept Iraq for a long time ago, they are currently being constructed/rehabilitated to meet increasing demands for irrigation and domestic uses, as well as for power generating purposes (Al-Ansari, 2013).

Groundwater resources in Iraq account for 0.9 BCM annual. And cover the needs of around 64,000 ha 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.

Good quality subterranean water could be found in the foothills of the northeastern mountains (only 5 – 50m deep). While water tables could also be found in the semi-flat terrain of central Iraq, at relatively higher levels (300m deep).

Currently, groundwater abstraction can be achieved from within the right bank of Euphrates basin, at nearly 13m^3/s. Nevertheless, water found there is found of high salinity (more than 1 mg/l) and increasing its salinity until reaching estuaries to the south-east.

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 20 km to the southeast of the new R2 water complex. 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 the figure below).

Table 6: 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

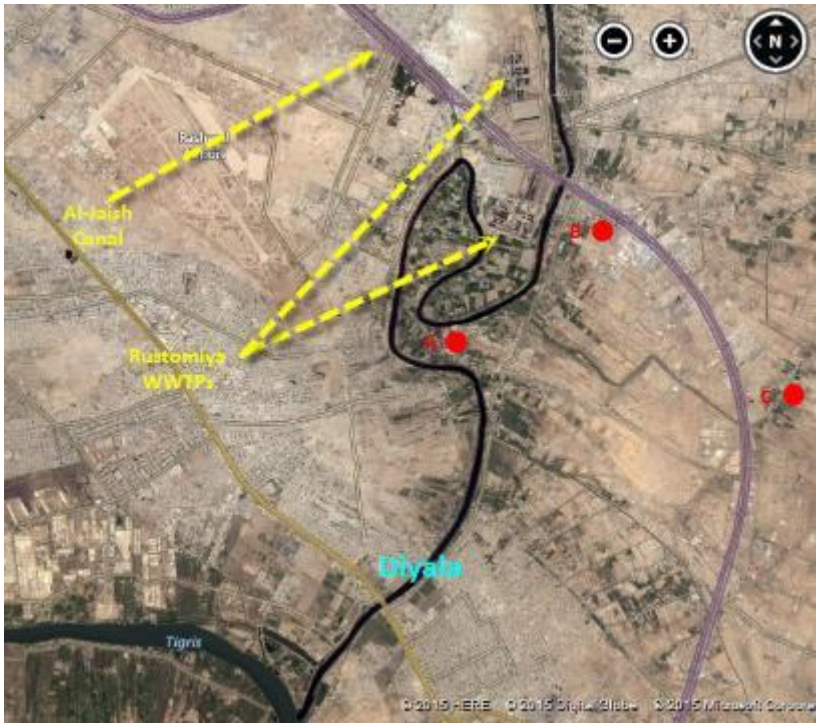


Figure 13: Locations of groundwater sampling in Baghdad – August, 2008

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 residential areas.

4.3. Socioeconomic Environment

4.3.1. Demographic characteristics

About 27 percent of the total urban population in Iraq resides in Baghdad. The population of Baghdad, as of 2016, was approximately 8,765,000 making it by far the largest city in Iraq (according to estimations of the Ministry of Planning and Development Cooperation). The population growth maintained a high rate of more than 3.1 percent in Baghdad during the 1980s. Nevertheless, official estimates forecasted a decline of the population's natural growth starting from 1990, and reflected by a rate of around 2.3% (in 2010 – 2015).

Towards the middle of the 20th century, the majority of the population in the Baghdad Governorate had gradually moved from rural to urban areas. Urbanization was maintained by the internal migration to Baghdad from other cities. Currently, the urban population of Baghdad represents more than 87.9 percent. See the following table and figure for percentage distribution of Baghdad population.

Table 7: Population distribution by age group in Baghdad – Year 2012

Age Group	Population			Percent		
	Male	Female	Total	Male	Female	Total
0 – 4	555,734	529,174	1,084,908	16.4	15.8	16.1
5 – 15	882,604	848,297	1,730,901	26.1	25.4	25.7
15 – 49	1,642,959	1,626,830	3,269,789	48.5	48.7	48.6
50 – 64	1,859,142	1,855,288	3,714,430	54.9	55.6	55.3
65+	89,555	106,634	196,189	2.6	3.2	2.9
Total	3,387,039	3,339,393	**6,726,432**	100	100	100
Percent	50.4	49.6	100	-	-	-
Total (1997)	2,722,095	2,701,869	5,423,964	50.2	49.8	100

Source: JICA report (Engineering Services for the Social and Economic Survey for Iraq Reconstruction)

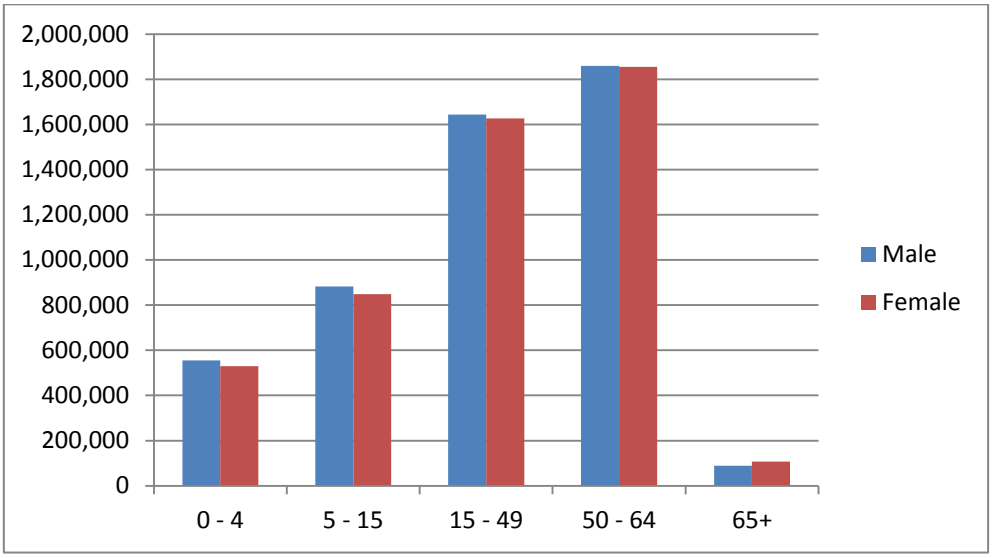


Figure 14: Population distribution by age and gender

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 1000 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

Between 2010 and 2015, population growth rate in Baghdad reached 2.33% (average annual) with a population density of 10,168 per sq km. Gross Domestic Product (GDP) per capita in Baghdad was 3,630 USD in 2008, while average annual real GDP growth rate in the period 2008 – 2025 is estimated at 5.8 (according to Price Waterhouse Coopers).

In general, 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

In Iraq access to improved water supply and sanitation is relatively high, but the quality of service is often low. In 2012, 95 percent of the households in Baghdad used piped water compared to 99 percent in 2007. The quality of services provided, however, is perceived to be low. Many households experienced regular and lengthy service interruptions in 2012 and beyond; due to the lack of maintenance and interruptions in water supply. Apart from the lack of reliable water supply, the water quality provided through the public network is also poor. Further, while almost all households have universal access to sanitation facilities, collection of wastewater is not equally developed with only 28 percent of the population having access to a sanitation facility connected to a piped sewerage network.

Potable water is provided for citizens of Baghdad initially through 11 big water treatment plants and compact units (33 in Rusafa and 18 in Karkh). These plants and units exclusively depend on Tigris River to fulfill their raw water intake. The following is actual production compared to design capacities, from 2010 to 2014.

Table 8: Actual water production versus design capacity (2010 – 2014)

Year	2010	2011	2012	2013	2014
Actual production	71,500 m^3/day	71,500 m^3/day	74,795 m^3/day	74,795 m^3/day	74,795 m^3/day
Design capacity	110,000 m^3/day	110,000 m^3/day	114,000 m^3/day	114,000 m^3/day	114,000 m^3/day

Source: BWA, 2015

The above quantities of finished water were believed much below actual demand. Therefore, a number of expansion projects have been taking place recently to meet increasing demands by all sectors.

Conflict-related damages to water and sanitation services have further affected 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, which greatly affected BWA's plans and end services.

Water prices in Baghdad are largely subsidized and based on a volumetric block tariff. For example, domestic subscribers are charged 7 IQD for consuming 1 – 30m^3, 17 IQD for 31 – 60m^3, 30 IQD for 61 – 90m^3, and 55 IQD for consuming more than 91m^3. However, final prices do not match actual cost of production, which is estimated at 155 IQD per cubic meter, which basically include sub-costs of maintenance, energy for treatment and pumping, as well as costs of monitoring, which does not also include cost of transportation.

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 the figure 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.

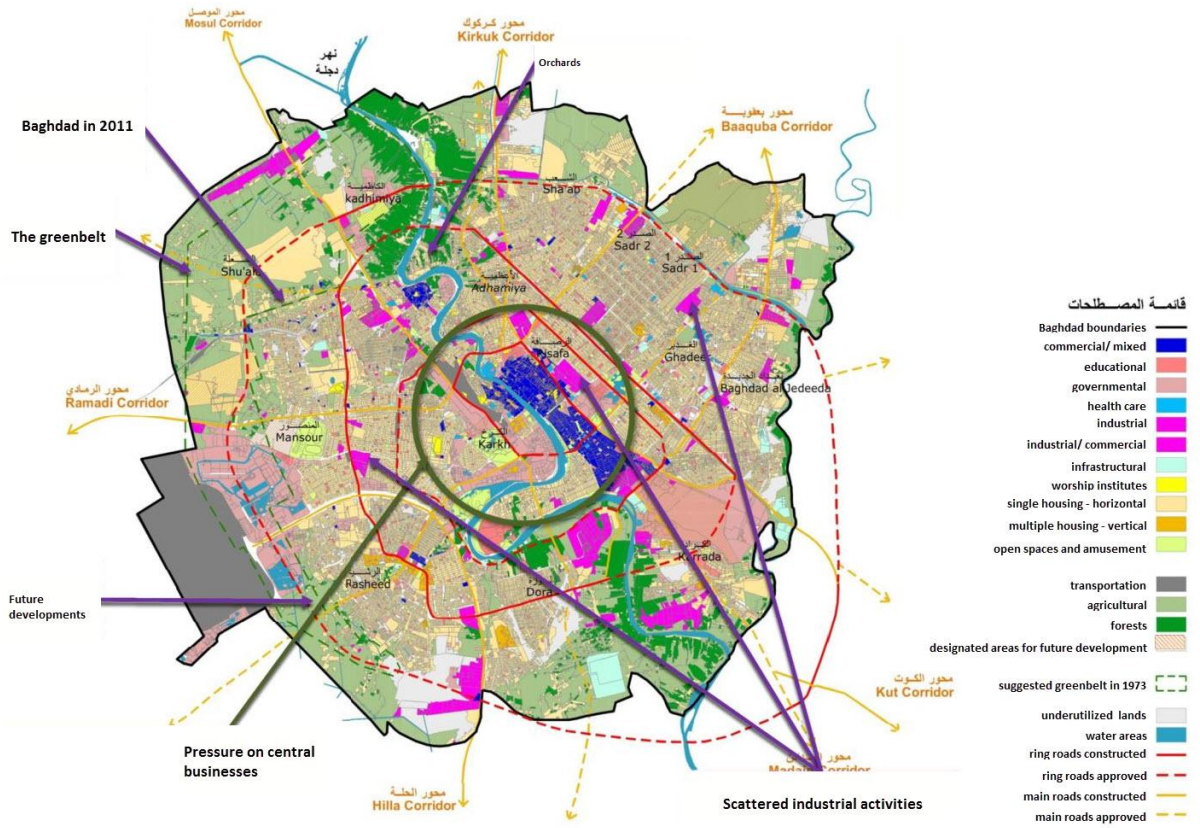


Figure 15: Land use in Baghdad, 2011

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.
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

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 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.

Drinking Water Standard no. 417 – 2009

This Standard defines the quality requirements for maintaining a potable non-bottled water source for the human consumption, and for household and food industry uses. This Iraqi standard was initially derived from the Public Health Law, and has also taken into consideration all physical, chemical, and radiological specifications of the recognized regional and international guides for drinking water. Worth mentioning is the Guidelines for Drinking Water Quality – WHO, 2006.

The following table compiles the needed specifications by the Iraqi Standard at minimum.

Table 9: Drinking water specifications by Iraqi Standards 417/2009 and 2270/2009

Parameters/ specifications	Maximum allowed values	Parameters/ specifications	Maximum allowed values
Physical specifications			
Color	10 units	Smell	Acceptable
Turbidity	5 NTU	pH	6.5 – 8.5
Taste	Acceptable	-	-
Inorganic constituents (mg/l)			
As	0.01	Total Hardness (as $CaCO_3$)	500
Cd	0.003	Fe	0.3
Cr (VI)	0.05	Mn	0.1
CN^-	0.02	Na	200
F^-	1	Total Dissolved Solids (TDS)	1,000
Pb	0.01	SO_4^{2-}	400
Hg	0.001	Zn	3
NO_3^-	50	Ca	150
NO_2^-	3	Mg	100
Se	0.01	Ba	0.7
Al	0.2	Ni	0.02
Cl^-	350	B	0.5
Cu	1	-	-
Organic constituents (mg/l)			
Carbon tetrachloride	0.004	Monochlorobenzene	0.3
Dichloromethane	0.02	1,2-dichlorobenzene	1
1,2-dichloroethane	0.03	1,4-dichlorobenzene	0.3
Benzene	0.01	Trichlorobenzen	0.02
Toluene	0.1	Acrylamide	0.0005
Benzo-a-pyrine	0.0007	Phenol	0.002
Disinfectants and disinfection by-products (mg/l)			
Residual chlorine (at the farthest network point)	Not less than 0.3 mg/l	2,4,6-trichlorophenol	0.2
Chlorite	0.7	Trihalomethane	0.15
Bromate	0.01	Dichloroacetic acid	0.05
Monochloramine	3	Trichloroacetic acid	0.1
di & trichloramine	5	-	-
Radioactivity			
Alpha	0.1 Bq/L	Beta	1 Bq/L

Parameters/ specifications	Maximum allowed values	Parameters/ specifications	Maximum allowed values
Microbial specifications (CFU/1ml)			
Aerobic Plate Count (APC)	$1X10^2$/ml	E.coli	Zero/100 ml
Total Coliform (TC)	Zero/100 ml	Fecal Streptococci (FS)	Zero/100 ml
Fecal Coliform (FC)	Zero/100 ml	-	-

Source: Drinking water Iraqi standards no. 417 & 2270/2009

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 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 articulates 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 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.

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

Table 10: 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^-)	0.05	0.5
Fluoride (F^-)	5.0	10
Free Chlorine (Cl_2)	Traces	100
Chloride (Cl^-)	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.	600

Pollutant	Limits for discharge to water resources	Limits for discharge to public sewers
	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	
Phenol	0.01 – 0.05	5 – 10
Sulfate (SO_4^{2-})	A. If the ratio of the amount of water discharged to the 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. 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. 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	300
Nitrate (NO_3^-)	50	-
Phosphate (PO_4^{3-})	3	-
Ammonium (NH_4^+)	-	-
DDT	Nil	-
Lead (Pb)	0.1	0.1
Arsenic (As)	0.05	0.05
Cupper (Cu)	0.2	-
Nickel (Ni)	0.2	0.1
Selenium (Se)	0.05	-
Mercury (Hg)	0.005	0.001
Cadmium	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	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. 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. 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	-

Pollutant	Limits for discharge to water resources	Limits for discharge to public sewers
	source should not be 300:1 or less.	
Sulfide (S^{2-})	Nil	3.0
Ammonia (NH_3)	Nil	10
Ammonia gas (free NH_3)	Nil	6.0
Sulfur dioxide SO_2	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
Bromine (Br_2)	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 11: 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 civil 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 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 water complex in Baghdad.

Table 12: 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_2)	500 mg/m^3	-	500 $\mu g/m^3$	10 min	Mean value
			-	1 hr	
			20 $\mu g/m^3$	24 hr	
			-	1 yr	
Carbon Monoxide (CO)	250 mg/m^3	other than fuel combustion sources	100 $\mu g/m^3$	15 min	Mean value
	500 mg/m^3	from old combustors	60 $\mu g/m^3$	30 min	
	250 mg/m^3	from new combustors	30 $\mu g/m^3$	1 hr	
			10 $\mu g/m^3$	8 hr	
Nitrogen Oxides (expressed as NO_2)	70 mg/m^3	From gaseous fuel combustion	200 $\mu g/m^3$	1 hr	Mean value
	150 mg/m^3	From liquid fuel combustion	-	24 hr	
			40 $\mu g/m^3$	1 yr	
Ozone	250 mg/m^3	-	100 $\mu g/m^3$	8 hr	Mean value
TSP	250 mg/m^3	From fuel combustion sources	-	-	-
$PM_{2.5}$	-	-	25 $\mu g/m^3$	24 hr	Mean value
			10 $\mu g/m^3$	1 yr	
PM_{10}	-	-	50 $\mu g/m^3$	24 hr	Mean value
			20 $\mu g/m^3$	1 yr	
Volatile Organic Compounds	20 mg/m^3	All sources	-	-	-

Pollutant	Government of Iraq		World Health Organization (WHO) – 2006		
	Maximum permissible concentration	Remarks	Limit	Monitoring period (averaging time)	Remarks
(VOCs)					

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

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

Combustion Technology / Fuel	Particulate Matter (PM)	Sulfur Dioxide (SO_2)	Nitrogen Oxides (NO_x)	Dry Gas, Excess O_2 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 air shed, or air sheds 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.

