Submitted To:

Republic of Iraq
Ministry of Construction and Housing and Municipalities and Public works

Att: Hussein Jasim Kadhum - RBD Director General,
GCFI PMT Manager
Ministry of Construction, Housing,
Municipalities and Public Works,
Roads and Bridges Directorate (MOCHMPW, RBD)
Baghdad, Iraq
E-mail: *iodpproject@gmail.com*

Presented By:

EcoConServ
ENVIRONMENTAL SOLUTIONS

EcoConServ Environmental Solutions
3 El-Mansour Mohamed St., Zamalek
Zamalek, Cairo, Egypt 11211
Tel: + 20 2 27359078
Fax: + 20 2 2736 5397
E-mail: genena@ecoconserv.com
URL: www.ecoconserv.com

ITREC Draft Project ESIA Report

March 2026

Document History

Date	Version	Issued by	Revision Description	Reviewed by	Approved by
21/02/2026	1.0	EcoConServ	Issue for Client Review		
25/03/2026	2.0	EcoConServ	Addressing feedback		

Table of Contents

List of Tables

List of Figures

List of Acronyms

Acronym	Definition
AoI	Area of Influence
BMP	Biodiversity Management Plan
Bsh	Semi-arid steppe climate (Köppen)
BWh	Hot desert climate (Köppen)
C-ESMP	Construction Environmental and Social Management Plan
CH	Critical Habitat
CHS	Community Health and Safety
CO	carbon monoxide
COSIT	Central Statistical Organization of Iraq
Csa	Warm temperate climate with dry summers (Mediterranean) (Köppen)
CSO	Central Statistical Organization of Iraq
CSOs/NGOs	Civil society organizations / non-governmental organizations
DJFM	December–March (winter months)
DTM	Digital Terrain Model
E&S	Environmental and Social
EEMP	World Bank sponsored Iraq Emergency Environmental Management Project
EHS	Environmental, Health, and Safety
EN	Endangered (IUCN Red List category)
EODP	Emergency Operation for Development Project
ERW	Explosive remnants of war
ESCP	Environmental and Social Commitment Plan
ESF	World Bank Environmental and Social Framework
ESF/ESSs	Environmental and Social Framework / Environmental and Social Standards
ESIA	Environmental and Social Impact Assessment
ESMoP	Environmental and Social Monitoring Plan
ESMP	Environmental and Social Management Plan
ESSs	Environmental and Social Standards
FAO	Food and Agriculture Organization of the United Nations
FGDs	Focus Group Discussions
GBV	Gender-Based Violence
GDRB	General Directorate of Roads and Bridges
GIIP	Good International Industry Practice
GoI	Government of Iraq
GRM	Grievance Redress Mechanism
GRS	World Bank Grievance Redress Service
IDPs	Internally Displaced Persons
ILO	International Labour Organization
IMOS	Iraqi Marshlands Observation System
IPF	Investment Project Financing
IRA	Internationally Recognized Area(s)
KBA	Key Biodiversity Area
KIIs	Key Informant Interviews
Leq	Equivalent continuous sound level

LMP	Labor Management Procedures
LRP	Livelihood Restoration Plan
M&E	Monitoring and Evaluation
MH	Modified Habitat
MICS	Multiple Indicator Cluster Survey
MM	million cubic meters
MOCHMPW	Ministry of Construction, Housing, Municipalities and Public Works
MoCHPM	Ministry of Construction, Housing, and Public Municipalities
MoEn	Ministry of Environment
MoT	Ministry of Transport
MoT/RBD	Ministry of Transport / Roads and Bridges Directorate
MPA	Multiphase Programmatic Approach
NH	Natural Habitat
NMVOCs	Non-methane volatile organic compounds
NOx	Nitrogen oxides
O&M	Operation and Maintenance
OHS	Occupational Health and Safety
OIPs	Other Interested Parties
OPC	Oil Pipelines Company
PA	Protected Area(s)
PAPs	Project-Affected People
PM2.5	Particulate matter ≤2.5 μm
PMT	Project Management Team
PPP	Public-Private Partnership
R9B	R9B road rehabilitation segment (subcomponent 3.5)
RAP	Resettlement Action Plan
RAS	Recirculating Aquaculture Systems
RBD	Roads and Bridges Directorate
RoW	Right-of-Way
RP	Resettlement Plan
RP/LRP	Resettlement Plan / Livelihood Restoration Plan
SDS	Sand and dust storms
SEA	Sexual Exploitation and Abuse
SEA/SH	Sexual Exploitation and Abuse / Sexual Harassment
SEP	Stakeholder Engagement Plan
SH	Sexual Harassment
SP	Poorly graded sand (USCS)
SW/SC	Well-graded sand with clay (USCS)
TOT	Training of Trainers
UIL	UNESCO Institute for Lifelong Learning
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UXO	Unexploded ordnance
VU	Vulnerable (IUCN Red List category)
WBG	World Bank Group
WHO	World Health Organization

WMO	World Meteorological Organization
WQI	Water Quality Index

Executive Summary

Introduction

The Environmental and Social Impact Assessment (ESIA) for the ITREC Project provides a structured evaluation of potential environmental and social risks and impacts associated with the ITREC sub-projects, with a focus on construction and subsequent operation. The ESIA has been prepared for the Government of Iraq through the Roads and Bridges Directorate to support informed decision-making and to ensure that the ITREC sub-projects' environmental and social performance is managed in accordance with applicable Iraqi requirements and the World Bank Environmental and Social Framework (ESF), together with relevant World Bank Group Environmental, Health, and Safety (EHS) Guidelines.

The ESIA identifies measures to avoid, minimize, mitigate, and manage adverse impacts while strengthening positive outcomes where practicable. It also defines the required management and monitoring arrangements, including mitigation commitments, monitoring measures, institutional responsibilities, and stakeholder engagement processes to support effective implementation across the ITREC sub-project lifecycle.

Project Description

The ITREC Project includes strategic road investments intended to improve road infrastructure service delivery and corridor performance in Iraq through targeted new construction, rehabilitation, and performance-based maintenance. The Project is structured into components; the ESIA focuses primarily on the corridor investments under Component 1. This component includes the carrying out of the construction on Expressway No. 2 and rehabilitation and maintenance on Expressway No. 1 through:

Subcomponent 1.1. Design, build and maintenance (as PBC) of Expressway No. 2 (100 km road corridor between Baghdad and Samarra): This subcomponent will finance the design, construction and maintenance of a 100 km greenfield road from Baghdad to Samarra, out of the 504 km greenfield Expressway No. 2 corridor from Baghdad to the Turkish border. A Performance-Based Contract (PBC) will be implemented. Includes (i) the construction of a 10 km greenfield feeder road, connecting areas within the vicinity of Samarra and (ii) investments in road safety design engineering through a multi-stage road safety audit process, with specific attention to work zone safety protocols, speed management strategies, and mitigation of roadside crash hazards through compliant barrier systems and safe access provisions. The design will include ITS and pilot tolling system. This subcomponent also includes design and rollout of fiberoptics (FO) infrastructure along highways by adopting a "dig once" policy (where appropriate). The FO infrastructure will support the ITS under the project, while utilizing the surplus capacity for national and metropolitan telecom wholesale services.

Subcomponent 1.2. Rehabilitation and maintenance of Expressway No. 1 (E1-R9B) as a PBC: This component will finance a PBC to rehabilitate and maintain an 86 km segment of the existing Expressway No. 1 (E1-R9B and other priority segments). It is considered a key transportation corridor in Iraq. The safety performance of the corridor under the PBC will be addressed by linking contractor payments to measurable performance outcomes during the design, operation, and maintenance phases, incentivizing performance through safe engineering practices, including multi-stage safety audits, enhanced work zone safety protocols, and targeted interventions for speed management and roadside crash hazard mitigation including emergency care services.

Subcomponent 1.3. Rehabilitation of priority corridors under the KRG: This subcomponent will be implemented under PBC. It comprises rehabilitation of two segments totaling approximately 100 km, including the Sulaymaniyah–Chamchamal–Kirkuk Road (about 50 km, links to Expressway No. 2) and the Girsheen–Suhaila Road upgrade as well as Girsheen Interchange (about 22 km, Duhok).

Institutional and Legal Framework

The sub-project will adhere to Iraqi legislations (across Federal and Kurdistan Region of Iraq) and WB ESSs as well as any relevant international conventions and treats.

Federal Iraqi Policies, Laws, and Regulations

- **Environmental Assessment and Protection**: **Law No. 27 (2009)**: environmental protection and EIA requirements; core legal basis for ESIA compliance.
- **Air Quality**: **Regulation No. 471 (2012)** and **Regulation No. 4 (2012)**: ambient air quality protection and emissions monitoring/control.
- **Noise**: **Law No. 41 (2015)** and **Law No. 21 (1966)**: noise control and permissible limits, including construction and operational traffic noise.
- **Water Resources and Public Health**: **Law No. 50 (2008)**, **Public Health Law No. 89 (1981, as amended 2001)**, and **River Protection Instrument No. 25 (1967)**: water protection, discharge controls, and public health safeguards.
- **Waste and Hazardous Materials**: **National Instruction No. 3 (2015)**: hazardous waste generation, handling, transport, and treatment/disposal.
- **Cultural Heritage**: **Law No. 55 (2002)**: antiquities/heritage protection; chance finds and archaeological resources.
- **Labor and Working Conditions**: **Labor Law No. 37 (2015)**: worker rights and working conditions applicable to contractors and the workforce.
- **Occupational Health and Safety**: **Instructions No. 12 (2016)** and **Law No. 6 (1988):** OHS requirements and enforcement.
- **Land Acquisition and Compensation**: **Law No. 12 (1981):** expropriation for public benefit and compensation/entitlements.

Kurdistan Region of Iraq Policies, Laws, and Regulations

- **Environmental Assessment and Protection:** KRG Environmental Protection and Improvement Law No. 8 (2008): environmental protection framework in KRI, including

requirements for environmental permitting, compliance monitoring, and enforcement by the Environmental Protection and Improvement Board (EPIB).

- **Air Quality:** KRG Instruction No. 2 on Ambient Air Quality (2011): ambient air quality standards and compliance requirements applicable in KRI.
- **Noise:** Noise Limits Instruction No. 1 (KRG) (2011): noise limits and permissible thresholds applicable to sensitive receptors in KRI, including requirements relevant to construction noise.
- **Cultural Heritage:** KRG Cultural Heritage Protection Law No. 5 (2021): archaeological clearance requirements and procedures for chance finds and cultural heritage protection during project implementation in KRI.
- **Roads and Right-of-Way:** Public Roads Law No. 35 (KRG) (2002): requirements governing road construction/rehabilitation activities and right-of-way management applicable in KRI.

Environmental and Social Standards (ESS)

Table 0-1: World Bank ESS Relevance to the ITREC Project

ESS	Relevance	Justification
ESS1: Assessment and Management of Environmental and Social Risks and Impacts	Relevant	ESS1 is applicable to all World Bank-financed projects. For the ITREC Project, the ESIA will assess construction and operation risks across the area of influence and apply the mitigation hierarchy to address material risks associated with greenfield earthworks, structures, utilities interfaces, borrow/material sources, and traffic operations.
ESS2: Labor and Working Conditions	Relevant	The ITREC Project will require a sizeable construction workforce and multiple contractors/subcontractors. Key risks include inadequate working conditions, OHS incidents (traffic interface, heavy equipment, excavations, asphalt works), labor influx–related pressures, SEA/SH risks, child labor risks within subcontracting chains, and worker accommodation risks where camps are used.
ESS3: Resource Efficiency and Pollution Prevention and Management	Relevant	Construction is expected to generate dust, emissions, noise/vibration, wastewater from sites/camps, and hazardous and non-hazardous wastes. Risks include spills from fuels/oils, asphalt/bitumen handling, and improper waste disposal. Operation will increase vehicle emissions, operational noise, and routine maintenance wastes.
ESS4: Community Health and Safety	Relevant	Major risks relate to construction traffic and public road interfaces, increased accident risk, temporary access restrictions, and nuisance (dust/noise). During operation, traffic and road safety risks are central (speed, crossings, interchanges, service areas). Community exposure to construction hazards and emergency events (fires, spills, crashes) will also be assessed, including risks to vulnerable receptors (schools, markets, clinics, densely settled areas).
ESS5: Land Acquisition, Restrictions on Land Use and Involuntary Resettlement	Relevant	The ITREC Project is expected to require permanent land acquisition for the corridor and associated facilities and temporary land take for construction areas, detours, camps, and materials handling. This may cause physical and/or economic displacement, including loss of agricultural land and impacts on livelihoods, businesses, and access to

		assets/services. The ESIA will define the risk profile and key sensitivities that drive displacement and compensation needs.
ESS6: Biodiversity Conservation and Sustainable Management of Living Natural Resources	Relevant	Greenfield sections may fragment habitats and affect natural or modified habitats, including vegetation clearance, disturbance (noise/light), and wildlife movement constraints. The ESIA will assess biodiversity sensitivities in the corridor, including any proximity to protected areas, key biodiversity areas, wetlands, or other sensitive ecosystems, and identify avoidance and minimization opportunities.
ESS7: Indigenous Peoples / Historically Underserved Traditional Local Communities	Not relevant (expected)	Indigenous Peoples as defined under ESS7 are not expected to be present in the Project area of influence. This will be confirmed through baseline work and engagement during the ESIA.
ESS8: Cultural Heritage	Relevant	The ITREC Project crosses areas with known and potential cultural heritage sensitivity. Risks include direct impacts from earthworks and structures, indirect impacts from vibration and access changes, and chance finds during excavation. The ESIA will identify known cultural heritage sites within the area of influence and define measures to avoid or minimize impacts and manage chance discoveries.
ESS9: Financial Intermediaries	Not relevant	The Project is not expected to be implemented through a financial intermediary arrangement requiring ESS9.
ESS10: Stakeholder Engagement and Information Disclosure	Relevant	The ITREC Project affects multiple communities along the corridor and at access/feeder connections. Stakeholder engagement is required to identify location-specific issues (land impacts, access severance, community safety hotspots, vulnerable groups) and to ensure disclosure and feedback mechanisms are accessible throughout preparation and implementation.