Table 14: 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 below

Table 15: 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 16: 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, indoors and outdoors	Hearing impairment	85	1	110

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 17: 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^2)**
4 – 8	4 g, or 0.40 m/s^2
2 – 4	6 g, or 0.61 m/s^2
1 – 2	8 g, or 0.81 m/s^2
Less than 1	12 g, or 1.22 m/s^2

** Gravity (g) = 9.81 m/s^2*

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[3], are the safeguard guidelines for environment, health

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

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 and specific guidance on the prevention and control of community health and safety impacts that may occur during a new 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 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.

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

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.

Around one quarter of the project land is temporarily utilized (within R2 land boundary) by the adjacent Al-Imam Al-Kadhum College (governmental university), in the time of preparing this report. These were caravans which have been established in prior agreement with BWA until main buildings of the university are fully established (located outside R2 land). Otherwise, the R2 land is free from other individual or group encroachments. Nevertheless, minor social, economic, and educational interruptions might be encountered during construction phase. Therefore, the WB's Involuntary Resettlement OP/BP 4.12 is triggered as a precautionary measure. Consequently, the project has prepared a Resettlement Policy Framework (RPF) in order to establish a reference and as a guidance for addressing any socio-economic and educational impacts that could arise by implementing and operating the project.

5.4.5. UN Framework Convention on Climate Change and Kyoto Protocol

This Convention was adopted on 9th 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 considered 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 tackled 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 tits 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 EIA 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 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 Drinking Water is categorized "C" under Article 65 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.

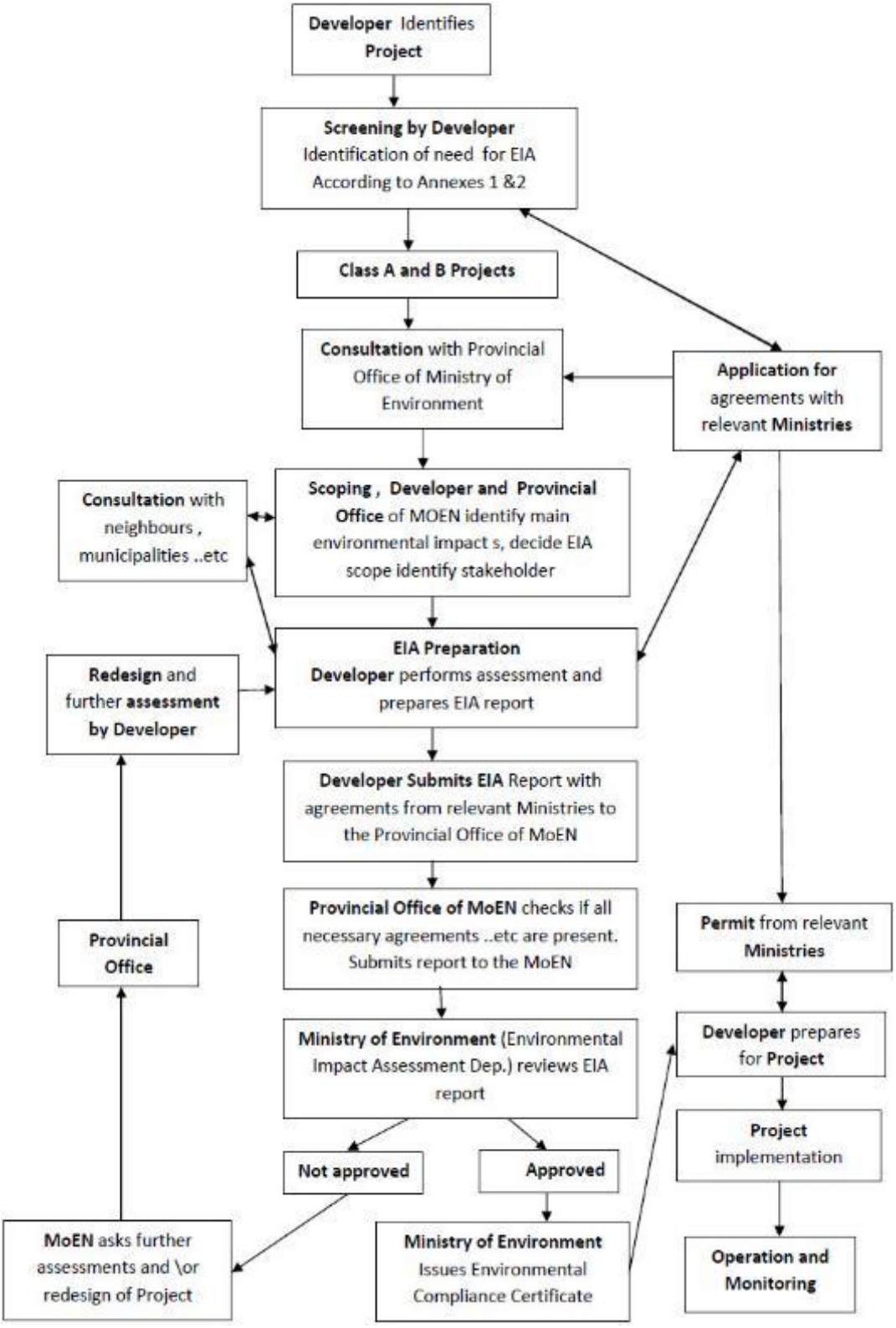


Figure 16: Simplified EIA process diagram in Iraq – categories A and B

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 in whole 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 flow chart summarizes the procedure for obtaining the WB's environmental clearance.

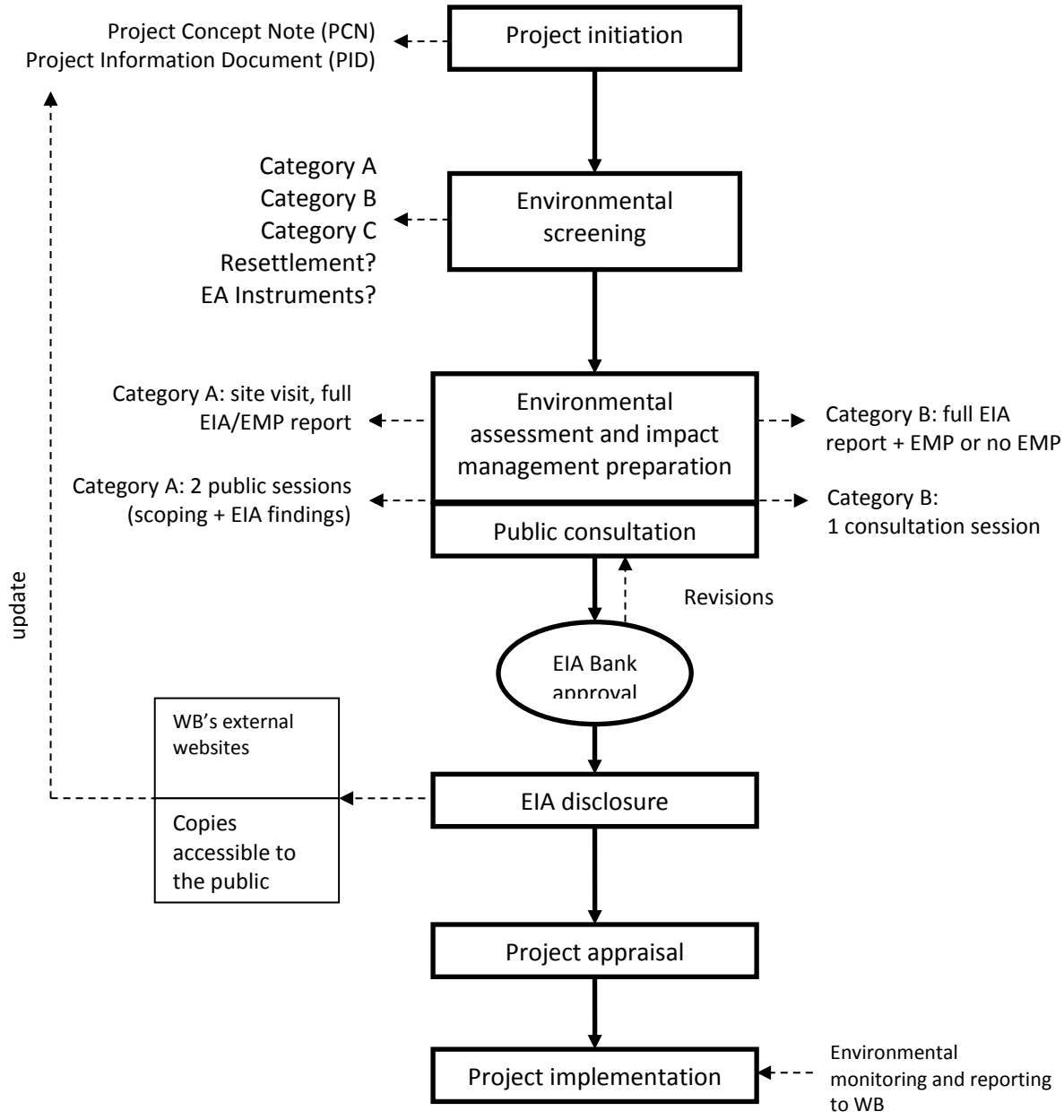


Figure 17: Simplified EIA process diagram according to the World Bank Operations Manual

5.5.3. Gap analysis

The Project 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).

Under the requirements of WB this Project was screened out as category B, should the new interventions, in general, have less significant and site-specific impacts on the surrounding environment. However, the Iraqi instructions no. 3 explicitly classifies drinking water projects under category C (Article 65), which implies that a project of constructing a water reservoir 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 BWA 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 subproject of R2 is planned on a BWA’s land plot (state-owned land). The adjacent university (Al-Kadhum College) is a governmental university and was utilizing R2 land for caravans and free parking for students. Although, this usage was agreed on and existed temporarily (which will be evacuated before the project start), and involuntary resettlement is not foreseen, yet there could be some minor social, economic, and cultural impacts. Therefore, OP/BP 4.12 is triggered as a precautionary measure, and a Resettlement Policy Framework (RPF) is prepared. This RPF includes useful information to guide through addressing any unexpected impacts of the project. The Iraqi "Acquisition Law no. 12" does not provide enough means for restoration. By the law only people

having the legal right on land/property are entitled, which highlights another shortcoming of the Iraqi EIA framework.

With respect to disclosing ESIA study findings, the Bank requires the disclosure of the ESIA 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 ESIA study on its external websites. 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 ESIA study publicly, by the Iraqi framework, nor is it specifying how such information could reach the community's attention.

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

Table 18: 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 R2 water reservoir project**	**Level of EIA study**	**Public Participation**	**Involuntary Resettlement**	**EIA disclosure**
WB's	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
Iraqi	Fairly presented	Anticipated category C	Anticipated EIA report (must be included in technical and feasibility study)	Not presented	Not presented	Not presented
Action proposed	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/ WB's external websites

6. PUBLIC CONSULTATION

6.1. Public Meetings

A public consultation meeting was held on the 7th of January 2016, in an open place opposite to Imam Al-Kadhum College (Mahalla 317/ Al-Sha'ab). Attendees included representatives of municipality and services councils, and a number of local community members, in addition to BWA's project team. In total, 27 people attended the meeting. Participants were from different age categories (mostly 15 – 49) and education levels (mostly basic school). The following table shows more detail on names, gender, age group, education level, and place of residence.

Table 19: Basic information of attendees – R2 public consultation – 7 Jan, 2016

#	Name	Gender	Age	Education	Address
1	Kadhum Hasan Al-Mousawi	M	48	First degree	Mahalla 317
2	Adel Kareem Al-Abadi	M	50	Basic school	Mahalla 327
3	Sheikh Sa'ed Darraji	M	65	Literate	Mahalla 327
4	Sheikh Hajji Sha'lan	M	65	Literate	Mahalla 327
5	Ali Nawaf Khalaf	M	50	First degree	Mahalla 327
6	Anwar Al-Maleki	M	60	Basic school	Mahalla 317
7	Hameed Sa'odi	M	60	Basic school	Mahalla 317
8	Hatif Abdel Amer	M	62	First degree	Mahalla 317
9	Salah Zeidan	M	36	Basic school	Mahalla 333
10	Basheer Sharif	M	40	Basic school	Mahalla 317
11	Mohammed Hussein	M	33	Diploma	Mahalla 321
12	Khalid Ali	M	33	Diploma	Mahalla 317
13	Mohammed Abed Al-Zahra	M	30	Basic school	Mahalla 317
14	Yousef Mohammed Hussein	M	53	Diploma	Mahalla 317
15	Ahmed Kadhum Hassan	M	52	Basic school	Mahalla 317
16	Ali Al-Hadi Sa'id	M	18	Basic school	Mahalla 317
17	Mohammed Hassan Mohammed	M	40	Basic school	Mahalla 317
18	Ali Adel Mohammed	M	22	Basic school	Mahalla 217
19	Hassan Jehad	M	46	Basic school	Mahalla 317
20	Jasem Ayed Abbas	M	30	Basic school	Mahalla 327
21	Nadia Fer'on Hamadeh	F	-	-	Mahalla 327
22	Ali Mohammed	M	-	-	Mahalla 317
23	Mohammed Aziz Mohammed	M	40	Basic school	Mahalla 339
24	Sheikh Ahmed Al-Oqabi	M	45	First degree	Mahalla 343
25	Yehya Fadel Ali	M	47	Diploma	Mahalla 357
26	Mahmoud Sa'di Mohammed	M	35	First degree	Mahalla 339
27	Mohammed Sa'di Mohammed	M	40	Diploma	Mahalla 339
	Total participants: 27 **Gender**: Male: 26 (96.3%), Female: 1 (3.7%) **Age category:** 15 – 49: 16 (59.3%), 50 – 64: 7 (25.9%), 65+: 2 (7.4%), not answered: 2 (7.4%) **Education level**: Literate: 2 (7.4%), Basic school: 13 (48.2%), Diploma: 5 (18.5%), First degree: 5 (18.5%), not answered: 2 (7.4%)				

The following figure also shows some photos during the meeting.

Figure 18: Photos of the consultation meeting – Al-Sha'ab (Mahalla 317), 7 January, 2016

BWA's team has organized the meeting to be placed close to the Project site; to allow for a wider participation of PAPs. During the meeting, a power point presentation on the Project's objectives and components was made, after which a plenary discussion was also allowed on expected impacts, general concerns, and queries. The following are concerns/ queries and relevant responses.

1. Reasons behind selecting the reservoir site

Feedback: The BWA's water master plan was originally established based on providing enough potable water for human consumption in Baghdad. Basically, the planning process deals with three main pillars: treatment (WTPs), distribution (local networks), and storage (above-the-ground reservoirs). Therefore, BWA has embarked on constructing large-scale water treatment projects since the early 80's. Those water projects included, for instance, Sharq Dijlah (East Tigris), Al-Karkh, Al-Karamah, and Al-Doura WTPs. Additionally, water projects were accompanied with laying the needed pipework for conveyance, and diligently allocating lands for constructing above-the-ground tanks. Land is already allocated for R2 with no other alternative.

2. Why not establishing these projects outside residential areas (as in other countries)

Feedback: Basically, infrastructural projects are planned in proximity to target people. In particular, water reservoirs are being built close to citizens; for public health and easiness of service purposes. Moreover, water reservoirs can be thought of as similar as establishing a small water tank at home.

3. The water source for the Tank, and validity for human consumption

Feedback: Water reservoirs in Baghdad are supplied with finished water from big water treatment plants, which afterward is pumped through main trunks. These mains were ultimately designed to replenish water reservoirs and are not used for normal distribution.

4. Planning the Project according to actual needs

Feedback: The process of Baghdad's water master planning has resulted in zoning the city according to its potable water needs. Such water zones were intended to be supplied by a water reservoir (a Tank) for each. A number of tanks have been built already, while few others are underway. Currently, Al-Sha'ab area receives intermittent supply, which urges the construction of R2.

5. The possibility of disturbing the University's activities and services

Feedback: Establishing this water project will not cause any obstruction to the Imam Al-Kadhum College. On the contrary, the Project will readily supply the University with its needed quantities of finished water.

6. Progress and implementation schedule

Feedback: The Bill of Quantities (BOQs) and the final design are ready. Next step, the team will work on completing the World Bank's requirements for appraisal/approval and official announcement. The Project implementation is expected to span two years.

7. The status of the Project's tendering process

Feedback: A Project tender has not yet been posted for bidding.

8. Effects on the residential road network during construction

Local people have pointed out negative effects by using local roads while setting piles during construction phase. Feedback: The Contractor will be obliged to apply a set of measures like installing guiding signage, warning lights, avoiding bulky roads, watering dusty roads, etc.

9. Creating job opportunities

Local people have also asked to engage local workforce in the Project. Feedback: The Project will help provide job opportunities at the local level.

10. Dust agitation

Local people have expressed their concerns on dust pollution from excavations and machinery movement. It was suggested that the Project management should consider effective fencing of worksite during excavation.

Feedback: Stringent conditions will be imposed on Contractors, with respect to maintaining public health and the environment.

11. Chlorine leakage

Feedback: New technologies will be applied. Chlorine leaks, if occurred, will be dragged into a special system for treatment rather than washing out by scrubbers.

6.2. Socio-economic Issues

Field investigations conducted in February 2017 showed that R2 land is free from any encroachments and/or private activities. Land is currently used by adjacent university (as student caravans and as free parking lot for students). Minor socio-economic issues may arise by implementing the project, due to relocation and construction works. These impacts include:

- Temporary loss of assets (partially or totally),
- Temporary loss of income and daily livelihoods, and access to resources;
- Potential interruption of daily social, educational, and economic life.

Losses should be compensated according to the World Bank's Involuntary Resettlement OP/BP 4.12, which is triggered for precautionary purposes. Accordingly, the environmental and social assessment team has prepared a Resettlement Policy Framework (RPF) for the entirety of BWSIP which outlines procedures for evaluation, compensation/entitlement, and monitoring, along with a proposed Grievance Redress Mechanism (GRM) as a guidance to resolve complaints and grievances.