International Conventions and Treaties

- Basel Convention on the Control of Trans-Boundary Movements of Hazardous Wastes and their Disposal
- Stockholm Convention on Persistent Organic Pollutants (POP)
- UN Convention on Biological Diversity (UNCBD)
- UN Convention to Combat Desertification (UNCCD)
- Ramsar Convention on Wetlands
- UNESCO World Heritage Convention
- United Nations Framework Convention on Climate Change (UNFCCC)

Summary of Impacts and Mitigation Measures

This section summarizes the ESIA impact analysis and the corresponding mitigation measures. Impact significance is evaluated by combining the environmental value/sensitivity of each receptor or resource with the magnitude of the project-induced change representing the effect results from the interaction of impact magnitude and receptor sensitivity. Table 0-2 below summarizes the ITREC sub-projects main impacts and mitigation measures.

Institutional Arrangements

The Project will be implemented by the appointed contractors under the overall responsibility of MoCHMPW, acting through RBD as the lead implementing authority. A PMT shall be maintained under the MoCHMPW/RBD implementation arrangement to support Project implementation, including management of environmental, social, health and safety (ESHS) risks and impacts across both the Federal Iraq and KRG sub-projects. The PMT shall be supported by a Project Management Consultant (PMC) at the coordination and systems level, while Engineering Supervision Consultants (ESCs) / Resident Engineers shall provide day-to-day field-level supervision of contractors' ESHS performance. For the KRG sub-projects, implementation shall be undertaken under the overall Project implementation arrangement led by MoCHMPW/RBD/PMT, in close coordination with the relevant KRG authorities, including the Ministry of Construction and Housing, GDRB, and other competent regional entities, as applicable. Contractors shall be required to maintain qualified environmental, social, and health and safety staffing and to prepare contract-specific environmental and social management documentation, including a Contractor Environmental and Social Management Plan (C-ESMP) and other relevant thematic plans. Civil works shall not commence until the required staffing arrangements and management plans have been reviewed and formally cleared through the established Project implementation and supervision arrangements.

Table 0-2: Summary of Impacts and Mitigation Measure

Receptor / Aspect	Impact	Impact Significance	Mitigation Measures
Pre-construction and Construction Phase			
Air Quality	Fugitive dust and diesel exhaust from earthworks and pavement works, material	**Moderate**	– Water spraying of dust-generating areas, particularly under dry conditions – Planning/siting stockpiles to minimize dust impacts considering wind direction and sensitive receptors – Minimize free-fall distance during loading/unloading to reduce dust generation – Locating stockpiles away from sensitive receptors where practicable

Receptor / Aspect	Impact	Impact Significance	Mitigation Measures
	handling/stockpiling, and construction traffic may cause localized disturbance and temporary air quality deterioration near active construction areas, access routes, and sensitive receptors. Indirect air emissions may also arise from associated facilities and material suppliers.		– On-site speed limits for trucks on unpaved surfaces (e.g., 20 km/h) and enforcement – Covering trucks transporting spoil or other dusty materials off-site before leaving the site – Wheel-washing facilities for trucks leaving the site to reduce track-out and secondary dust on public roads – Regular sweeping of public roads used by site traffic to prevent dirt accumulation and re-suspension – Minimizing idling / throttling down equipment between tasks – Prohibiting burning of waste or vegetation on site – Training equipment operators and truck drivers on air-pollution control practices – Routine/periodic washing of construction machinery and vehicles to minimize dust carryover and emissions – Establish and implement a documented preventive maintenance program to ensure construction machinery and vehicles are maintained in good working condition and to minimize exhaust emissions – Communicate activity schedules to nearby residents in advance (for high-activity/dust periods) – Erect effective barriers/screens around dusty activities or along the site boundary where receptors are close – Conduct visual inspections of exhaust emissions from construction machinery and vehicles and take corrective action where excessive smoke is observed – Carry out periodic air quality monitoring at sensitive receptor locations to confirm effectiveness of controls and check against applicable standards where monitoring is required – Phase earthworks to limit exposed soil area and duration – Complete and stabilize finished sections before opening new construction areas – Suspend or reduce dust-intensive activities during high wind conditions where dust cannot be effectively controlled – Source materials only from licensed/permitted asphalt plants, concrete batching plants, and quarries/borrow sources (where used), and maintain valid permits on file

Receptor / Aspect	Impact	Impact Significance	Mitigation Measures
			– Locate staging, refueling, and maintenance areas away from sensitive receptors where practicable – Water spraying of dust-generating areas, particularly under dry conditions – Planning/siting stockpiles to minimize dust impacts considering wind direction and sensitive receptors – Minimize free-fall distance during loading/unloading to reduce dust generation. – Locating stockpiles away from sensitive receptors where practicable
Noise and Vibrations	Construction activities may cause temporary, localized increases in noise and ground-borne vibration, resulting in disturbance to nearby residents and sensitive receptors.	**Moderate**	– Restrict construction hours to daytime periods near houses and other noise-sensitive receptors – Set and enforce site-traffic speed limits – Install temporary noise barriers (e.g., plywood or acoustic blankets) around high-noise equipment/activities near sensitive receptors – Train staff on construction best practice for noise and vibration control – Maintain equipment regularly (e.g., lubrication, tightening loose parts, replacing worn components) – Ensure all equipment is fitted with effective noise control devices (e.g., mufflers/silencers, shrouding, engine covers, vibration isolators) and keep them operational; inspect periodically – Use newer/quieter equipment and improved muffling where practicable – Shut down or throttle down machinery and vehicles when not in active use (minimize idling) – Orient noisy equipment to direct noise away from receptors – Locate stationary noisy equipment and temporary plants as far from receptors as practicable and apply temporary shielding/barriers where relocation is not feasible (e.g., generators, compressors) – Avoid transporting materials and off-site movements through community areas during nighttime hours and route construction traffic away from sensitive receptors where feasible – Use material stockpiles and site structures to screen noise to sensitive receptors – Inform nearby residences in advance about noisy activities during construction phases including timing/duration and a contact point for complaints

Receptor / Aspect	Impact	Impact Significance	Mitigation Measures
			– Conduct periodic noise and vibration monitoring to demonstrate compliance with project limits and to support complaint investigations where required – Record, investigate, and respond to complaints through the established grievance mechanism – Use low-noise/low-vibration construction methods and equipment where practicable – Fit high-noise tools (e.g., jackhammers, pavement breakers) with acoustic shrouds/attenuating shields – Schedule truck loading/unloading and material handling to minimize noise near noise-sensitive receptors – Provide workers exposed to high noise with hearing protection (earmuffs/earplugs) and enforce use – Require suppliers/contractors to ensure equipment complies with applicable noise standards – Maintain smooth temporary access/detour surfaces where used to reduce vehicle component rattling and avoid unnecessary noise – Identify structures located close to vibration-generating activities (e.g., vibratory compaction and heavy vehicle movements) and conduct visual checks for cracking/damage; modify methods if vibration-related impacts are observed – Limit use of vibratory rollers and heavy compaction equipment to where technically necessary
Soil Quality	Construction activities may cause localized soil degradation and contamination risks due to soil disturbance, topsoil loss/erosion, compaction, and spills/leaks (particularly within agricultural and orchard areas).	**Moderate**	– To avoid loss of the productive soil layer, all suitable topsoil and other material shall be saved and stockpiled separately for future reinstatement / recultivation – Stockpiles of removed topsoil shall be properly designed/shaped and managed – Temporary detention/containment measures to control silt runoff shall be provided – Soil compaction shall be reduced by keeping vehicles and machinery within defined temporary road/work boundaries – Embankment slopes shall be protected from erosion through stabilization measures and slope drainage – Disturbed areas shall be reinstated progressively after completion of works in each section

Receptor / Aspect	Impact	Impact Significance	Mitigation Measures
			– Temporary construction camps and storage areas shall be set up to minimize land take and reduce soil erosion impacts – Off-site fueling and maintenance shall be used as the default – Refueling, oil changes, and equipment maintenance shall not be undertaken near rivers, canals, drains, or other water bodies, including at or near crossing locations; all fueling/maintenance shall be limited to designated contained areas – Secondary containment (e.g., drip trays, bunds) shall be used to prevent leaks/spills during fluid handling; absorbent materials shall be available for immediate response – Vehicles and equipment shall be inspected regularly for leaks; leaks shall be repaired immediately, and leaking vehicles/equipment shall not be permitted on site – A wastewater management plan and appropriate sewage collection and disposal systems shall be implemented for camps/facilities to prevent pollution of soils and nearby water bodies – No uncontrolled discharge or drainage of contaminated water (including runoff from work areas, refueling/maintenance areas, wash water, or dewatering effluent) shall occur onto adjacent agricultural land or orchards; such water shall be contained and managed through controlled drainage and, where required, settlement/filtration prior to discharge at approved locations – No unauthorized dumping shall occur – Waste collection/storage areas shall be located on impermeable surfaces and arranged to prevent runoff from transporting contaminants to water bodies or agricultural soils (bunding and good housekeeping) – Materials designated for disposal shall be assessed and, where required, tested to confirm chemical characteristics so they can be classified and managed appropriately – Staff shall receive adequate training on environmental protection, spill prevention/response, and safe handling practices – Phase construction activities so exposed soils are limited to approved and active construction areas only, and prohibit soil disturbance outside the approved construction footprint

Receptor / Aspect	Impact	Impact Significance	Mitigation Measures
			– Restrict construction traffic and equipment movement to designated access routes and working areas; prohibit operation or parking of heavy machinery on undisturbed soil – Confine temporary access roads and staging/laydown areas to designated locations and remove and restore them following completion of works – Store excavated soil and reuse for backfilling where technically suitable; avoid unnecessary on-site storage of surplus material – Identify and isolate soil affected by spills/leaks; remove contaminated soil and dispose of it through authorized facilities, in accordance with applicable requirements – Source raw materials only from authorized/licensed quarries and borrow sources (where used) – Restore agricultural land, roadside areas, and temporarily occupied land to original or agreed conditions following completion of works
Surface and Groundwater	Construction activities may cause localized deterioration of surface water and groundwater quality due to sediment runoff, spills/leaks, improper waste/material handling, and inadequate wastewater management, particularly near canals/drains and at river crossing locations and seasonal drainage features, including localized flood/ponding	**Major**	– A Spill Management Plan and Emergency Response Plan shall be implemented, and personnel shall be trained in spill prevention and emergency response procedures. – Once detailed designs are available for Expressway No. 2 and prior to commencement of the relevant works, undertake any additional surface water and groundwater assessment required for sections involving crossings, drainage structures, or works near water environments, including, as applicable, hydraulic / hydrological assessment, drainage-capacity verification, and review of dewatering arrangements, and reflect the resulting requirements in the relevant site-specific ESIAs/ESMPs. – Discharge of any untreated water to surface water bodies (rivers, canals, drains, and channels) shall be prohibited. – Runoff control and erosion / sediment control measures shall be implemented to prevent transport of soil / sediments to canals / drains and seasonal drainage features. – Earthworks and paving activities will be planned and managed to minimize runoff and sediment transport during rainfall; exposed soils, embankments, and stockpiles will be protected and stabilized.

Receptor / Aspect	Impact	Impact Significance	Mitigation Measures
	risk where drainage structures are obstructed, diverted, or not reinstated during phased works. The significance and extent of such impacts will require further refinement, once detailed designs are available, for sections involving river crossings, canal-crossing bridges, irrigation canal crossings, culverts, drainage structures.		– Drainage systems and erosion / sediment controls will be inspected and maintained regularly. – Construction materials, and wastes shall be stockpiled and stored to prevent wash-off to surface water bodies; runoff shall be diverted away from stockpiles and work areas using drainage trenches/ditches and containment measures. – Waste shall be segregated (non-hazardous and hazardous) and stored in appropriate, labeled containers within contained areas; storage shall allow inspection and spill control. – All wastes shall be transported and disposed of through licensed/authorized contractors and approved facilities; dumping near canals/drains or river margins shall be prohibited. – Worker camps/facilities shall implement appropriate sanitation and wastewater management; sewage and septic sludge shall be collected and disposed of through authorized providers and no uncontrolled discharge shall occur to land or surface water bodies. – Refueling, oil changes, and equipment maintenance shall not be undertaken near rivers, canals, drains, or other surface water bodies all fueling/maintenance shall be limited to designated contained areas. – Fuel tanks, chemical storage, and hazardous materials storage shall be placed on impermeable surfaces within bunded/contained areas designed to retain spills and prevent runoff to surface water bodies. – Vehicles and equipment shall be inspected regularly for leaks; leaks shall be repaired immediately and leaking vehicles/equipment shall not be permitted on site. – Vehicle/equipment washing shall not occur near surface water bodies; where washing is required, it shall be conducted in controlled wash areas and wash water shall be contained and managed. – Dewatering activities shall be managed to prevent pollution: pumped water shall be contained and treated for suspended solids prior to discharge; discharge locations and discharge controls shall be defined in accordance with the detailed design and site-specific conditions, and shall be controlled to prevent erosion and impacts on canals, drains, rivers, and other nearby water environments – At river and canal crossings, work areas shall be clearly defined and controlled; in-river and near-river works shall apply sediment control measures.