6.2.1. Grievance Redress Mechanism

It is advisable that the Project team do a final visit to the project site prior to commencing construction, in order to collect social and economic information about the affected person(s) if any, and to conduct a preliminary valuation of assets on the ground. The date on which the affected people is inspected is called the "Cut-Off" date, after which no further surveys to be done in the site and no entitlement to be claimed. Surveys should be concluded before the beginning of evacuation and construction.

For any similar cases expected to show up 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 integrated, managed, and maintained at the MOB level. 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 pursing grievance redress.

This mechanism could also be integrated into the already existing complaining system at MOB. During public consultation, the Project Affected Persons (PAPs) had the chance to get introduced to the complaining system at MOB. However, the whole process of raising a complaint should be described to the PAPs in more detail prior to commencing construction activities. This could be done by reaching out the community or by conducting a meeting with community representatives. Additionally, a complaining box should be posted at the project site in Arabic Language, and be accessible to all people around the project area.

The GRM should facilitate lodging a complaint by PAP(s) easily and anonymously. Information to be deposited in the complaining system must include at minimum: contact information, a full description of the issue, and attaching to it all necessary documentation to support the case (see Annex VIII for example). 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 cycle. Personnel responsible for processing complaints have to inform complainers on the assigned legal time period for responding to their 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 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

As described for the components of the proposed Project, there is only 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 the water reservoir complex would resemble the following interaction with the surroundings. 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 operating, maintaining and monitoring the daily work at the water complex.

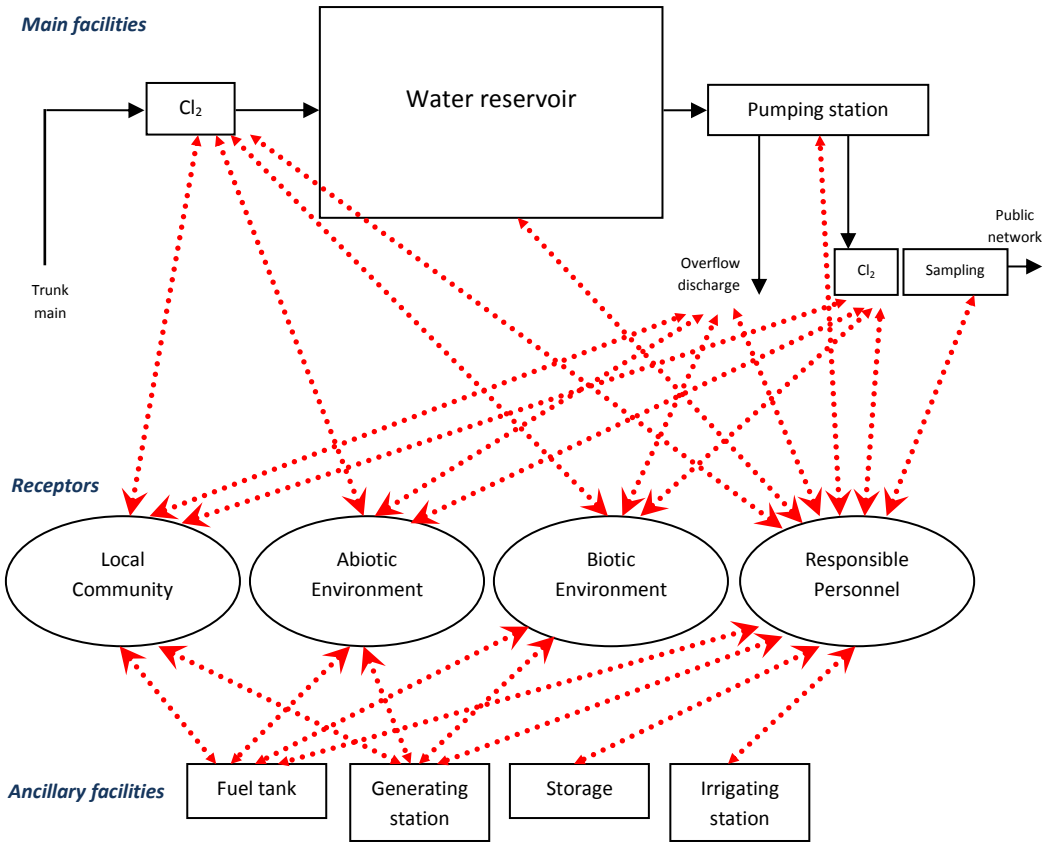


Figure 19: Suggested interaction between the water storage process and the surroundings

The above diagram suggests that the normal process of receiving – storing - pumping municipal drinking water could have the highest interaction with personnel workers in the site. Workers on-site would come across many risks related to occupational health and safety. However, some operations of the water complex could affect the surrounding community, biotic and abiotic environments as well; due to abnormal incidents or due to mismanaging daily operations/maintenance.

Very unlikely interaction at the start pipe and end pipe may occur with the four main impact receptors. However, this very unlikely interaction may occur in unusual conditions like vandalism/looting actions, military operations, or natural disasters.

The impact analysis will go beyond the above process, at some points, when it relates to socio-economic development, in order to address the overall water supply services and pros and cons for having or not having the needed interventions. A basic water supply system is usually presented by the following sketch.

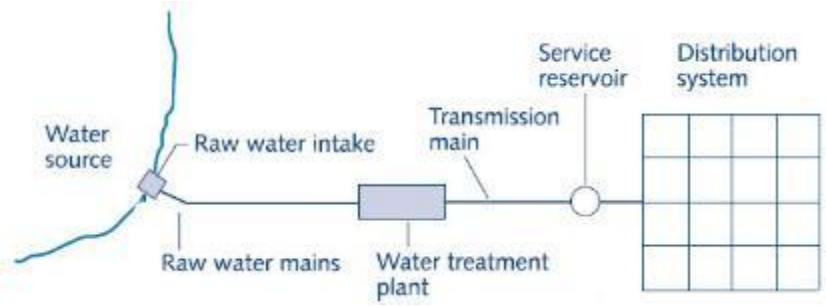


Figure 20: key components of a typical water supply system

Adapted from: Small Community Water Supplies, ch21, by Nemanja Trifunovic – 2002

Impact analyses presented in the following subsequent sections will study positive and negative impacts of continuing with the current situation (the No-Project scenario), and will provide a full account of impacts that could arise during excavation/construction and operation/maintenance phases of the proposed Project (the Project scenario).

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 municipal water service, people illegally connecting to the service, and even going beyond, to people who may exist in the area without necessarily benefiting from the service,
- Responsible staff: this category would involve on-site staff like operators, guards, janitors, maintenance and engineering staff; and the supervising and higher management visiting the site,
- Biotic environment: including sensitive habitats, flora and fauna, either endangered or not currently threatened

- Abiotic environment: including non-living categories; like the natural media (ambient air, water, soil, land), as well as the human-made media like the existing infrastructure (water, wastewater, road, power, telecommunication networks, etc.)

During construction phase, the impact analysis will take into account (among many others) activities related to occupational health and safety, interference with cultural heritage, and usage of local roads and infrastructures. Analysis of impacts during construction phase is going to be similar to a wide range of construction projects, thus, impacts will be presented in some generic way. However, the study will address some specific activities like those related to land uses and any potential of involuntary resettlement, as well as public engagement in the Project. Again, impacts will be evaluated against the four main sensitive receptors.

During operation phase, the impact analysis will focus on maintenance activities in a greater level than operational activities, since occupational health and safety is again going to be the most important area. The Project will provide for enough technologies to carry out daily operations, so no serious impacts are foreseen in the normal operations mode.

Mitigation measures were put according to industrial recommendations and guides set out locally, in addition to the guidelines of the World Bank, and the best common practices globally proven. However, the most stringent measures were recommended for this study.

Finally, impacts and their associated mitigation measures are more solidified by the views collected through consulting the local community (Public consultations meeting, 7 Jan 2016).

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 deemed highly applicable;
- Baseline data collected by the Iraqi team;
- Designs and tender documents prepared for the proposed Project;
- Public consultations at the municipal and individual levels;
- Literature reviews of similar interventions; and
- Practical experience in the field of Environmental Assessment and Environmental Management.

By understanding the operational process that R2 water complex will 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 author embarked on evaluating positive and negative impacts of the two alternatives, during construction and operation phases. Impacts have dealt with the three following major themes:

- Physiochemical aspects: land, soil, water, air, etc.
- Biological aspects: habitats, flora, fauna, etc.
- Socio-economic aspects: public health, infrastructural 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, Medium, 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 foreseen type and level of impacts (Public consultation meeting, 7 Jan 2016).

Next step was putting the soundest mitigation measures, for both construction and operation phases of the proposed Project, after which impacts were evaluated again for their remaining level of significance, assuming the full implementation of mitigation measures by responsible parties. Adverse impacts are either be avoided, eliminated, minimized, mitigated, or 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 clearly highlighted the 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 ensure the full adherence to the ESMP, so a monitoring plan has been prepared to ensure reaching levels foreseen for addressing impacts. Such Plan included parameters to be monitored during construction and operation phases; Key Performance Indicators (KPIs) and limits set out locally and internationally; the requirements of monitoring; frequency and tools; as well as budgetary estimates for implementing the monitoring program.

7.2. Selection of Action Measures – Risk Assessment

In the Project lifecycle, contractors and operators are required to evaluate risk associated with their activities of hazardous nature. Of special attention is risks encountered when performing site clearance, excavation, and construction work during construction phase, and performing maintenance work in the water reservoir, pumping and chlorination stations, generator room, etc during operation phase. Occupational health and safety related works can have a wide range of

hazards, which are localized and easy to detect. Well-experienced staff should be commissioned 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 local exhaust ventilation, isolation rooms, machine guarding, acoustic insulating, etc;
- Minimizing the hazard through design of safe work systems and administrative or institutional control measures. Examples include job rotation, training on 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.

Prioritization analysis could be done on hazards of high risks as below.

Table 20: 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

There were no design alternatives provided for the R2 water complex at this stage, thus, we are left with the "No Project" as the only alternative to the Project.

There will be no positive impacts gained by not implementing the proposed Project. On the opposite, if the operational status of the water supply system in Al-Sha'ab sub-district have been kept as is, the area will keep receiving intermittent and insufficient piped water, leading to some areas continuously disadvantaged, especially those at the coverage border. The domestic network will remain unevenly pressurized, affecting distribution efficiency and impacting pumping capabilities at the source. This in turn, will increase system failure, further complicates maintenance works in the network and at the source, and will eventually increase financial burdens for carrying out such work and providing replacement parts.

Water network in Al-Sha'ab sub-district is deemed beyond its design age. Leakage and breakage are very common, thus high losses of water will persist, despite of BWA's continuous efforts of follow-up. Water running through the pipe is subject to receiving pollutants at points where there are loose joints, or during incidents of breakage. Water quality delivered to end users will then be subject to decline, causing many health issues at the consumers end. Chlorination at a middle point is necessary to ensure adequate levels of disinfection until reaching taps. The water supply system will lose this disinfection opportunity if the Project is not implemented.

No additional water abstraction is foreseen for the new water reservoir. However, enough water quantities will be secured in case of shortage. The design has been finalized to provide a storage capacity of 135 ML. By not granting such quantities in case of any failure in the supply system in a timely manner, many areas will suffer water shortage for prolonged periods.

Generally speaking, with the No-Project option, water supply system and consumers' health will remain at risk; due to currently lacking proper technical and financial capabilities.

The following table aims to provide a better insight to the level of significance for the No-Project scenario, and what remedial measures could be possible.

Table 21: Summary impacts for the No-Project option and possibilities for mitigation

Area of concern	Impact	Sensitive receptor(s)	Level of significance	Mitigation?
Water supply system (infrastructure)	System failure due to elevated pumping pressures at the source plant	Water supply system	H	Reduce extra pressure at the source pump (effects on distribution)
	Poor maintenance due to aging pipework and lack of water storage	Water supply system	H	Provide more capacity and spare parts and maintenance equipment
	Palatability issues due to insufficient chlorination	Water supply system	M	Increase doses and monitor at the tap
BWA's technical staff	Overburdening maintenance staff in response to service-related complaints	Maintenance staff in the field Supervisors,	M	- Increase human resources, - Provide more

Area of concern	Impact	Sensitive receptor(s)	Level of significance	Mitigation?
				training, - Provide more equipment
	Overburdening financial resources in response to service-related complaints	BWA's financial management system	H	- Increase annual budget, - Fund raising
Water supply service (local community)	Intermittent service due to pumping failure	All consumers/ end users	M	Increase pumping capabilities (costly and unsustainable)
	Insufficient supply due to storage issues	All consumers/ end users	H	Increase water quantities (new sources)
Community Health and safety	Various health issues of direct and indirect contact with waterborne pathogens (diarrhea cases) and contaminants due to leakage	All consumers/ end users	H	- Apply corrective maintenance (poor capacity), - Replace old and damaged lines/ connections (very costly) - Check water quality (need to increase QA/QC capacity)
	Various health issues of direct and indirect contact with waterborne pathogens due to inadequate disinfection	All consumers/ end users	H	- Improve disinfection systems at the source (impracticable and costly), - Check water quality (need to increase QA/QC capacity)

Most of the above impacts are considered medium – to – high significant, which necessitates the BWA to act promptly and widely. Mitigatory measures suggested above are essential to address chronic and long term problems with the current network, yet extensive, costly, unsustainable, and exhausting to current resources. Fluctuated pressures in the network are causing unbalanced distribution through the network. Degradation of disinfecting materials at the borders of the network is yet another health-related issue. Improvements to the affected receptors may include creating a new facility at some point of the water supply system, where intermediary storage and disinfection utility can be provided. These all could establish the rationale behind carrying out the proposed interventions (R2 water complex).

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

9.1. Positive Impacts in the Operational Phase

The new Project of constructing a service reservoir (R2 water complex) is envisaged to have much of positive impacts on the pre-described receptors. These positive impacts are expected to flourish throughout the lifetime of the Project. Positive impacts would be reflected on all receiving environments, with the greatest positive effect being on the community of Al-Sha'ab sub-district and on the regime of the Baghdad Water Authority. These impacts, and more, are further detailed as below.

9.1.1. Abiotic Environment – water resources and infrastructure

Long product lifecycle has a positive impact on carbon footprint. Pumping stations at the water storage facilities use significant amounts of energy. Pumps intensively consume electricity for their daily operation, which requires big generators that use significant amounts of fossil fuel. Increased demands on fuel will in turn increase greenhouse gases (GHGs) emission to the environment, thus increasing carbon footprint in the physical environment. The new reservoir will minimize high pumping requirements at the source through providing intermediate storage and pumping for conveying water to the farthest taps at the network. Although pumps at the new Project will still need energy, but this demand is envisaged in lesser amounts than those at the source. Positive impacts on carbon footprint are envisaged moderate and long lasting through the lifetime of the Project.

On another hand, the Project will not require increasing water abstraction from Tigris River, or utilizing new resources; since the Project is wholly established for storage and not for production. However, introducing new technologies would always decrease losses throughout the supply system. This constitutes an indirect positive impact on water resources in the area.

9.1.2. Biotic Environment

The area where the Project lies is not well-known for its biological diversity/abundance, which is attributed to the high rate of urbanization and intensive land use shifting. However, as the biological baseline of the area suggests, some floral and faunal scenes can still be found. It is not expected to have any positive direct impacts on the available biotic life in the area as influenced by the Project. However some slight and indirect enhancement to the natural life could be attained by operating such Project in the long run. That could be best reflected on the water basin from which water is being abstracted and whatever biological life it may embrace.

9.1.3. Working Personnel's OHS and Institutional Capacity

The new Project will provide all means of Occupational Health and safety (OHS) during normal operations and maintenance for responsible personnel at the water complex. The reservoir (tank)

will be equipped with openings at each corner of the two compartments to provide enough ventilation for maintenance personnel. Moreover, these openings will be used for accessing and exiting the water compartments by using a galvanized ladder for each. Ladders will also be used for lowering equipment and maintenance materials to the reservoir floors. Maintenance personnel need to perform cleaning and maintenance works easily and safely inside such confined places. These are expected to be done when the tank is empty, or when it has some water left in. The floors of the two compartments are designed with a slight slope to facilitate drainage through an outlet piping system.

As for chlorination rooms, the structure will promote maximum safety measures in case of any emergency. That would include inter-alia, forced ventilation; exit doors; drum submersion system; exhaust air cleaning system; chlorine detection and alarm systems, and a scrubber system that would enable neutralization of leaks. The floor will also be elevated above ground level in order to withstand flooding conditions.

Pumping facilities (including irrigation water pumps), will have a design that cater for drainage and maintenance works. That would include access ladders and openings into the motor room/ basement.

Other facilities of potential hazards include the power generating room, and the fuel tank. As for the generator room, the site will be provided with sufficient gravel filled sump to contain the oil capacity of a transformer in the event of failure. The fuel storage tank will be constructed underground with enough forced ventilation.

Therefore, the new design is collectively expected to support occupational health and safety given the proper management of the site and the use of Personal Protective Equipment (PPE) as instructed.

It is worth mentioning in this context, that BWA's maintenance teams in the field will have their working conditions indirectly enhanced by reducing number of complaints and fixing orders requested by the service subscribers. Financial capabilities of BWA will be further relaxed, which will enable re-arming maintenance crews with better equipment and training. More provisions by the Project will include awareness and educational programs on working hazards and best management practices, as well as operational procedures and evacuation drills in case of emergencies.