Receptor / Aspect	Impact	Impact Significance	Mitigation Measures
			– Water bodies shall be kept free of construction debris; measures shall be implemented to maintain drainage/irrigation conveyance during works and prevent obstruction. – Crossings with surface water bodies and associated work areas shall be inspected routinely for evidence of erosion, elevated turbidity, oil/grease sheen, or waste accumulation.
Waste Generation and Management	Construction activities may generate non-hazardous and hazardous wastes; inadequate segregation, storage, transport, or disposal may cause localized pollution and health and safety risks. Improper waste handling may also contribute to blockage/contamination of drains and canals and localized nuisance conditions.	**Moderate**	– Prepare and implement a detailed Waste Management Plan covering all solid wastes, liquid wastes, and hazardous wastes, in consideration of the applicable local waste management system, including roles and responsibilities (Contractor, supervision, and HSE staff), a waste classification/handling table (waste type, segregation method, storage method, collection frequency, and disposal route), and estimated waste quantities – Allocate a separate bin/container for each waste type and ensure clear labeling and segregation at source – Designate waste collection and storage areas within the construction sites and ensure adequate housekeeping and access control – Ensure waste storage areas are arranged to prevent mobilization by wind/rainfall and to avoid impacts on drains/canals – Reuse excavated material where technically suitable and dispose of surplus or unsuitable material only at approved disposal locations (with documentation) – Promote the 3Rs (Reduce, Reuse, Recycle) to minimize waste generation and maximize reuse/recycling opportunities – Prohibit open burning of waste and prohibit unauthorized dumping/fly-tipping – Implement worker awareness and training on waste management, with emphasis on prevention of oil and fuel spills/leaks and proper handling of hazardous materials – Separate hazardous waste and dispose to appropriate treatment/disposal facilities – Store hazardous waste (e.g., contaminated soil, paint cans, epoxy containers, oily rags/absorbents, used filters, batteries, contaminated containers) in separate labeled containers in a controlled storage area – Implement spill response procedures, including availability of spill kits, immediate containment and cleanup, and management of contaminated absorbents/soil as hazardous waste

Receptor / Aspect	Impact	Impact Significance	Mitigation Measures
			– Ensure wastewater and septic sludge from workforce facilities are collected in septic tanks and removed through authorized providers; prohibit any uncontrolled discharge – Enforce the use of appropriate PPE and safety precautions when handling hazardous wastes and contaminated materials – Conduct routine inspections of waste storage areas and housekeeping practices, and implement corrective actions promptly for any nonconformities – Use licensed/authorized contractors for non-hazardous and hazardous wastes; transport wastes only to legally permitted/approved facilities; and maintain a waste register with records of quantities removed/disposed (including manifests/tickets/receipts and disposal certificates where applicable) – Where landmines, UXO, or ERW are identified and removed, implement site-specific handling and disposal procedures consistent with Good International Industry Practice and maintain the relevant records and supporting documentation.
Risk of Unexploded Ordinance (UXO)	Ground-disturbing works may pose landmine / UXO / ERW risks to workers and nearby communities where works extend into unverified ground, including at greenfield sections, borrow areas, temporary access roads, drainage works, and other ancillary work areas.	**Major**	– Screen all relevant work sites, access routes, and ancillary areas for landmine / UXO / ERW risk prior to commencement of any ground-disturbing works. – Obtain landmine and explosive remnants of war (ERW) clearance letters from the Ministry of Environment / Directorate of Mine Action to ensure that all work sites under the Project, and their access routes, are free of mines and ERW. – Share with the Bank each worksite clearance letter and the necessary supporting documentation demonstrating that the decontamination process has been conducted in accordance with Good International Industry Practice.
Biological Environment	Construction activities may cause localized	**Major**	– For Expressway No. 2, undertake detailed biodiversity field surveys, once detailed designs are available and well in advance of commencement of construction

Receptor / Aspect	Impact	Impact Significance	Mitigation Measures
	habitat disturbance and biodiversity impacts across the ITREC sub-projects, with higher biodiversity risk associated with greenfield Expressway No. 2 and lower biodiversity risk generally expected for the R9B segment under Expressway No. 1 and the KRI sub-projects, where works are predominantly within existing road corridors and disturbed footprints. Nevertheless, localized impacts may still occur at the Tigris and Euphrates interfaces, seasonal drainage crossings, canal / drain intersections, and other riparian or aquatic habitat features.		works, to better understand potential direct and indirect impacts and to inform the design of appropriate mitigation and management measures. – For Expressway No. 2, undertake a Critical Habitat Assessment (CHA), once detailed designs are available and prior to construction, informed by the detailed biodiversity field surveys, to confirm the presence and extent of any Critical Habitat features and to inform the design of mitigation and management measures in accordance with ESS6. – For Expressway No. 2, Based on the findings of the detailed biodiversity field surveys and the CHA, prepare a Biodiversity Management Plan (BMP) prior to construction, including site-specific requirements for river/canal crossings, responsibilities, supervision arrangements, and monitoring. – Delineate and mark vegetation clearance and work limits prior to commencing works to minimize the area cleared and prevent encroachment outside the approved footprint. – Limit vegetation clearance and land take to the minimum required, restrict all works to the approved footprint, and reinstate disturbed areas after works, including revegetation using appropriate native species with emphasis on riparian / canal-margin habitats – Maintain habitat connectivity at irrigation / drainage canal crossings and riparian interfaces by avoiding complete barriers and ensuring crossings do not obstruct movement pathways along canal margins and riparian strips. – Design and implement wildlife crossings at key movement routes, particularly where the alignment intersects riparian corridors and irrigation/drainage canals near the Tigris River, Ishaqi River and Euphrates River, using appropriately designed culverts / bridges / underpasses that can facilitate fauna passage. – Install wildlife-friendly fencing at high-risk sections, where relevant, to guide fauna toward crossing points and reduce wildlife–vehicle interactions; ensure fencing design does not trap fauna and does not obstruct drainage flow. – Minimize movement of machinery within river channels and banks and restrict in-water equipment movement to cases where it is unavoidable for structure works. – Phase crossing works to reduce the extent of simultaneous disturbance at biodiversity-sensitive locations and avoid opening multiple high-sensitivity fronts at the same time.

Receptor / Aspect	Impact	Impact Significance	Mitigation Measures
			– Implement measures to minimize turbidity and sediment disturbance during crossing works (sediment controls appropriate to the activity and location), and manage dewatering to avoid impacts on aquatic habitats. – Use erosion and sediment controls at disturbed areas, particularly near canals / drains and riparian habitats, to protect habitat quality and prevent siltation. – Reinstate disturbed riverbanks / canal margins promptly after completion of works at each location, including stabilization and revegetation using appropriate native riparian vegetation where practicable. – Implement invasive species prevention measures (cleaning of machinery / vehicles before moving between sensitive sites, control of disturbed soil/stockpiles, and prompt stabilization of disturbed areas). – Minimize night-time disturbance near river/canal crossings by restricting lighting to what is necessary for safety and directing lighting away from water bodies and riparian habitats. – Prohibit hunting / poaching and wildlife harassment by the workforce; implement a worker code of conduct, awareness training, and enforcement, with enhanced supervision for teams working near the Tigris, Ishaqi and Euphrates crossings. – Provide training for staff on biodiversity protection requirements, including avoidance of vegetation damage outside marked work limits and requirements applicable at river/canal crossings. – Prepare site-specific method statements for each river / canal crossing (including access, in-water works, dewatering if required, sediment / turbidity controls, and reinstatement). – Where Natural Habitat loss is unavoidable, implement compensation measures consistent with No Net Loss objectives through the BMP (e.g., riparian / canal margin restoration and rehabilitation measures). – If Critical Habitat is confirmed and adverse residual impacts cannot be avoided, implement additional measures to achieve Net Gain and, where required, prepare and implement offsets through a Biodiversity Offset Management Plan, consistent with applicable lender requirements.
Occupational Health and Safety (OHS)	Accidental hazards, working conditions, and site housekeeping, as	**Major**	– Implementation of a project-specific OHS Management Plan. – Mandatory site induction for all workers. – Task-specific safety training.

Receptor / Aspect	Impact	Impact Significance	Mitigation Measures
	well as transmission of communicable diseases, including high-risk activities such as works adjacent to live traffic, major lifting operations, excavation and trenching, electrical works, and work under extreme heat conditions		– Provision and enforcement of PPE. – Regular inspection and maintenance of equipment. – Safe work procedures for excavation and lifting. – Traffic control for workers near moving vehicles. – Emergency response and first aid arrangements. – Reporting and investigation of incidents and near misses. – Toolbox talks conducted regularly. – Adequate lighting at work areas. – Restricted access to high-risk zones. – Appointment of qualified HSE officers. – Monitoring compliance with safety procedures. – Disciplinary action for repeated violations. – Appointment of a full-time Health, Safety and Environment (HSE) Manager or HSE Lead for each contractor package – Maintenance of dedicated on-site HSE officer coverage for each active work front and each work shift, with authority to stop unsafe work and require corrective action – Provision of additional competent supervision for high-risk activities – Preparation of task-specific risk assessments and method statements for high-risk activities prior to commencement of works – Implementation of heat stress prevention and response measures – Designation of trained traffic management personnel for all works undertaken adjacent to live traffic – Designation of competent lifting supervisors and trained operators, riggers, and signalers for major lifting activities
Community Health and Safety (CHS)	Construction and operation of the ITREC sub-projects may pose risks to community health and safety, mainly from increased traffic volumes and	**Major**	– Prepare and implement a Community Health and Safety Management Plan in line with ESS4 – Design and install continuous fencing to prevent uncontrolled access to the ITREC sub-projects – Provide grade-separated pedestrian and livestock crossings aligned with community movement patterns – Install and maintain road signage, markings, and warning systems – Implement speed management measures near settlements and sensitive receptors

Receptor / Aspect	Impact	Impact Significance	Mitigation Measures
	higher vehicle speeds. Pedestrians, livestock, and vulnerable road users face elevated risks at uncontrolled crossings, potentially leading to serious or fatal accidents if adequate safety measures are not implemented. In addition, during construction, interactions between project workers, subcontractors, transport personnel, security personnel, and local communities may increase the risk of sexual exploitation and abuse and sexual harassment (SEA/SH), as well as related gender-based violence and child safeguarding concerns.		– Provide adequate lighting at crossings, interchanges, and high-risk sections – Maintain service roads to ensure safe local mobility – Conduct road safety awareness campaigns for affected communities – Coordinate with traffic police and local authorities on enforcement and emergency response – Prepare, adopt, and implement a SEA/SH Action Plan, consistent with the ESCP, prior to commencement of relevant construction activities. – Include SEA/SH prevention and response requirements in contractor and subcontractor contracts and contractor Environmental and Social Management Plans (C-ESMPs). – Require all workers, including subcontractors and security personnel, to sign and comply with Codes of Conduct addressing acceptable behavior, sanctions, and reporting obligations. – Provide mandatory induction and periodic refresher training for all project workers and subcontractors on respectful community interaction, and consequences of non-compliance. – Establish and maintain safe, confidential, and survivor-centred grievance uptake and referral arrangements for SEA/SH complaints, including linkage to available service providers.
Land Acquisition and	Land acquisition for the ITREC sub-projects may result in loss of	**Major**	– Implement the approved Resettlement Action Plan / Livelihood Restoration Plan (RP/LRP) in line with ESS5 – Ensure compensation is paid prior to land take

Receptor / Aspect	Impact	Impact Significance	Mitigation Measures
Involuntary Resettlement	agricultural land, access restrictions, and livelihood impacts for affected households. Fragmentation of land holdings and reduced access may persist during operation if crossings and service roads are inadequate or poorly maintained.		– Restore access to agricultural land and grazing areas – Provide service roads and crossings where land is fragmented – Implement livelihood restoration measures where required – Maintain regular engagement with affected households – Address land-related grievances promptly and transparently
Traffic Flow, Road Safety and Access	Construction and operation will alter traffic patterns and local access routes. Temporary diversions and increased traffic may affect daily movement, while insufficient crossings during operation could encourage unsafe crossing behavior, increasing accident risks, particularly in rural and agricultural areas.	**Major**	– Prepare and implement a Traffic and Road Safety Management Plan (TRSMP) – Maintain alternative access routes during construction – Schedule heavy vehicle movements outside peak community hours – Deploy trained traffic marshals at critical locations – Install and maintain traffic signage and barriers – Maintain service roads and controlled access points during operation – Monitor unsafe crossing behavior and adjust mitigation measures
Labour and Working Conditions	Risk of unfair labor practices, wage delays, excessive working	**Major**	– Implement Labor Management Procedures (LMP) consistent with national law and ESS2. – Ensure signed employment contracts and age verification for all workers.

Receptor / Aspect	Impact	Impact Significance	Mitigation Measures
	hours, child or forced labor in lower tiers, inadequate worker welfare conditions, ineffective grievance mechanism, and potential labor disputes during construction.		– Prohibit child labor and forced labor. – Timely wage payment and regulated working hours. – Establish and operationalize the Worker Grievance Mechanism prior to commencement of relevant Project activities and before mobilization of the contractor's workforce, and maintain it throughout Project implementation in accordance with the LMP and applicable Project requirements. – Provide adequate welfare facilities (water, sanitation, rest areas). – Apply Code of Conduct and conduct induction training (including SEA/SH awareness). – Monitor subcontractor compliance.
Cultural Heritage	Construction activities may affect cultural heritage resources in historically sensitive areas, particularly within the wider Samarra setting. The current alignment has been realigned to avoid six previously identified cultural heritage sites; however, residual risks remain due to the potential presence of archaeological traces and the possibility of previously undiscovered subsurface remains, especially along the Samarra access roads located in an area not	**Moderate**	– Confirm the final alignment coordinates with the State Board of Antiquities and Heritage (SBAH) and obtain formal no-objection/clearance prior to mobilization in culturally sensitive sections. – Develop and implement a site-specific Cultural Heritage Management Plan (CHMP) – Maintain avoidance of the six identified sites through demarcation on construction drawings and on-ground marking, and enforce no-works requirements within any agreed buffer zones – Undertake targeted archaeological screening/field verification for sensitive sections, with priority for Samarra access roads (unscreened area) and any locations flagged by SBAH. – Undertake site-specific cultural heritage surveys, where required by the applicable site-specific ESIA/ESMP or SBAH, prior to commencement of the relevant works, and use the results to inform final alignment, detailed design, buffer requirements, and site-specific mitigation / CHMP measures. – Implement a Chance Finds Procedure for all ground-disturbing works (excavation, trenching, earthworks, foundations, temporary facilities). – Provide mandatory worker and supervisor training on cultural heritage awareness and chance finds. – If cultural materials are encountered: stop work immediately, secure the find location, notify SBAH, and resume only after written clearance and agreed management actions.