9.1.4. Local Community – service enhancement

Many areas in Baghdad experience chronic water shortage and supply intermittence, especially during peak demands. The aging status of the current network has much exacerbated the problem. The Unaccounted For Water (UFW) is relatively high and could reach up to 35% (BWA, 2015). Water quality is also subject to deterioration due to seepage and possibility of contact with pollutants. The Mayoralty of Baghdad has master planned the construction of water storage systems to support Water Zoning Systems (WZS) all over Baghdad, one of which is the R2 water reservoir in Al-Sha'ab sub-district. If implemented as planned, citizens of the Al-Sha'ab will enjoy more equalized flows, less supply interruptions, secured amounts of water in cases of system failure, and safer drinking water at the consumer tap, and consequently would also reduce financial burdens for purchasing private water from shops and tankers. Additionally, the Project would increase flexibility to provide

the service to new subscribers. Of greater importance is protecting the public health through ensuring the safer level of chlorine residual until reaching the end pipe, as the new Project will provide.

In general, there would be more positive impacts on the water service throughout the lifetime of the Project, and they are direct, indirect; and short and long term.

9.2. Negative Impacts in the Construction Phase

The Project of the new water reservoir complex will include site clearance and carrying out constructions as well as installing new equipment and electrical devices. This type of construction has a strong interaction with working personnel on-site and interference with public daily life while mobilizing construction materials and workforce to the construction site. Releases to the external environment are expected if mismanaged. The Project land if found utilized by other parties will have some socio-economic impacts on the Project Affected Persons (PAPs). The following subsections provide a full discussion on expected adverse impacts during construction phase and propose a set of mitigatory measures accordingly.

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 clearing the site, excavations, and performing construction and civil 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.

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

The following will provide a full discussion of impacts, impact ranking, and proposed mitigation measures in the Construction Phase.

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 sites. 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 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, trips, and falls

Impact: Health issues related to accidental slips, trips, and falls

Slips, trips 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 the new water reservoir. 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 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 structures are among the most common cause of fatal or permanent disabling injury at the construction site. 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 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, 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

Installing new 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,
- 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 an 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 the Project 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 the construction of various facilities at the water complex. Workers could be subject to exposed wiring and electrical switches and devices, which will increase risk of 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 work,
- 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,
- Use electricity-specific PPE, including insulating clothing, suits, and gloves.

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

Respiratory hazards

Impact: health issues related to respiratory hazards mismanagement

During construction, 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 heaps to wind. Other emissions include exhaust gases from diesel engines, from transportation vehicles, as well as from open burning of solid waste on-site. Among the most affected receptors are workers in the site. If not managed properly, the impact on workers 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 (stockpiles) by applying control measures, like installing enclosures and covers,
- Use dust suppression techniques by applying water or non-toxic chemicals to minimize dust from vehicle movements,
- Use PPE, such as dust masks, where dust levels are excessive,
- Avoid burning of solid wastes.

If mitigated properly, the expected impact will be moderate.

Confined spaces

Impact: Health issues related to working in confined places

This type of projects involves the construction of reservoir compartments, chambers, and wells. The workers in the site need to enter these places in order to apply finishing materials and light fixtures. However, these places possess poor ventilation in nature, which could result in serious health consequences, like the risk of suffocation. Workers in the site are the most affected receptors of these impacts. If not mitigated properly, these impacts are considered moderately significant, direct, and short 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 activities may have the potential for releasing petroleum based products, such as lubricants, hydraulic fluids, and fuels during their storage, or transfer or use in equipment. If not managed properly, this impact is expected to be highly significant, direct, accumulative, 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,
- Provide awareness to workers on EHS related risks,
- 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 construction activities, noise and vibration may be caused by operation of pile drivers, earth moving and excavation equipment, air compressors, hand and power tools, concrete mixers, and cranes. It is expected that these activities and tools would cause heath issues to workers onsite. If not managed properly, this impact on the workers onsite 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

Communicable and vector-borne diseases

Impact: Spread of communicable and vector-borne diseases

This impact may result from exposure to biologically hazardous environments. This includes illnesses communicated by different kinds of water, land, and air-borne pathogens among workers on-site. The impact could extend off-site when infected workers come in contact with local communities. This impact, if not managed properly, would be considered highly significant, direct, indirect, short and long term. Some recommendations for mitigation would 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,
- 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,
- 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.

Access to working sites

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

The working site could be subject to unauthorized access from the local community, which will pose unlimited risks on public health and safety. In addition to the possibility of looting materials and equipment from the site. If not managed properly, the impact of this unauthorized access will be highly significant, direct, and short term. Recommended actions to prevent unauthorized access to the working site include:

- 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, and
- Remove hazardous conditions on construction sites that cannot be controlled by restricting access, such as covering openings to 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, 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 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 camp workers.

If managed properly, this impact will be negligible.

9.2.3. Waste Management

Solid waste

Impact: solid waste mismanagement

Clearing the site and constructing various structures will produce excess fill materials from grading/excavation activities, scrap wood and metals, and concrete spills. Other non-hazardous wastes would include wastes from working areas as they are considered part of the Project daily 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 an 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 activities of the Project may include the generation of sanitary wastewater discharges, from working areas, in varying quantities depending on the number of workers involved. 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 the 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

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 wet 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 excavation and construction is site-specific. Activities involved in this phase will take place within the plot of the Project. Workers are also envisaged to localize themselves in working spaces within the construction area. Therefore, it is not expected that the Project will have serious impacts on the natural life in the area. 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 change their course through remote areas of any natural value. Impacts on the biotic environment, hence, are minor, indirect, and long term. Mitigation measures would include:

- Ensure full adherence to the zero-discharge criteria to the surrounding environment during transportation of materials,
- 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 discovers anywhere in the area. The Project will involve clearing land and excavating the ground 3 meters deep for an area of 20 dunums or so, in order to set piles and part of the reservoir body. 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 importance of such finds and should be able to manage any type of discovery. Historical finds could be damaged due to excavation activities, or they could lose value if relocated from their original place. This impact is considered highly significant, direct, and 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 – Involuntary resettlement

Impact: temporary loss of assets, livelihoods, and interruption of social, economic, and educational activities

67,000 square meter of land was reserved for construction of the water tank and is owned by the government. The Project land is entirely owned by the MOB, which was transferred to the ownership of BWA to complete the Project. Currently R2 land is used by an adjacent governmental university (Imam Al-Kadhum College) in prior agreement with BWA. R2 land includes caravans and a free parking lot for students. However, land is to be evacuated voluntarily before the commencement of construction works. Nevertheless, the project would have minor socio-economic impacts, which would include interruption to social, economic, and educational activities in close proximity. This might also include temporary loss of assets and livelihood when caravans are relocated. The project has triggered the WB's Involuntary Resettlement OP/BP 4.12 for precautionary purposes, and thus, prepared a Resettlement Policy Framework (RPF). This RPF outlines procedures for evaluation, compensation/entitlement, and monitoring, along with a proposed Grievance Redress Mechanism (GRM) as a guidance to resolve complaints and grievances.

To this end, socio-economic impacts are considered minor, direct, and short term.

9.3. Negative Impacts in the Operation Phase

This phase of the Project includes daily operations of the R2 water complex, and all associated maintenance and supervision work.

The core value of a water service reservoir is to provide adequate amount of water in a safe manner whenever it's needed. Water quality is the most important factor in this process. Water will be received, stored, disinfected and pumped back again to downstream users. Great public health concerns will always be associated with the quality of water supplied to the community. If water is stored and managed inappropriately, a wide range of significant and unpredictable health impacts will be hard to avoid.

On-site, there are risks associated with daily operations and maintenance of all facilities. Working personnel are the sensitive receptors of any hazards that probably merge during daily operations. Therefore, negative impacts are much related to Occupational Health and Safety.

On another hand, this new utility is not envisaged to come in contact with the surrounding community by any reason. However, in the very unlikely conditions, where a natural disaster possibly lead to a major fire, or an emergency overflow to the outdoor environment, a serious impact on the surrounding environment may be received.

In any case, the site management should make available all necessary provisions to help site workers protect their safety and health, and should prepare and well-train their staff on contingency procedures in case of any emergency. The following subsequent sections will provide a full discussion on the anticipated impacts and the soundest mitigatory measures.

9.3.1. Water quality

Quality deterioration

Impact: Public health issues due to poor quality of water

Water received from the municipal supply network will be stored in the reservoir for hours or perhaps for days before it is pumped back into the network. Prolonged storage times will cause water to age and degrade its disinfectants, which will accelerate pathogenic growth. Poor mixing will cause zones of stagnant water inside storage compartments. Varying temperatures between incoming water and water already exists in the reservoir will cause stratification and, thus will increase risk of water deterioration when it's pumped into the pipeline. A great health impact is associated with mismanaging water storage. The new design has taken into consideration a number of measures to avoid stagnation of water though injecting chlorine at the inlet chamber, and at the outlet chamber, as well as allowing for sampling and monitoring of water quality before pumping back into the municipal network. The reservoir design has also provided two separate compartments to reduce bulk size and avoid stagnation. The impact of health issues by deterioration of water quality is foreseen moderately significant, direct, and short term. However, the following are a set of proposed mitigation measures:

- Avoid prolonged periods of storage,

- Monitor water quality levels at the inlet as well as at the outlet (residual chlorine in this case),
- Ensure adequate level of capacity building among working personnel to handle sampling and testing,
- Apply preventive checks on chlorination facilities,
- Maintain a communication channel with the higher management for any arising health issues. (Annex I provides a template Contingency Plan in case of water quality decline)

If managed properly, the health impacts expected will be reduced to negligible.

Water contamination

Impact: Public health issues due to water contamination

The water reservoir was designed to be a covered structure, in order to prevent any possible cross contamination with outer environment. The reservoir is provided with hatches on each corner of the whole tank for maintenance work. If not kept closed, there will be a possibility of bird falling and/or contamination with animal faeces and dust. Additionally, the interior walls of the reservoir if not checked for cracks and integrity of proofing coats, there will be a possibility of vermin breeding inside cracks. Water possibility contaminated will reach end users and will have a significant impact on public health. The preliminary design has already taken into consideration isolations from contamination sources by providing proper hatching, and insulation materials for the interior walls. Therefore, the health impact if occurred is foreseen minor significant, direct, and short term. However, more measures could be taken:

- Ensure proper closure of hatches by applying daily surveillance,
- Check integrity of coating on the interior walls of the reservoir as a preventive action,
- Fix poorly-closing hatches and provide more coating when necessary,
- Test water quality at the outlet for microbiological parameters,
- Maintain a communication channel with the higher management for any arising health issues downstream (see Annex I for a template Contingency).

If managed as recommended above, the health impact would be negligible.

9.3.2. Occupational health and safety

During the daily operation and maintenance of the R2 water reservoir complex, working personnel, including operators, supervisors, and engineers, will yet be subject to common OHS hazards 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.

Slips, trips, and falls

Impact: Health issues related to accidental slips, trips, and falls

Workers at the site will be required to enter the water tank, or descend to the pumping rooms to perform various types of maintenance and replacement works. Hatches and ladders used for that purpose may impose risk of falling, or slipping. The inside environment of the reservoir is of a special concern, and is expected to be wet most of the times, which promotes slippery floors and walls. Additional, poor housekeeping environments may cause tripping, 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 site. These sites include all chambers, the pumping station, the storage room, the electrical power generator room, in addition to the surrounding landscape. 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 elevations associated with roofing, and scaffolding, are among the most common cause of fatal or permanent disabling injury at maintenance sites (especially when dealing with reservoir roof, and entering the dry wells for maintaining pumps). 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 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.

Drowning

Impact: Health issues related to risk of drowning in the reservoir

The water reservoir is a confined place; where water is most probably exist. Either half-filled or having small pools of water, workers could be subject to drowning in such environment. Full drainage should be ensured before entering the reservoir (the tank). Drowning can occur in small pools of water if workers felt unconscious due to poor ventilation.

The preliminary design has already provided for a drainage system. And has also proposed two separate compartments to allow maintenance and cleaning of one compartment at a time. However, if instructions not adequately adhered to, the health impact by such kind of incidents would be highly significant, direct, and short term. The following are proposed measures:

- Schedule a full drainage of water from the compartment under cleaning/ maintenance,
- Take necessary precautions inside places with high risk of drowning, by ensuring enough ventilation and/or using appropriate respiratory apparatus, life vests, and danger signage,
- Educate workers on first aid procedures in case of drowning.

If managed as suggested above, the significance of drowning impact on workers' health would 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, such as the reservoir, chambers, utility vaults, tanks, pipes, and access shafts. The workers in the site need to enter these places in order to fix broken items, replace old parts, clean up sediments, apply several maintenance

materials to the interiors, as well as to grab samples. However, these places possess poor ventilation in nature, which is further exacerbated by the use of spray materials and yielding gases by welding operations. Such working environments could result in serious lack of oxygen and would lead to various health consequences, most commonly is the risk of suffocation. Workers in the site are the most affected receptors of these impacts. If not mitigated properly, these impacts are considered highly significant, direct, 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,
- 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 and maintenance, working personnel are required to enter pumping rooms. This environment can include excessive levels of noise and vibration. 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. And the workers are expected to adhere to safety instructions during their duty. If not managed properly, this impact is considered of minor significance, direct, and short term. Measures to offset this impact would include:

- Effectively insulate the control room against noise and vibration,
- Avoid prolonged exposure periods beyond permissible 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.

9.3.3. Releases to the environment

Hazardous wastes and materials

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

A wide range of hazardous materials can be encountered during maintenance events at the water reservoir complex. 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 enables release to the environment by means of runoff and/or air turbulence. Impacts may arise if storage and handling were inadequate, of which working personnel and local adjoining community and physical environment among the most affected. Of special concern is the leakage of chlorine gas from chlorinators, which if happened would put workers health at great risk. The new design has put the most stringent measures to prevent any gas leakage through providing adequate controlling means, recommending corrosion resistant containers, and enabling manual control in case of any unforeseen emergencies.

Disposal of sediments, cleaning wastes, residual wastes, and washouts, fuel and lubrication spills are of special concern during the maintenance of the reservoir and other facilities (pumping and chlorination stations, the generator room, the fuel tank, etc.). Such materials could be mismanaged and disposed of to the surrounding environment through improper pathways, like discharging to the municipal sewerage system or to open lands.

The impact on public health and environment is highly significant, direct, accumulative, short and long term. Proposed mitigation measures include:

- Train operators on release prevention, including drills specific to hazardous materials as part of an emergency preparedness response training,
- 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,
- 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,
- 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,
- Make available specific PPE and training needed to respond to an emergency,
- Make available spill response equipment sufficient to handle at least initial stages of a spill and a list of possible interventions.

Main elements in a spillage response plan could include, but not limited to, the following:

- 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.

Natural disasters

Impact: Public health issues and contamination of environment due to releases by natural disasters

The design of the water reservoir (tank) has adopted a number of measures to avoid unpredictable consequences of natural disasters. For example, the reservoir has been designed as a semi underground structure; since the area is considerably flat and does not require elevated tanks for gravity flows. This is a significant safety measure when considering the risk of seismic activities. The structure was designed to withstand earthquake loads, and will be provided with sufficient earth retaining structures, as well as providing enough considerations to withstand seismic behavior of the liquid. Also the structure is a closed one, and elevated by nearly 2 meters above the ground, which is also important to prevent water from mixing with floods, which if happened, could result in spoiling big amounts of potable water. Risk of fire is always a possibility. Fire can occur by means of natural disasters or as a result of poor in-house control/ operations. In this regard, the design has provided for fire protection specifications, like using fire resistant materials and finishing per internationally recognized safety and fire codes, in addition to emergency exits and fire distinguishers.

To this end, the impact on public health due to natural disasters is expected highly significant, direct, indirect, short, and long term. However, the following would be some recommendations:

- Ensure the full implementation of safety measures set out by the final design,
- Ensure adequate planning for contingency in case of natural disasters,
- Train workers at the site on general safety measures and ensure full adherence,
- Provide special training and drills on emergency situations, evacuation procedures, and recovery from disasters.

If managed properly, the impact on public health will be alleviated to moderate.

Abnormal operations – Overflows

Impact: Public health issues and contamination of environment due to releases by abnormal operations

Overflows could occur in many circumstances that would include: poor flow control; damage to the control valves; malfunctioning of water level sensors; surplus amounts of pumped water from the source; or as a result of extremely unusual cases of water contamination/ water degradation. Whatever the scenario is, the design has enough provisions to account for emergent overflows. For example, the new interventions will include stand-by pumps and flow control and alarm systems to accommodate exceptional situations, in addition to providing the reservoir with a bypass pipework.

Discharges are primarily made to the Al-Jaish Canal (Army Canal). However, discharges of clean water would be used in irrigating landscape and flushing/ washing (if applicable).

To this end, the impact of overflow on the surrounding environment is foreseen moderately significant, direct and 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 site-specific contingency plan in case of emergency overflows,
- Response to overflows by preventing, containing, minimizing, the overflow where it is feasible and safe to do so,
- Notify responsible parties, which include the Baghdad Water Authority in this case.