Receptor / Aspect	Impact	Impact Significance	Mitigation Measures
	previously screened for archaeological sites.		
Operation Phase			
Air Quality	Vehicle exhaust emissions and traffic-related dust may cause localized air quality deterioration near the sub-projects corridors, particularly where sensitive receptors are close to the alignment and during high-traffic or unfavorable dispersion conditions	**Minor**	– Arrange and maintain vegetation barriers/green buffers along the sub-projects corridors, particularly near settlements and other sensitive receptors, to reduce dust-related impacts and nuisance. – Support measures that promote more efficient vehicles and alternative/cleaner fuels to reduce transport-sector CO_2 and exhaust emissions (typically through coordination with the responsible transport/traffic authorities, as applicable). – Conduct periodic air quality checks/monitoring at representative sensitive receptor locations where receptors are close to the alignment and elevated exposure is expected. – Apply dust and emission control measures during road maintenance activities (e.g., dust suppression, covering materials during transport, minimizing idling, and equipment maintenance). – Implement traffic regulation / management measures to minimize congestion and unnecessary idling, particularly near built-up sections and junctions – Apply water spraying for dust control during maintenance and cleaning activities where dust nuisance is observed
Noise and Vibrations	Operational traffic may cause localized noise impacts near sensitive receptors; traffic-induced vibration is expected to be negligible under normal operating conditions	**Minor**	– Install noise barriers at sections where the corridor is close to residential areas and other sensitive receptors – Maintain smooth pavement surfaces and structural joints through routine O&M (including periodic pavement condition surveys), to minimize tire–road noise and prevent localized vibration associated with surface irregularities and heavy vehicle passage – Maintain bridges / overpasses and associated structural joints to prevent rattling and structure-borne noise at crossings – Implement a complaints management process for operational noise, including investigation, documentation, and corrective actions where recurring issues are identified – Provide advance notice to communities prior to planned maintenance and repair activities that may generate elevated noise, and restrict noise-generating maintenance activities near receptors to daytime working hours

Receptor / Aspect	Impact	Impact Significance	Mitigation Measures
Soil Quality	Traffic-related dust, runoff, and incidental spills/leaks may cause localized soil degradation or contamination near the sub-projects corridors	**Minor**	– Maintain roadside stabilization and revegetation limit dispersion of fine dust, reduce erosion, and support slope stability. – Implement awareness measures and enforce prohibitions on illegal dumping and littering by road users – Conduct regular maintenance and cleanup of the drainage system to prevent erosion, water accumulation, and localized soil deterioration. – Implement spill response procedures for maintenance activities – Ensure routine maintenance activities (including drainage cleaning) are carried out with proper housekeeping and controlled handling of wastes/materials
Surface and Groundwater	Road runoff, litter, and traffic-related spills may cause localized deterioration of surface water and groundwater quality, particularly near irrigation/drainage canals and seasonal drainage features, and at sensitive receptor interfaces including the Tigris River, the Ishaqi River, the Euphrates River, and Tharthar Lake and Habbaniyah Lake.	**Minor**	– Maintain and clean the ITREC Sub-projects drainage system regularly to prevent blockage and reduce transport of pollutants to canals/drains and the Tigris River, the Ishaqi River, the Euphrates River, and Tharthar Lake and Habbaniyah Lake.. – Maintain routine roadside cleaning to prevent waste transport to canals/drains and surface water bodies. – Implement traffic-related spill response measures to prevent contaminants from reaching drains/canals and surface water bodies. – Apply pollution prevention controls during periodic maintenance works (contain materials within the work area, prevent wash-off to nearby drains/canals, and clean up any spills promptly). – Inspect and clean drainage structures, culverts, curb inlets, and roadside ditches to prevent blockage – Remove accumulated debris and sediment from drainage channels, culverts, and inlets
Waste Generation and Management	Road-user litter and maintenance wastes may cause localized disturbance and pollution, including	**Moderate**	– Implement a Waste Management Plan covering all solid wastes, liquid wastes, and hazardous wastes generated during operation and maintenance, including segregation, storage, transport, and disposal arrangements and responsibilities and ensure wastes are collected and transported through licensed/authorized contractors and disposed of at legally permitted facilities.

Receptor / Aspect	Impact	Impact Significance	Mitigation Measures
	blockage of drains/canals and contamination risks where hazardous wastes or spill residues are not properly managed		– Provide bins/collection points and implement routine collection and removal of road-user litter to prevent accumulation along the sub-projects corridors. – Conduct regular cleaning of shoulders and drainage features and remove accumulated debris to prevent blockage of drainage and irrigation channels. – Segregate maintenance wastes (scrap metal, asphalt/concrete fragments, used parts, packaging) and transport them to approved disposal/recycling routes. – Store hazardous wastes from maintenance activities in labeled containers within a controlled storage area and transport them through authorized contractors to legally permitted facilities. – Manage spill-cleanup wastes as hazardous waste and transport them to legally permitted treatment/disposal facilities. – Manage wastewater from operational buildings/maintenance facilities through appropriate sanitation systems; collect septic sludge (if any) and remove through authorized providers; prohibit uncontrolled discharge. – Enforce housekeeping, PPE, and safe handling procedures during waste collection, storage, loading, and transport to reduce worker health and safety risks. – Keep a waste register of quantities transported and disposed (by waste type) and retain disposal receipts/certificates. – Provide basic training/awareness for maintenance staff and road users on proper waste disposal and anti-littering. – Conduct periodic inspections/audits to verify waste management compliance and implement corrective actions.
Biological Environment	Operation of the ITREC road sub-projects may cause localized biodiversity impacts, including wildlife–vehicle collisions and barrier effects, particularly near the Tigris and Ishaqi River crossings	**Moderate**	– Maintain and operate wildlife crossings at key movement routes, particularly at and near the Tigris River crossing, the Ishaqi River crossing and the Euphrates River crossing, to reduce wildlife–vehicle collisions and avoid habitat fragmentation. – Install and maintain wildlife-friendly fencing at high-risk sections to guide fauna toward designated crossing points and reduce collision risk; ensure fencing does not trap fauna and does not obstruct drainage flow. – Install wildlife warning signage at identified collision hotspots, particularly near riparian / canal interfaces and river crossings, and update locations based on incident records.