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

9.4. Summary Impacts and Mitigation

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

Table 22: Summary adverse impacts – construction and operation phases

Area of concern	Impact	Sensitive receptor	Ranking before mitigation	Ranking after mitigation
Construction phase				
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, trips, and falls	Working personnel	highly significant, direct, short and long term	Low
	Health issues related to working in heights	Working personnel	highly significant, direct, 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	Moderate
	Health issues related to working in confined places	Working personnel	moderately significant, direct, and short term	Low
	hazardous solid and liquid materials mismanagement	Working personnel Surrounding environment	highly significant, direct, accumulative, 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	Spread of communicable and vector-borne diseases	Working personnel, Local community	highly significant, direct, indirect, short and long term	Low
	public safety issues due to unauthorized access to working sites	Local community	highly significant, direct, and short term	Low
	Traffic safety	Local community	moderately significant, direct, and short term	Negligible
Waste management	solid waste mismanagement	Working personnel, Local community,	moderately significant, direct, and short term	Negligible

Area of concern	Impact	Sensitive receptor	Ranking before mitigation	Ranking after mitigation
		Surrounding environments.		
	Domestic wastewater mismanagement	Working personnel, Local community, Surrounding environments.	highly significant, direct, short and long term	Low
Physical environment	Soil erosion and sediment mobilization	Surrounding environment	moderately significant, indirect, and long term	Low
Biotic environment	Altering/ endangering biological life	Biological environment (flora, fauna, and habitats)	low 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	Minor
Socio-economic	temporary loss of assets, livelihoods, and interruption of social, economic, and educational activities	Local community	minor, direct, and short term	Negligible
Operation phase				
Quality deterioration	Public health issues due to poor quality of water	Local community	moderately significant, direct, and short term	Negligible
Water contamination	Public health issues due to water contamination	Local community	low significant, direct, and short term	Negligible
OHS	Health issues related to accidental slips, trips, and falls	Working personnel	highly significant, direct, short and long term	Low
	Health issues related to working in heights	Working personnel	highly significant, direct, short and long term	Low
	Health issues related to risk of drowning in the reservoir	Working personnel	highly significant, direct, and short 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
Noise and vibration	Health and stress issues due to noise and vibration in work environment	Working personnel	low significance, direct, and short term	Negligible
Releases to the environment	Public health issues and contamination of environment due to mismanagement of hazardous waste and materials	Working personnel, Local community,	highly significant, direct, accumulative, short and long term	Low
	Public health issues and contamination of environment due to releases by natural disasters	Working personnel, Local community, biotic environment, And abiotic environment	highly significant, direct, indirect, short, and long term	Moderate
	Public health issues and contamination of environment due to releases by abnormal operations	Working personnel, Local community, biotic environment, And abiotic environment	moderately significant, direct and indirect, short and long term	Low

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 pre-construction and post-construction phases) the Contractor is required to update and implement this 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 suggests 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, including – inter-alia, topography, soil, and geotechnical investigations. The Contractor should not start working in the site unless all grievances raised by local community/ Land user have been addressed by the MOB. Especially those related to socio-economic aspects. 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 BWA Team is expected to hire a Project Implementing Consultancy (PIC) firm, who will be responsible for overseeing day-to-day activities, and will report back to BWA and MOB. Other tasks will be attached to this supervisor like ensuring full adherence to environmental and social measures and monitoring parameters thereof. Costs of a supervision contract is covered by the project, however, follow-ups of BWA will be incurred as part of the BWA's budget.

In operation phase, BWA 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 external environments and local communities. Impacts should be managed effectively by continuously strengthening institutional capabilities, 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 BWA's budget. The following are tabulated formats for the ESMP in construction as well as in operation phases.

10.1.2. Proposed ESMP

Table 23: Environmental and Social Management Plan – Construction phase

#	Area	Impact	Mitigation/ Management	Roles & Responsibilities	Requirements	Time/frequency
1	**OHS**	Health issues related to over-exertion and ergonomic injuries and illnesses	• 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.	• Contractor to implement, • BWA to assist and supervise	• Training on OHS, • The best design of work station, • Personnel rotation system, • First aid.	• Prior to construction for training and work station, • Weekly for rotation, • Daily for others
2		Health issues related to accidental slips, trips, and falls	• Implement good house-keeping practices, such as the sorting and placing of loose construction materials 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.	• Contractor to implement, • Supervision contract, • BWA to follow up	• Housekeeping practices, • Cleanup kits, • First aid, • PPE.	On daily basis
3		Health issues related to working in heights	• Train and use temporary fall prevention devices, such as rails or other barriers able to support a weight of 90.7kg at 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, roofs, or walking surfaces.	• Contractor to implement, • Supervision contract, • BWA to follow up	• Education, • Acquisition of right expertise, • Provision of safety devices, • Provision of safety monitoring systems, • PPE, • First aid,	• Prior to construction for "Education" and employing "right expertise", • Daily for other provisions
4		Health issues related to getting struck by objects	• Use a designated and restricted waste drop or discharge zones, • 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	• Contractor to implement, • Supervision contract,	• Education, • Acquisition of right expertise, • Provision of	• Prior to construction for "Education" and "right expertise",

#	Area	Impact	Mitigation/ Management	Roles & Responsibilities	Requirements	Time/frequency
			loose scrap, • Use temporary fall protection measures in scaffolds and out edges of elevated work surfaces, such as hand rails an 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.	• BWA to follow up	safety devices, • First aid, • PPE	• Daily for other provisions
5		Health and accidental issues related to exposing to moving machinery	• 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.	• Contractor to implement, • Supervision contract, • BWA to follow up	• Provision of safety devices, • Provision of safety monitoring systems, • Provision of suitable equipment, • First aid, • PPE.	• Prior to construction for devices and systems, • Daily for other provisions
6		Health issues related to working with exposed electrical parts	• 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 work, • 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, • Use electricity-specific PPE, including insulating clothing, suits, and gloves.	• Contractor to implement, • Supervision contract, • BWA to follow up	• Education, • Acquisition of right expertise • Provision of safety devices, • PPE, • First aid,	• Prior to construction for "Education" and "right expertise", • Daily for safety devices and PPE
7		health issues related to respiratory hazards mismanagement	• Minimize dust from material handling sources, such as conveyors and bins, by using covers and/or water suppression, • Minimize dust from open area sources (stockpiles) by applying control measures, like installing enclosures and covers, • Use dust suppression techniques to minimize dust from vehicle movements • Use PPE, such as dust masks, where dust levels are excessive, • Avoid burning of solid wastes.	• Contractor to implement, • Supervision contract, • BWA to follow up	• Provision of respiratory controls, • PPE, • Best management practices.	• Daily for controls, • Weekly for local communication
8		Health issues related to working in confined places	• Provide safe means of access and egress from confined places, such as stairs and ladders, and safety ropes,	• Contractor to implement,	• Education, • Provision of	• Prior to construction for

#	Area	Impact	Mitigation/ Management	Roles & Responsibilities	Requirements	Time/frequency
			• Avoid operating combustion equipment for prolonged periods unless the area is actively ventilated, • Use special PPE including respirators, protective suits, gloves, and eye protection.	• Supervision contract, • BWA to follow up	safety devices, • Ventilation system, • PPE, • First aid.	"education", • Daily for safety devices, ventilation, and PPE
9		Hazardous solid and liquid materials mismanagement	• 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, • Provide awareness to workers on EHS related risks, • 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.	• Contractor to implement, • Supervision contract, • BWA to follow up, • MOB to approve final treatment.	• Education, • Secondary containment, • Ventilation, • Refueling areas, • Spill and cleanup, • Waste management plan, • Material storage plan	• Prior to construction for education, • Daily for management
10		health issues related to noise and vibration mismanagement	• 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.	• Contractor to implement, • Supervision contract, • BWA to follow up	• Education to workers, • Preventive and corrective Maintenance, • PPE,	• Prior to construction for education, • Daily for management
11	**Public health and & safety**	Spread of communicable and vector-borne diseases	• 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,	• Contractor to implement, • Contractor to implement, • Supervision	• Immunization programs, • Municipalities to apply pest control	• Prior to construction for immunization • monthly for pest management

#	Area	Impact	Mitigation/ Management	Roles & Responsibilities	Requirements	Time/frequency
			• 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, • 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, • 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.	contract, • Health centers to immunize, • Municipalities to apply controls (in liaison with the environmental dept of MOB), • BWA to follow up,	programs	
12		Public safety issues due to unauthorized access to working sites	• 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, and • Remove hazardous conditions on construction sites that cannot be controlled by restricting access, such as covering openings to confined spaces, and ensuring means of escape, like in case of locked storage of hazardous materials.	• Contractor to implement, • BWA to supervise,	• Education, • Acquisition of right expertise, • Collection and disposal plan, • Provision of safety devices, • PPE, • First aid, • Site security.	• Prior to construction for "Education" and "right expertise", • Daily for other provisions
13		Traffic safety	• Emphasize safety aspects among drivers, • Avoid 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 camp workers.	• Contractor to implement, • Supervision contract, • BWA to follow up, • Traffic department to advise, • Local representatives to get in touch	• Education, • Provisions of suitable means of transportation, • Best management practices, • Provision of regular maintenance, • Provisions of	• Daily for education, • Weekly for traffic communication, • Weekly for local communication, • Periodically for local market inclusion.

#	Area	Impact	Mitigation/ Management	Roles & Responsibilities	Requirements	Time/frequency
					traffic safety measures, • Considering local market	
14	**Waste Management**	Solid waste mismanagement	• Identify types and estimate quantities of waste expected during construction, • Identify available collection and treatment programs and infrastructure to manage waste in an 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.	• Contractor to implement, • Supervision contract, • BWA to follow up, • MOB to approve dumpsite.	• Waste management plan, • Material storage plan	• Prior to construction for plans, • Daily for management
15		Domestic wastewater mismanagement	• Identify types and estimate quantities of wastewater expected during construction, • Segregate wastewater streams to ensure compatibility with the 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.	• Contractor to implement, • Supervision contract, • BWA to follow up, • MOB to approve dumpsite.	• Waste management plan, • Storage plan, • Quality testing for groundwater resources • Provisions for on-site treatment	• Prior to construction for plans, • Daily for management • Quarterly for water quality monitoring

#	Area	Impact	Mitigation/ Management	Roles & Responsibilities	Requirements	Time/frequency
16	**Physical environment**	Soil erosion and sediment mobilization	• Schedule to avoid heavy rainfall periods, to the extent practical, during wet 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. • Monitor groundwater quality that could exist close to the working areas to ensure compliance.	• Contractor to implement, • Supervision contract, • BWA to follow up, • Meteorological department for weather forecast	• Best management practices, • Provision of drainage/ segregation systems, • Weather forecast • Quality testing for groundwater resources	• Daily for best practices, • Seasonally for rainfall seasons • Quarterly for water quality monitoring
17	**Biotic environment**	Altering/ endangering biological life	• Ensure full adherence to the zero-discharge criterion to the surrounding environment during transportation of materials, • 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 occur, and apply prompt and approved site cleanup procedures, • Raise awareness on the importance of natural life in the area and possible ways for protection.	• Contractor to implement, • Supervision contract, • BWA to follow up, • MOB to designate and approve dumpsite, • Environment department to advise,	• Best management practices, • Provisions of off-site cleanup, • Waste and spill management plan, • Flora and fauna mapping, • Awareness on natural life	• Prior to construction for flora and fauna mapping, • Daily for zero-discharge, driving routes, • Weekly for awareness, • Continuously for contact with environment dept.

#	Area	Impact	Mitigation/ Management	Roles & Responsibilities	Requirements	Time/frequency
18	**Cultural heritage and chance finds**	Possible damage to objects of historical/ cultural value	• 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.	• Contractor to implement, • Supervision contract, • BWA to follow up, • Dept. of antiquities to approve chance finds procedures,	• Education & awareness, • Procedures for chance finds, • Well-defined communication channels,	• Prior to excavation for "education", • Prior to excavation for "chance finds procedures", • On daily basis during excavation works
19	**Socio-economic**	Temporary loss of livelihood, Temporary interruption of social, economic, and educational activities	• Conduct site survey in order to provide full inventory of PAPs and their activities and asset before commencement of construction, • Update and apply the BWSIP's Resettlement Policy Framework, • Ensure and apply a grievance redress mechanism (GRM) at early stages, • Engage affected people in the project if possible	• The Project team/ BWA to conduct a site survey, • MOB to establish a GRM, • The Contractor to engage affected people.	• Socio-economic baseline information, • Site visit and establishment of Cut-Off date, • Establishment of GRM, • A compensation/ engagement plan.	• Before project commencement for "site survey", • Before project commencement for "GRM" • During the project lifetime to ensure satisfactory measures.

Table 24: Environmental and Social Management Plan – Operation phase

#	Area	Impact	Mitigation	Responsibility	Requirement	Frequency
1	**Water Quality**	Public health issues due to poor quality of water	• Avoid prolonged periods of storage, • Monitor water quality levels at the inlet as well as at the outlet (residual chlorine, in this case), • Ensure adequate level of capacity building among working personnel to handle sampling and testing, • Apply preventive checks on chlorination facilities, • Maintain a communication channel with the higher management for any arising health issues	• Reservoir management to report water issues • BWA to provide means for testing water quality, • BWA to provide needed capacity building.	• Procedures put in place to carry out water monitoring, • Water safety plan, • Testing equipment, • Training courses on monitoring of water quality.	• Daily for applying procedures and monitoring, • Monthly for reporting to BWA's higher management, • Annually for training on water quality
2		Public health issues due to water contamination	• Ensure proper closure of hatches by applying daily surveillance, • Check integrity of coating on the interior walls of the reservoir as a preventive action, • Fix poorly-closing hatches and provide more coating when necessary, • Test water quality at the outlet for microbiological parameters, • Maintain a communication channel with the higher management for any arising health issues downstream	• Site management to report water issues • BWA to provide means for testing water quality, • BWA to provide needed capacity building.	• Procedures put in place to carry out water monitoring, • Water safety plan, • Contingency plan, • Testing equipment, • Training courses on monitoring of water quality.	• Daily for applying procedures and monitoring, • Monthly for reporting to BWA's higher management, • Annually for training on water quality
3	**OHS**	Health issues related to accidental slips, trips, and falls	• 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.	• Working personnel to implement, • BWA to provide medical insurance, monitor implementation, and provide education.	• Capacity building, • Best practices, • Cleanup kits, • First aid and medical insurance, • PPE,	• Daily for best practices, medical care, and PPE, • Periodically for capacity building and job rotation,
4		Health issues related to working in	• Train and use temporary fall prevention devices, such as rails or other barriers able to support a weight of 90.7kg at minimum, when	• Working personnel to implement,	• Capacity building,	• Daily for best practices,

#	Area	Impact	Mitigation	Responsibility	Requirement	Frequency
		heights	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.	• BWA to provide medical insurance, monitor implementation, and provide training.	• Best practices, • Provision of safety devices, • Provision of monitoring systems, • First aid and medical insurance, • PPE,	medical care, safety devices, monitoring systems PPE, • Periodically for capacity building,
5		Health issues related to risk of drowning in the reservoir	• Schedule a full drainage of water from the compartment under cleaning/ maintenance, • Take necessary precautions inside places with high risk of drowning, by ensuring enough ventilation and/or using appropriate respiratory apparatus, life vests, and danger signage. • Educate workers on first aid procedures in case of drowning.	• Site management to provide reservoir cleaning procedures, PPE, ensure ventilation, and signage, • BWA to provide training.	• Safety and cleaning equipment, • Danger signage, • Training courses.	• Periodically for cleaning and safety equipment, • Annually for training.
6		Health issues related to working with electrical equipment and control panels	• 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.	• Working personnel to implement, • BWA to provide medical insurance, monitor implementation, and provide training.	• Capacity building, • Best practices, • Acquisition of right expertise, • Provision of safety devices, • Provision of monitoring systems, • First aid and medical insurance, • PPE,	• Daily for best practices, medical care, safety devices, monitoring systems PPE, • Periodically for capacity building and "right expertise"
7		Health issues related to working in confined places	• 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,	• Working personnel to implement, • BWA to provide medical insurance, monitor implementation,	• Education, • Provision of safety devices, • Ventilation system, • PPE,	• Daily for best practices, medical care, safety devices, PPE, • Periodically for

#	Area	Impact	Mitigation	Responsibility	Requirement	Frequency
			• Minimize exposure period to the extent possible.	and provide training.	• First aid.	capacity building
8		Health and stress issues due to noise and vibration in work environment	• Effectively insulate the control room against noise and vibration, • Avoid prolonged exposure periods beyond permissible 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.	• Working personnel to implement, • BWA to provide medical insurance, monitor implementation, and provide training.	• Education, • Provision of insulation, • Provision of monitoring devices and programs, • PPE, • Medical insurance, • Record keeping	• Daily for best practices, medical care, PPE, • Weekly and monthly for monitoring, • Periodically for capacity building
9	**Releases to the environment**	Public health issues and contamination of environment due to mismanagement of hazardous waste and materials	• Train operators on release prevention, including drills specific to hazardous materials as part of an emergency preparedness response training, • 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, • 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, • 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, • Make available specific PPE and training needed to respond to an emergency, • Make available spill response equipment sufficient to handle at least initial stages of a spill and a list of possible interventions.	• Working personnel to implement, • BWA to monitor, • Environment dept to advise, • Local representatives to assist.	• Capacity building, • Inspection programs, • Documented procedures, • Best management practices, • Legal and approved dumpsite, • Provision of PPE, • Provision of spill equipment.	On daily basis
10		Public health issues and contamination of environment due to releases by natural disasters	• Ensure the full implementation of safety measures set out by the final design, • Ensure adequate planning for contingency in case of natural disasters, • Train workers at the site on general safety measures and ensure full adherence,	• Site management to implement safety measures, and contingency planning,	• Safety measures, • Contingency plan, • Emergency and	Annually for amending safety measures and providing emergency and

#	Area	Impact	Mitigation	Responsibility	Requirement	Frequency
			• Provide special training and drills on emergency situations, evacuation procedures, and recovery from disasters.	• BWA to provide emergency and evacuation drills.	evacuation drills.	evacuation drills.
11		Public health issues and contamination of environment due to releases by abnormal operations	• Develop and implement appropriate protocols to reduce risks to safety, public health, and environment that include well-written instructions, • Develop a site-specific contingency plan in case of emergency overflows, • Response to overflows by preventing, containing, minimizing, the overflow where it is feasible and safe to do so, • Notify responsible parties, which include the Baghdad Water Authority in this case.	• Site management to implement, • BWA to monitor, • Environment dept to monitor, • Local representatives to assist.	• Contingency plan, • Public health standards, • Maintenance plans, • Community outreach	• Daily for contingency, and maintenance, • Seasonally for community outreach

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 BWA team also may share responsibility along with a PIC firm for conducting site visits jointly with other departments, like Al-Sha'ab Municipality, including participation from the contractor's side. Site visits should result in furnishing visit reports by the PIC firm. On another hand, BWA 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 gives more details on 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 BWA 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 BWA 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 BWA budget. Tables 25 & 26 below provide monitoring programs pertinent to the construction and operation phases respectively, while table 28 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 USD * 4 = 800 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 USD*22 parameter = 4,400 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)

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10.2.3. Proposed monitoring plan

Table 25: Monitoring plan – 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	• Zero medical complaint/ assistance, • 100% clear inspection report	• Contractors' incident records • Keeping records at medical care centers	• Resident engineer of PIC • Resident engineer of BWA • ESO- BWA	Monthly, Annual review	Construction site	• PIC's budget. • BWA's resident engineer daily rate (approx. 50 USD/day) • ESO-BWA's daily rate (approx. 50 USD/day)
2	Training effectiveness	• Zero incident reports related to training, • 100% clear inspection report	• Contractor's incident reports	• Resident engineer of PIC • Resident engineer of BWA • ESO- BWA	Monthly, Annual review	Construction site	• PIC's budget. • BWA's resident engineer daily rate (approx.. 50 USD/day) • ESO-BWA's daily rate (approx. 50 USD/day)
3	Housekeeping in-situ	• Zero incident reports, • Zero complaints, • 100% clear inspection report	• Contractor's incident records, • Contractor's complaining system, • Contractor's environmental engineer reporting	• Resident engineer of PIC • Resident engineer of BWA	Bi-weekly, Monthly, Annual review	Construction site	• PIC's budget. • BWA's resident engineer daily rate (approx. 50 USD/day) • ESO-BWA's daily rate (approx. 50 USD/day)
4	PPE effective usage	• Zero incident reports related to misusing PPE, • 100% clear inspection report, • 100% clear Occupational Health (OH) report	• Contractor's incident records, • Contractor's complaining system, • Site engineer's reporting, • OH inspection system	• Contractor • Resident engineer of PIC • Resident engineer of BWA	Monthly	Construction site	• Contractor's budget • PIC's budget. • BWA's resident engineer daily rate (approx. 50 USD/day)
5	Site hygiene	• Zero incident reports related to waste mismanagement, • 100% clear inspection report, • 100% clear PH report	• Contractor's incident records, • Contractor's complaining system, • Site engineer's reporting, • PH inspection system	• Contractor • Resident engineer of PIC • Resident engineer of BWA	Monthly, Quarterly, Annual review.	Construction site	• Contractor's budget • PIC's budget. • BWA's resident engineer daily rate (approx. 50 USD/day)

#	Parameter to be monitored	Target KPI/limit	Monitoring requirements	Monitoring Responsibility	Frequency	location	Cost estimate
6	Off-site hygiene	• Zero complaints related to illegal dumping off-site, • 100% clear PH report	• BWA's complaining system, • PH inspection system	• Resident engineer of PIC MOB	Monthly, Quarterly, Annual review	Transporting routes	• PIC's budget. • MOB budget (daily rates of field inspectors approx. 50 USD/day)
7	Ambient air quality and noise	• Zero complaints related to air and noise nuisance, • 100% clear Environmental Health (EH) report, • Thresholds are fully complied with.	• BWA's complaining system, • EH. inspection system, • Air and noise monitoring equipment, measurements and analyses.	• Resident engineer of PIC • Resident engineer of BWA • ESO- BWA	Quarterly, Annual review.	Site vicinity	• PIC's budget (monitoring cost estimated at 10,000 USD quarterly). • BWA's resident engineer daily rate (approx. 50 USD/day) • ESO-BWA's daily rate (approx. 50 USD/day)
8	Surface and groundwater quality	• Physical, chemical, and bacteriological parameters are within national limits	• Water quality monitoring services	• Resident engineer of PIC • ESO-BWA for final reporting	Quarterly	• Intake points from Tigris, • Discharge points of untreated sewage, • Groundwater wells within 1km of point of discharge into Tigris, and • Groundwater wells within 1 km distance along open canals of untreated sewage.	• 6,100 USD per each round of testing from 4 locations • ESO-BWA's daily rate (approx. 50 USD/day)
9	Public health and safety	• Zero complaints related to vector nuisance and communicable diseases, • Zero incidents of Project related infections/diseases.	• Immunization program, • Records of BWA's complaining system, • Records of Health inspection system, • Records of Health care systems.	• Health care provider • Resident engineer of PIC • MOB • ESO-BWA for final reporting	Monthly, Annual review.	On-site, localities	• Cost of health care program included in the contractor's budget (estimate: 200 USD/worker/year), • Cost of MOB's complaining system included in MOB's budget, • PIC's budget • ESO-BWA's daily rate (approx. 50 USD/day)
10	Traffic safety	• Zero traffic accident reports related to the Project, • Zero complaints of project related traffic accidents	• Traffic dept records, • Records of BWA's complaining system, • Contractor's record.	• Traffic dept, • MOB • Resident engineer of PIC	Monthly, Annual review	Public road network	• Costs of accidents recording included in Traffic Department's budget, • Cost of MOB's complaining

#	Parameter to be monitored	Target KPI/limit	Monitoring requirements	Monitoring Responsibility	Frequency	location	Cost estimate
				for reporting • ESO-BWA for final reporting			system included in MOB's budget, • PIC's budget • ESO-BWA's daily rate (approx. 50 USD/day)
11	Natural life (flora & fauna)	• Zero incident reports related to altering/ endangering natural life	• Environmental inspection system, • Incident records.	• Environmental dept at MOB • Resident engineer of PIC for reporting • ESO-BWA for final reporting	Monthly, Annual review	Natural life in vicinity and downstream	• Costs of environmental monitoring included in environmental dept's budget, • PIC's budget • ESO-BWA's daily rate (approx. 50 USD/day)
12	Cultural heritage and chance finds	• Incident reports of chance finds are fully addressed to responsible authorities • No activity has resulted in any archaeological/cultural heritage damage during construction	• Incident reports, • Site surveillance during work • Open reporting channels with responsible authorities (dept. of antiquities and MOB)	• Antiquities dept. • Resident engineer of PIC for reporting • ESO-BWA for final reporting	Daily, quarterly review	Alongside roads that will have excavations	• Antiquities Department monitoring budget, • PIC's budget • ESO-BWA's daily rate (approx. 50 USD/day)

Table 26: Monitoring plan – Operation phase

#	Parameter to be monitored	Target KPI/limit	Monitoring requirements	Monitoring Responsibility	Frequency	location	Cost estimate
1	Water quality	• River water quality within thresholds, • Zero complaints related to overflows	• Water quality monitoring services	• MOB for complaining • BWA's central labs • ESO-BWA	Semiannual	• Intake points from Tigris, • Discharge points of untreated sewage, • Groundwater wells within 1km of point of discharge into Tigris, and • Groundwater wells within 1 km distance along open canals of untreated sewage.	• MOB's budget for running complaining system, • 6,100 USD per each round of testing from 4 locations • ESO-BWA's daily rate (approx. 50 USD/day)
2	Health issues linked to nature of	• Zero medical complaint/ assistance,	• Incidents records,	• Site management,	Monthly, Annual	Water reservoir complex	• Costs of medical care included in BWA's budget (estimate: 200

#	Parameter to be monitored	Target KPI/limit	Monitoring requirements	Monitoring Responsibility	Frequency	location	Cost estimate
	work	• Zero incident reports	• Records at medical care centers	• BWA's OHS dept.	review		USD/personnel/month)
3	Housekeeping in-situ	Zero incident reports related to operational and maintenance activities,	Site inspection system and records	• Site management, • ESO-BWA	Bi-weekly, Monthly, Annual review	Water reservoir complex	• Costs of inspection and incidents record keeping included in the site's and MOB/BWA's budgets (estimate: 2,000 USD/year) • ESO-BWA's daily rate (approx. 50 USD/day)
4	PPE effective usage	Zero incident reports related to misusing PPE,	Site inspection system and records	• Site management, • ESO-BWA.	Monthly	Water reservoir complex	• Costs of inspection and incidents record keeping included in the site's and MOB/BWA's budgets (estimate: 2,000 USD/year) • ESO-BWA's daily rate (approx. 50 USD/day)
5	Site hygiene	Zero incident reports related to waste mismanagement.	Site inspection system and records	• Site management, • ESO-BWA.	Monthly, Quarterly, Annual review.	Water reservoir complex	• Costs of inspection and incidents record keeping included in the site's and MOB/BWA's budgets (estimate: 2,000 USD/year) • ESO-BWA's daily rate (approx. 50 USD/day)
6	Public health related to natural disasters	• Zero complaints of operation-related public health, • Zero incidents of Project related infections/diseases.	• Records of BWA's complaining system, • Records of Health inspection system, • Records of Health care systems.	• Site management, • ESO-BWA, • Health dept. • Health care centers.	Monthly, Annual review.	Nearby residential areas	• Costs incurred by Health inspector included in Health dept's budget (estimate: 100 USD/day), • Costs of running complaining system included in BWA's budget,
7	Capacity building	• Zero incident reports related to operational and maintenance activities, • Staff evaluation (highest score)	Human resources system	• HR at MOB/BWA • ESO-BWA	Semi-annual Annual review	Water reservoir complex	• Costs of capacity building and training included in BWA's budget (estimate: 1,000 USD/worker/year) • Costs of staff evaluation included in BWA's HR budget.

10.2.4. Site visits and reporting responsibilities

For construction phase, the BWA 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 as 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 (BWA) and representatives from Al-Sha'ab Municipality 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 covered, photos, names of interviewees, conclusions, and recommendations. The site report will then be submitted to the higher management (BWA/ 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 (BWA/ MOB). Reporting information should include as 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 BWA (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 BWA (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 (BWA/ MOB). A full inventory of interviewees should be included in such report, which could 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 as applicable,

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

Table 27: 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	**From** Representatives of BWA (ESO-BWA), Al-Sha'ab Municipality, and Contractor's environmental engineer **To** the higher management of BWA, MOB, and WB	This stems from BWA'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 ESMP	Once upon starting the Project	**From** Representatives of BWA (ESO-BWA), Al-Sha'ab Municipality, and Contractor's environmental engineer **To** the higher management of BWA and MOB Then **from** BWA **to** Contractor for action	This stems from BWA'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	**From** the Contractor's environmental engineer **to** the BWA's supervision team, Then **from** BWA **to** 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	**From** the Contractor's environmental engineer **to** the BWA's supervision team, **to** the higher management at BWA/ MOB and WB Then **from** BWA **to** 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 actions responded.
5	Monitoring	Quarterly from	**From** Representatives of	Aims to rectify proceedings of the

#	Type of reporting	Timing	Reporting (from whom to whom)	Description
	complaints/concerns of local community	starting constructions	BWA (ESO-BWA), Al-Sha'ab Municipality, and Contractor's environmental engineer **to** the higher management of BWA and MOB, Then **from** BWA **to** Contractor for action (through supervision contractor)	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 BWA's relevant environmental department on daily management. Then feedback should be pursuit from BWA to the site management for further improvements. BWA should report to the higher management (MOB and WB) on a quarterly basis for quality-checks and areas for improvement.

10.2.5. Proposed monitoring schedule

Table 28: Monitoring schedule for construction phase

#	Parameter	Year 1			Year 2												Year 3												Year 4								
1	Health issues linked to nature of work				x	x	x	x	x	x	x	x	x	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	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	xx	xx	xx	xx	xx	xx	xx	xx	xx			
4	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	x	x	x	x	x	x	x	x	x			
5	Site hygiene				x	x	**x**	x	x	**x**	x	x	**x**	x	x	**x**	x	x	**x**	x	x	**x**	x	x	**x**	x	x	**x**	x	x	**x**	x	x	**x**			
6	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	x	**x**	x	x	**x**	x	x	**x**			
7	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	xx	xx	xx	xx	xx	xx	xx	xx	xx			
8	Surface & groundwater quality				x	x	**x**	x	x	**x**	x	x	**x**	x	x	**x**	x	x	**x**	x	x	**x**	x	x	**x**	x	x	**x**	x	x	**x**	x	x	**x**			
9	Public health				x	x	**x**	x	x	**x**	x	x	**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	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	x	**x**	x	x	**x**	x	x	**x**			
12	Cultural heritage & chance finds				xx	xx	**xx**	xx	xx	**xx**	xx	xx	**xx**	xx	xx	**xx**	xx	xx	**xx**	xx	xx	**xx**	xx	xx	**xx**	xx	xx	**xx**	xx	xx	**xx**	xx	xx	**xx**			

10.3. Institutional Arrangements and Training Requirements

10.3.1. Institutional Arrangements

The project will be implemented by the Mayoralty of Baghdad, which should allow for a smooth flow of information among Contractors, Supervision, and higher managements at BWA/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 water systems/ water safety plans 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.

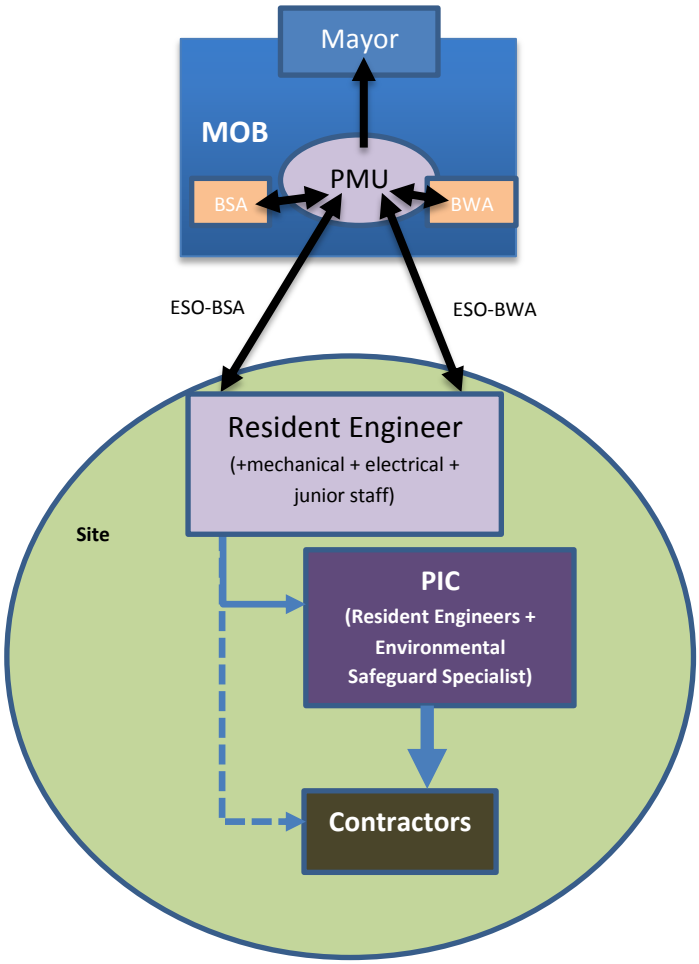

Figure 21: Institutional arrangement

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 29: Proposed training workshops and courses

Target Group	Workshop/ Training Sessions	Training Provider	Costs (USD)
Coordinators and Project Officers (MOB, BWA)	- Training session on planning and design of ESIAs/ESMPs.	ESO-BWA	7,000

Target Group	Workshop/ Training Sessions	Training Provider	Costs (USD)
Project Beneficiaries and Stakeholders	- Consultation sessions on potential environmental and social impacts of the Project.	Project Unit with assistance from the ESO-BWA	10,000
Project Proponent (BWA), Site personnel, OHS dept.	- Training session on planning and design of ESIAs/ESMPs. - The design and implementation of mitigation measures. - Occupational health and safety guidelines.	Project Unit with assistance from the ESO-BWA, External training provider for OHS	18,000
Specialized training			
BWA 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
		Sub Total (USD)	**50,000**
		Environmental and Social Officer Salary*	**40,000**
		Total (USD)	**90,000**

* 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 constructed water reservoir complex, 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 international 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 BWA 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 BWA/MOB or by relevant municipalities through continuous meetings and workshops.

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- World Bank, "Iraq: Country Water Resources, Assistance Strategy: Addressing Major Threats to People's Livelihoods," Report No. 36297-IQ, 2006, p.97.

ANNEXES

Annex I: Contingency Plan Template – drinking water contamination

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 cases of breaching of water safety at water storage – R2 Water Service Reservoir in Al-Sha'ab sub-district.

III. **Breaching Event:** water samples have been grabbed from (inlet/ outlet chambers) and tested at accredited laboratories. Lab tests have shown incompatibility with local and international standards for drinking water. A major public health outbreak occurred downstream according to authorities.

IV. **Problem Indicators:** quality has declined due to either one or part of the following indicators:
- Below limit residual disinfectants {yes, No}
- Above limit growth of microbiological parameters {yes, No}
- Above limit chemical constituents {yes, No}
- Unacceptable palatability signs {yes, No}
- Evident cross-contamination with outer environment {yes, No}
- Called upon water outbreak downstream {yes, No}

V. Specific Actions:
- Stop pumping to the public network immediately,
- Isolate storage water from the public network,
- Announce quality breaching through BWA official channels,
- Announce "Boil Your Water" to the water users (service subscribers),
- Apply physical checks on the reservoir roof openings for any evident breakage/ ingress of faeces/ dead animals/ pollutants, etc.
- Check functionality of Chlorine dosing utility both at inlet and outlet,
- Fix the problem,
- Apply an emergency drainage of all affected waters to the pre-designated discharge channel,
- Clean out the interior of the affected reservoir/compartment
- Flush out inlet and/or outlet pipelines, and discharge to the pre-described discharge channel,

- Return storage mechanism as appropriate,
- Grab water samples for confirmatory checks.
- Announce the "Drinking water is safe".

VI. Responsibilities:

- Site management to announce water safety breaching,
- Maintenance personnel to perform stoppage, checks, and re-pumping,
- BWA to reach out the public.

VII. Emergency contacts

1. Site management**:** Name: ----------, Land line: ----------, mobile: ----------
2. Maintenance personnel: Name: ----------, Land line: ----------, mobile: ----------
3. BWA quality inspection department: Name: ----------, Land line: ----------, mobile: ----------
4. MOB's Mayor Office: Name: ----------, Land line: ----------, mobile: ----------
5. Testing laboratory: Name: ----------, Land line: ----------, mobile: ----------

VIII. Laboratory checks

Water quality	**Test**
Organoleptic	Taste, smell, color
Chemical	pH, Temperature, chemical constituents, residual chlorine, pesticides, heavy metals, as required by the national drinking water standards
Microbiological	Total plate counts, T. coliforms, Fecal coliforms, E. Coli, protozoa, Clostridium, as required by the national drinking water 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

Project Proponent: ……
Project Name:……
Visit Date:……
Participants:……

	Impact to check	Yes	No	Remarks	Safeguards/ Mitigation measures carried on
1	Disturbance to social daily life				
2	Disturbance to economic daily life				
3	Water Services problems				
4	Sewerage Services problems				
5	Solid Waste Services problems				
6	Traffic problems (hindering, detours, closure etc.)				
7	Pedestrians' safety endangered				
8	Landscape / aesthetic element/s deteriorated				
9	Natural Resources negatively affected				
10	Biodiversity and Wildlife threatened				
11	Dust spreading out				
12	Odor emission				
13	Noise/alarm generation				
14	Workers safety and health considered				
15	Workers commitment to OHS (vests, gloves, Heavy Duty wearing apparel etc.)				
16	Working machines suitability				
17	Improper storage of materials and equipment				
18	Security breaching at the working site				
19	Additional Impact (please add here) …… ……				

20. Comments: ……..

21. Recommendations: ……

Environmental and Social Officer's Signature……
Date……

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

The Environmental and Social Officer (ESO) is expected to be internally assigned from BWA, 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 BWA 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 BWA'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 BWA 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 BWA'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;
- Prepare/update ESIA/ESMP; Project construction- and operational-phase ESMP supervision and monitoring; and other subject matter as needed; and

II. Minimum Requirements

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

- An advanced degree in social and environmental or 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 water 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. Prevent and minimize the impacts of quarrying, earth borrowing, piling and building of temporary construction camps and access roads on the biophysical environment.
5.7. Upon discovery of remains of archeological or historical importance during the, immediately report to the Client (BWA and MOB).
5.8. Prohibit workers from exploiting natural resources: hunting, fishing, etc.
5.9. Prohibit the transport of firearms and/or third parties in Project-related vehicles.
5.10. Implement soil erosion control measures.
5.11. Ensure garbage, sanitation and drinking water facilities are provided in construction camps.
5.12. Ensure that, local materials are used in lieu of transporting foreign materials, whenever possible.
5.13. Ensure public safety and avoid traffic accidents, and comply with speed limits.
5.14. Ensure enough demarcation to any trench, pit, excavation, hole or other hazardous feature.
5.15. 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 inspector 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 camp 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 camp 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. Where temporary dump sites for clean excavated material are necessary, they shall be located in areas, approved by the MOB, where they will not result in supplemental erosion.

15. 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.

Quarries and Borrow Areas

16. The Contractor shall obtain appropriate licenses/permits from relevant authorities to operate quarries or borrow areas.

17. For new extraction sites: located not less than 1km from settlement areas, archaeological, and cultural sites, wetlands or any other valued ecosystem component. Not located in water bodies, or adjacent to them, as well as to springs, and wells. Not located in or near forest reserves, natural habitats or national parks.

18. Shall have clearly demarcated and marked boundaries to minimize vegetation clearing and safety hazards for third parties.

19. The licensing/permitting for operating quarries, borrow areas, and new extraction sites shall comply with the World Bank Safeguard Policy OP/BP 4.12.

20. Stockpile areas shall be located where trees can act as buffers to prevent dust pollution, and generally at a distance from human settlements. Deposition of excess material shall be approved by MOB.

Rehabilitation of Work and Preparation Sites

21. 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.

22. Reinstate natural drainage patterns where they have been altered or impaired.

23. Remove toxic materials and dispose of in designated sites. Backfill with soils free of foreign material.

24. Ensure reshaped land is returned stable, and adequately drained.

25. Minimize erosion by wind and water both during and after the process of reinstatement.

26. Compacted surfaces shall be deep ripped to relieve compaction unless dictated otherwise.

Management of Water Needed for Construction Purposes

27. 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.

28. 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.

29. Site spoils/temporary stockpiles shall be located away from the drainage system and surface run off.

Traffic Management and Community Safety

30. 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.

31. Upon the completion of civil works, all temporary access roads shall be ripped and rehabilitated.

32. Measures shall be taken to suppress dust emissions generated by Project traffic.

33. Maximum speed limits for any construction-related traffic shall not exceed 50km/h in inhabited areas.

Damage to Property

34. 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.

35. 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)

36. The Contractor shall prepare an HSE-MP or CEMP within 6 weeks of signing the Contract. The Contractor's EHS-MP/ CEMP shall provide:

- 36.1. a description of procedures and methods for complying with environmental management conditions, and any specific conditions specified in an ESMP;
- 36.2. a description of specific mitigation measures that will be implemented in order to minimize adverse impacts;
- 36.3. a description of all planned monitoring activities and the reporting thereof;
- 36.4. The internal organizational, management and reporting mechanisms put in place for such.

37. The Contractor's HSE-MP/ CEMP will be reviewed and approved by BWA before start of the works.

HSE Reporting

38. 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:

38.1. HSE management actions/measures taken, including approvals sought from local or national authorities;
38.2. Problems encountered in relation to HSE aspects (incidents, including delays, cost consequences, etc. as a result thereof);
38.3. Non-compliance with contract requirements on the part of the Contractor;
38.4. Changes of assumptions, conditions, measures, designs and actual works in relation to HSE aspects; and
38.5. Observations, concerns raised and/or decisions taken with regard to HSE management during site meetings.

39. 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

40. 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 BWA.

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 biding 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 ESMF 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.

<u>The following form will be used for the environmental/ social note:</u>

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 Completive Bids

ESMF Compliance Penalty		
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 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 BWA/BSA 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

ESMF Compliance Penalty		
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.

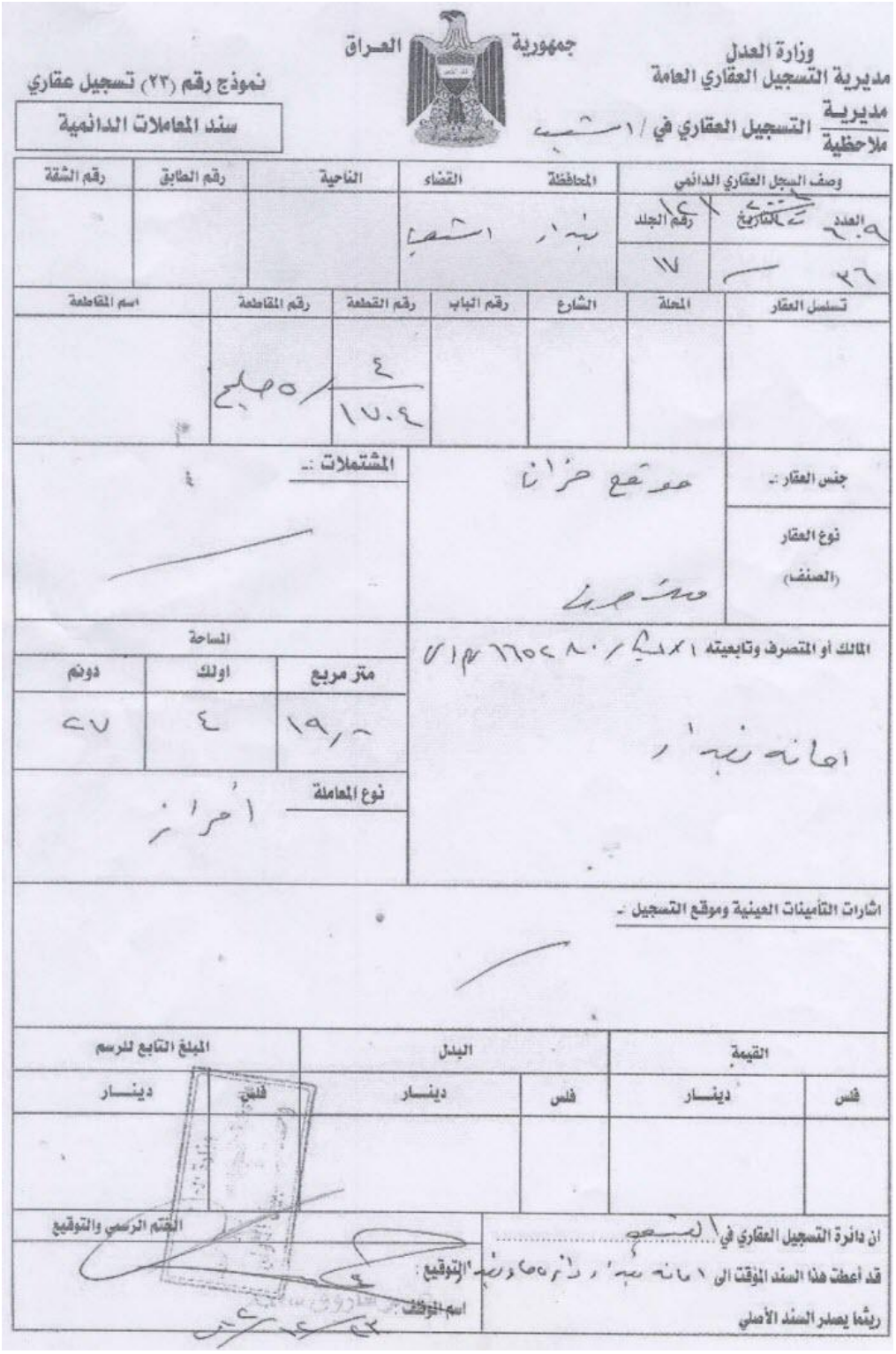
Deduction for N= [percentage of deduction of (N-1) + (0.5* percentage of deduction of (N-1)]* contract Amount.

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: Land plot register and transfer letter for R2 reservoir

A. official registration of the land plot (record number 23). The record refers to the land plot number 4/1704 in Al-Sha'ab sub-district, with a total area of 27 Iraqi donum, 4 olks, and 19 meters



وزارة العدل
مديرية التسجيل العقاري العامة
مديرية التسجيل العقاري في / الشعب
ملاحظية

جمهورية العراق

نموذج رقم (٢٣) تسجيل عقاري
سند المعاملات الدائمية

وصف السجل العقاري الدائمي					رقم الشقة
العدد ٢٣ التاريخ ٢٦	رقم الجلد ١٧	المحافظة بغداد	القضاء الشعب	الناحية	رقم الطابق

تسلسل العقار	المحلة	الشارع	رقم الباب	رقم القطعة	رقم المقاطعة	اسم المقاطعة
				٤/١٧٠٤	٥ صليخ	

جنس العقار :- موقع خزان

نوع العقار (الصنف) صناعي

المشتملات :-

المالك أو المتصرف وتابعيته امانة بغداد

المساحة		
متر مربع	اولك	دونم
١٩,٠	٤	٢٧

نوع المعاملة اقرار

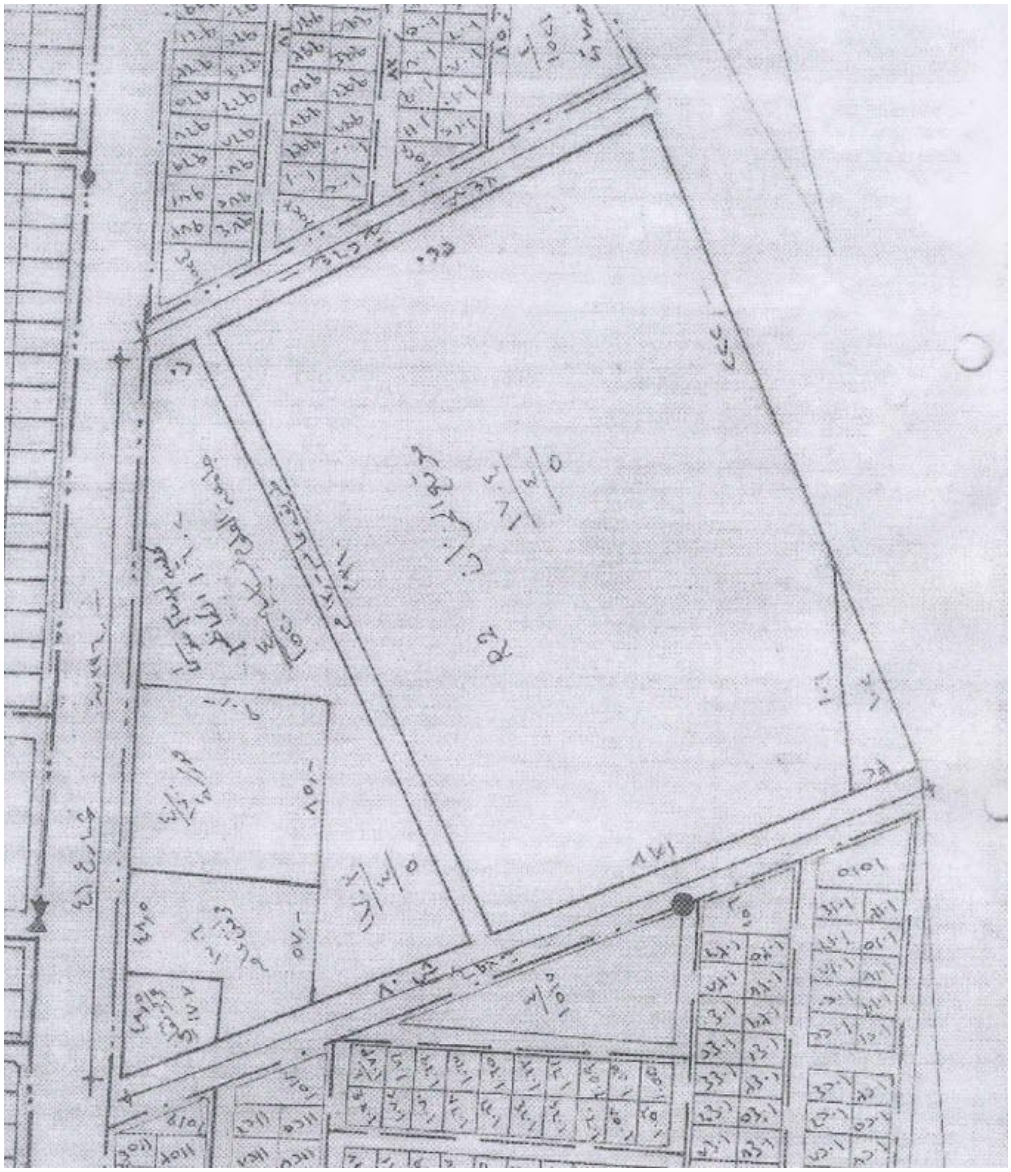
اشارات التأمينات العينية وموقع التسجيل :-

القيمة		البدل		المبلغ التابع للرسم	
فلس	دينار	فلس	دينار	فلس	دينار

ان دائرة التسجيل العقاري في الشعب
قد أعطت هذا السند المؤقت الى امانة بغداد / دائرة ماء الرشيد
ريثما يصدر السند الأصلي

الختم الرسمي والتوقيع

التوقيع :
اسم الموظف



B. Approval letter (no. 2/145941, date: 19 November 2007) from MOB/BWA to the real estate department of Al-Adhamiya district for official registration of R2 for BWA. Approval by the Mayor of Baghdad was dated back on 23 October 2007

بسم الله الرحمن الرحيم

العدد/٢/١٤٥٩٤١
التاريخ / ١٩ / ١١ / ٢٠٠٧

امانة بغد اد
دائرة ماء بغداد
الحقوق

مديرية التسجيل العقاري في الاعظمية

م/ القطعة المرقمة ٦/١٥٢٠/٥/صليخ

حصلت موافقة السيد امين بغداد بتاريخ ٢٠٠٧/١٠/٢٣ على تخصيص القطعة المرقمة اعلاه والعائدة ملكيتها الى امانة بغداد لصالح دائرة ماء بغداد لغرض انشاء خزان الماء R2 .
للتفضل بالاطلاع وتأشير ذلك في سجلاتكم واعلامنا .

... مع التقدير ...

المرفقات /
موافقة السيد امين بغداد

صادق محمود الشمري
المدير العام
٢٠٠٧/١١/١٧

نسخه منه الى/
مكتب امين بغداد / للتفضل بالاطلاع ... مع التقدير
مكتب الوكيل الفني / للتفضل بالاطلاع ... مع التقدير
دائرة التصاميم / لتأشير ذلك في السجلات والخرائط الموجودة لديكم ... مع التقدير
دائرة العقارات / للعلم ... مع التقدير
مكتب المدير العام
قسم التصاميم / مذكرتكم المؤرخة في ٢٠٠٧/١١/٧
قسم الادارية والمالية
شعبة الحقوق / مع الاوليات
الاوراق

عائدة ١١/١٣

C. Official letter (no. 3908, date: 19 March 2017) from BWA to MOB to communicate with Al-Sha'ab Municipality for the urgent evacuation of R2 land

بسم الله الرحمن الرحيم

العدد : ٣٩٠٨
التاريخ : ١٤ / / هـ
٢٠١٧/٢/٩ م

جمهورية العراق
أمانة بغداد - دائرة ماء بغداد
قسم التصاميم

الى / مكتب وكيل امانة بغداد للشؤون الفنية

م / استغلال الارض المخصصة لخزان R2

الحاقاً بكتابنا المرقم ٣٢٨٦ في ٢٠١٦/٢/١٧ المتضمن رفع كافة التعارضات من مساحة الارض العائدة الى امانة بغداد والمخصصة للخزان الارضي R2 المقترح تنفيذه على قرض البنك الدولي .
يرجى التفضل بالاطلاع والموافقة على الايعاز الى دائرة بلدية الشعب بضرورة الاسراع برفع كافة التجاوزات على الموقع مع ابقاء الصبات الكونكريتية حول محيط الموقع حالياً لضمان عدم التجاوز عليه مرة ثانية واعلامنا لغرض استلام الموقع .

مع التقدير.

ر . مهندسين
عمار موسى كاظم
المدير العام / وكالة
١٥ / ٣ / ٢٠١٧

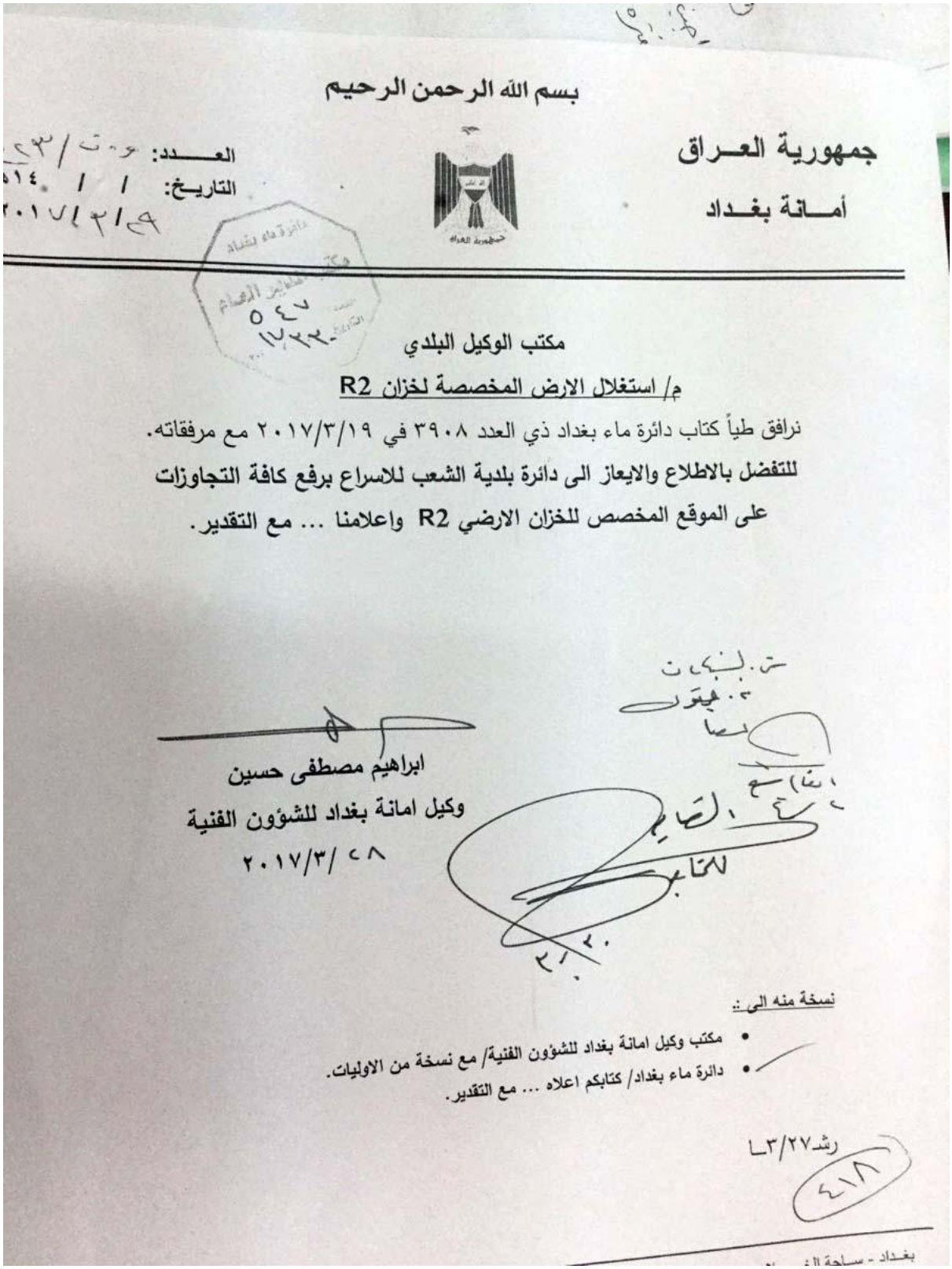
نسخة منه الى /
- دائرة بلدية الشعب / للتفضل بالاطلاع والايعازباللازم .....مع التقدير .
- مكتب المدير العام .
- مكتب المعاون الفني / الاول .
- قسم التصاميم / مع الاوليات .
- الاوراق .

سهام ٢٠١٧/٣/٨

Baghdad - Khilany square Al-Kholfaa street
Tel.: (+964) 8189010 (9 lines)
E-mail: maabaghdad@bm.gov.iq

بغداد - ساحة الخلاني - شارع الخلفاء
هاتف : ٨١٨٩٠١٠ (٠٩٦٤) بدالة ٩ خطوط
بريد الكتروني : E-mail: maabaghdad@bm.gov.iq

D. Official letter (dated: 29 March 2017) from MOB to MOB secretary general for municipal affairs for the urgent evacuation of R2 land



بسم الله الرحمن الرحيم

جمهورية العـراق
أمـانة بغـداد

العـــدد:
التاريـخ:

مكتب الوكيل البلدي

م/ استغلال الارض المخصصة لخزان R2

نرافق طياً كتاب دائرة ماء بغداد ذي العدد ٣٩٠٨ في ٢٠١٧/٣/١٩ مع مرفقاته.

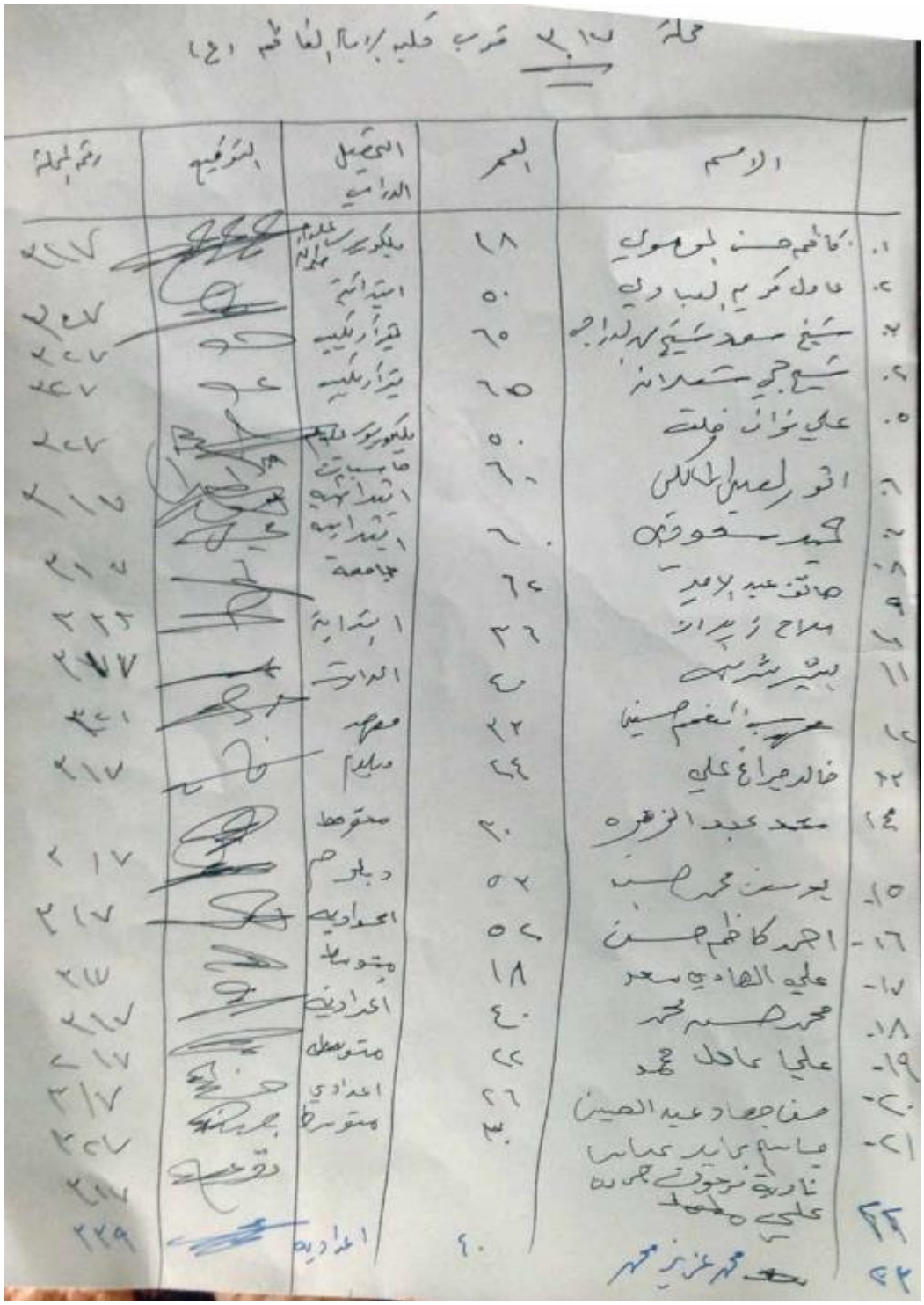
للتفضل بالاطلاع والايعاز الى دائرة بلدية الشعب للاسراع برفع كافة التجاوزات على الموقع المخصص للخزان الارضي R2 واعلامنا ... مع التقدير.

ابراهيم مصطفى حسين
وكيل امانة بغداد للشؤون الفنية
٢٠١٧/٣/ ٢٨

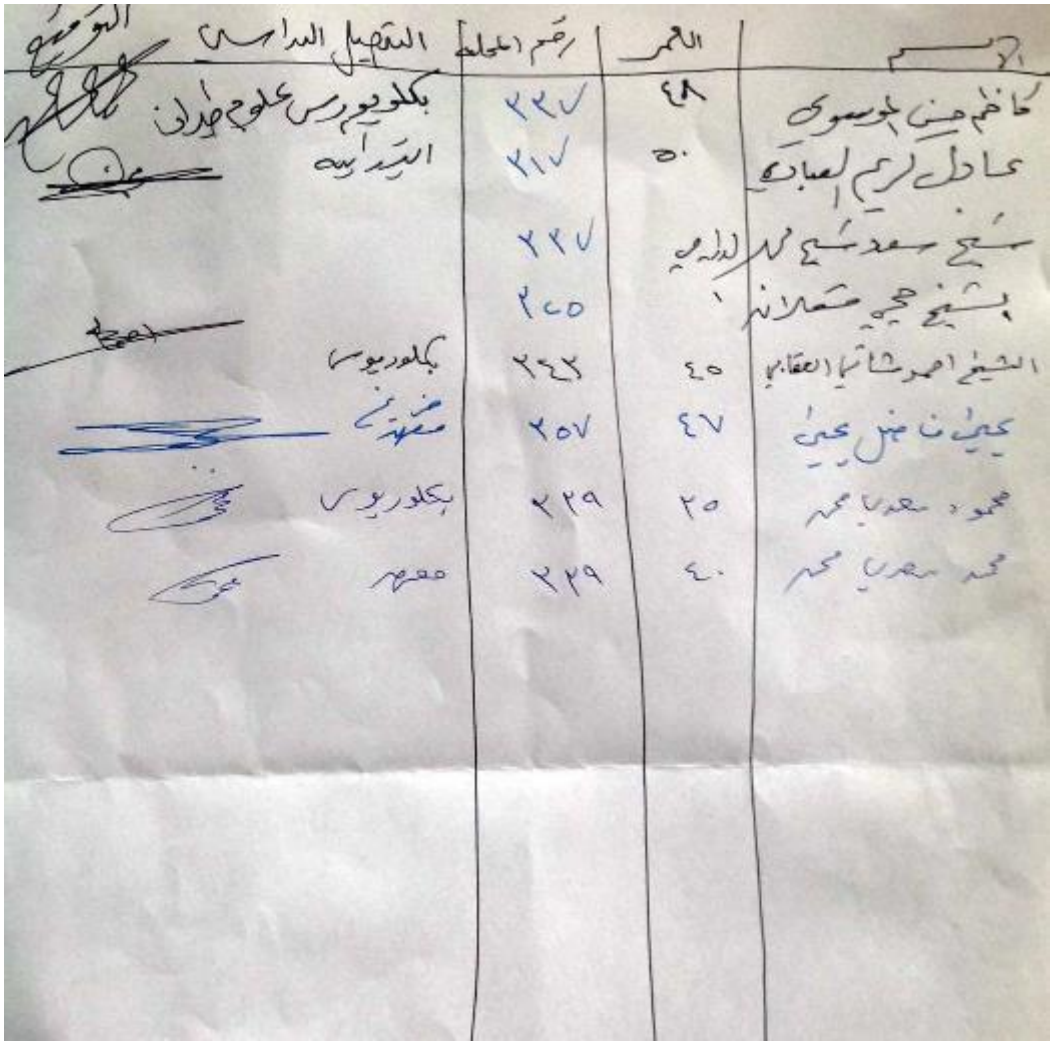
نسخة منه الى :-

- مكتب وكيل امانة بغداد للشؤون الفنية/ مع نسخة من الاولويات.
- دائرة ماء بغداد/ كتابكم اعلاه ... مع التقدير.

Annex VII: List of attendees – Public consultation – 7 January, 2016



	الاسم	العمر	التحصيل الدراسي	التوقيع	رقم الجلة
١.	كاظم حسن [illegible]	٤٨	[illegible]	[illegible]	٢١٧
٢.	عادل كريم [illegible]	٥٠	ابتدائية	[illegible]	٢٤٧
٣.	شيخ سعد شيخ [illegible]	٦٥	[illegible]	[illegible]	٢٤٧
٤.	شيخ جبر شعلان	٦٥	[illegible]	[illegible]	٢٤٧
٥.	علي نوان خلف	٥٠	[illegible]	[illegible]	٢٤٧
٦.	[illegible]	٦٠	[illegible]	[illegible]	٢١٧
٧.	[illegible]	٦٠	[illegible]	[illegible]	٢١٧
٨.	[illegible]	٦٠	جامعة	[illegible]	٢١٧
٩.	[illegible]	٦٤	[illegible]	[illegible]	٢٢٢
١٠.	[illegible]	٣٦	ابتدائية	[illegible]	٢٧٧
١١.	[illegible]	٤٠	[illegible]	[illegible]	٢٤١
١٢.	[illegible]	٤٢	[illegible]	[illegible]	٢١٧
١٣.	خالد مراع علي	٤٤	[illegible]	[illegible]	
١٤.	[illegible]	٢٠	[illegible]	[illegible]	٢١٧
١٥.	[illegible]	٥٢	[illegible]	[illegible]	٢١٧
١٦.	احمد كاظم حسن	٥٧	[illegible]	[illegible]	٢٤٧
١٧.	علي الهادي سعد	١٨	[illegible]	[illegible]	٢٤٧
١٨.	[illegible]	٤٠	[illegible]	[illegible]	٢١٧
١٩.	[illegible]	٢٢	[illegible]	[illegible]	٢١٧
٢٠.	[illegible]	٢٦	[illegible]	[illegible]	٢٤٧
٢١.	[illegible]	٣٠	[illegible]	[illegible]	٢٤٧
٢٢.	[illegible]			[illegible]	٢٤٧
٢٣.	[illegible]	٤٠	[illegible]	[illegible]	٢٢٩



الاسم	العمر	رقم المحلة	التوقيع
كاظم حسن الموسوي	٤٨	٢٢٧	
عادل كريم الصباغ	٥٠	٢١٧	
شيخ سعد شيخ محمد		٢٢٧	
الشيخ حميد حسن		٢٠٥	
الشيخ احمد شاتيا العقابي	٤٥	٢٤٢	
عبد الحسين	٤٧	٢٥٧	
محمود سعد محمد	٢٥	٢٢٩	
محمد سعد محمد	٤٠	٢٢٩	

Annex VIII: 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.

Date		**Place of Registration**			
Contact Information/Personal Details					
Name		**Gender**	* Male * Female	**Age**	
Home Address					
Place					
Phone no.					
E-mail					
Complaint/Suggestion/Comment/Question Please provide the details (who, what, where, and how) of your grievance below: If included as attachment/note/letter, please tick here:					
How do you want us to reach you for feedback or update on your comment/grievance?					

FOR OFFICIAL USE ONLY

Registered by: (Name of Official Registering Grievance)	
Mode of Communication: Note/Letter E-mail Verbal/Telephonic	
Reviewed by: (Names/Positions of Officials Reviewing Grievance)	
Action Taken:	
Whether Action Taken Disclosed:	Yes No
Means of Disclosure:	

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 "سرّي" فوق الاسم مباشرة، مع جزيل الشكر.

التاريخ		مكان تسجيل الشكوى			
معلومات عامة/ التفاصيل الشخصية					
الاسم		الجنس	ذكر انثى	السن	
عنوان الاقامة					
المكان					
رقم الهاتف					
البريد الالكتروني					
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 ☐					
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	