Receptor / Aspect	Impact	Impact Significance	Mitigation Measures
	(Expressway No. 2), Euphrates-adjacent sections (R9B), and along canals/drains and drainage crossings.		– Maintain or restore riparian strips and canal-edge vegetation where present, particularly near the Tigris River, Ishaqi River and Euphrates River crossings, to support fauna movement and reduce fragmentation along water edges. – Maintain habitat connectivity during operation by keeping canal / drain crossings functional for fauna movement (e.g., keep culverts / underpasses and canal margins clear of debris and avoid blocking access). – Minimize disturbance from permanent lighting at structures / interchanges near sensitive areas by using only necessary lighting, directing lights downward, and avoiding light spill toward rivers/canals and riparian habitats. – Maintain drainage systems and implement routine pollution prevention measures to reduce transport of sediments and vehicle residues to canals/drains and to the Tigris River and Ishaqi River, with enhanced attention at river crossings. – Implement invasive species controls during operation and maintenance, including cleaning of maintenance vehicles / equipment when moving between sensitive areas, monitoring for invasive plants in disturbed roadside areas, and rapid removal / control where detected. – Prohibit hunting / poaching and wildlife harassment by operation and maintenance personnel and contractors; implement awareness measures and enforce workforce requirements, with enhanced attention near river crossings and riparian areas.
Occupational Health and Safety (OHS)	OHS impacts during operation are limited due to the small workforce involved in routine inspections and maintenance. Risks are mainly associated with working near live traffic, use of maintenance equipment, and short-term exposure to noise	**Moderate**	– Implement an OHS Management Plan for maintenance activities – Apply traffic control measures during maintenance works – Provide task-specific safety training to maintenance staff – Enforce use of appropriate personal protective equipment – Ensure maintenance equipment is properly maintained – Restrict public access to maintenance work zones

Receptor / Aspect	Impact	Impact Significance	Mitigation Measures
	and dust during maintenance activities.		
Community Health and Safety	During operation, the main community risk relates to road traffic safety. High vehicle speeds and traffic volumes increase the likelihood of severe or fatal accidents involving pedestrians, livestock, and vehicles, particularly at uncontrolled crossings near settlements and agricultural areas.	**Major**	– Prepare and implement a Community Health and Safety Management Plan in line with ESS4 – Install and maintain fencing along the ITREC sub-projects – Provide grade-separated pedestrian and livestock crossings – Install clear road signage and markings – Implement speed management measures near communities – Provide lighting at crossings and high-risk sections – Conduct periodic road safety audits
Traffic Flow, Road Safety and Access	While the ITREC Project improves regional connectivity, it may restrict local movement by severing traditional access routes. Inadequate access points may encourage unsafe crossing behavior and affect daily mobility for farmers and nearby communities.	**Moderate**	– Prepare and implement a Traffic and Road Safety Management Plan (TRSMP) – Maintain service roads and controlled access points – Provide adequate crossings aligned with community movement patterns – Install directional and warning signage – Monitor traffic behavior near access points – Adjust access arrangements where safety issues persist

Receptor / Aspect	Impact	Impact Significance	Mitigation Measures
Labor and Working Conditions	Risk of non-compliance with labor standards, inadequate working conditions during routine maintenance, and ineffective worker grievance handling.	**Insignificant**	– Maintain Labor Management Procedures for operation phase. – Ensure formal contracts and compliance with wage and working hour regulations. – Maintain Worker Grievance Mechanism. – Provide OHS training and welfare facilities during maintenance activities. – Periodic review of contractor compliance.
Cultural Heritage	No direct impacts on cultural heritage are anticipated during operation, provided maintenance activities remain within the right-of-way and avoid protected areas.	**Insignificant**	– Restrict maintenance activities to approved areas – Maintain awareness of heritage buffer zones – Apply chance-find procedures if unexpected finds occur – Coordinate with heritage authorities when required
Land Acquisition and Restrictions on Land Use	No additional land acquisition is expected during operation. However, long-term access restrictions and land fragmentation may continue to affect affected households if crossings and service roads are not maintained.	**Moderate**	– Maintain access routes, service roads, and crossings – Monitor long-term access and livelihood impacts – Address land-related grievances – Engage affected land users periodically

Stakeholder Engagement

Stakeholder engagement is a core component of the Project and has been implemented in accordance with the World Bank Environmental and Social Standard 10 (ESS10). The engagement approach is designed to be inclusive, transparent, and proportionate to the Project's scale and risks across the four subprojects implemented in federal Iraq and the Kurdistan Region of Iraq.

The objectives of stakeholder engagement are to ensure timely disclosure of information, promote meaningful participation of affected communities and vulnerable groups, identify environmental and social sensitivities, integrate stakeholder feedback into project design and mitigation measures, and ensure compliance with national requirements and World Bank standards.

Stakeholders were identified and categorized as Project-Affected Parties (PAPs), Other Interested Parties (OIPs), and Disadvantaged or Vulnerable Groups. Key project-affected stakeholders include households along the corridors, farmers and landowners, informal and licensed roadside businesses, road users, sensitive receptors, and project workers. Other interested parties include relevant ministries, environmental and antiquities authorities, governorate and municipal administrations, professional associations, civil society organizations, and media. Vulnerable groups such as female-headed households, informal land users, low-income households, internally displaced persons, and persons with disabilities were specifically considered to ensure inclusive engagement.

Consultation activities were conducted during ESIA preparation through Key Informant Interviews, Focus Group Discussions, phone consultations, and community surveys. A total of consultations were carried out with government entities, local authorities, agricultural and environmental directorates, antiquities departments, health and emergency services, and affected communities along the project corridors.

Across all subprojects, stakeholders expressed overall support for improved connectivity, safety, and economic development. However, key concerns raised include:

- Land acquisition impacts on productive agricultural land and orchards, and the need for fair, transparent, and timely compensation.
- Potential displacement and impacts on informal land users and roadside businesses.
- Road safety risks, particularly at junctions, crossings, and accident hotspots.
- Protection of irrigation canals, drainage systems, and utilities (including gas and oil pipelines).
- Impacts on cultural heritage sites, particularly near Samarra.
- Construction-related impacts such as noise, dust, waste management, and traffic disruptions.
- Emergency response capacity and the need for improved roadside health and safety infrastructure.

In the Kurdistan Region, stakeholders emphasized congestion management, pedestrian safety, median widening preferences, livestock crossings, and coordination with antiquities authorities. Road users strongly prioritized safety improvements, lighting, controlled crossings, and improved grievance channels.

Stakeholder engagement represents an ongoing process. Continued consultations will take place during detailed design, land-related processes, construction, and operation. A structured engagement

register will be maintained to document disclosure methods, participants, key issues raised, agreed actions, and follow-up measures. Feedback received to date will inform final alignment decisions, mitigation measures, traffic management planning, road safety design, community health and safety provisions, and implementation arrangements.

Overall, stakeholder engagement has provided critical input to strengthen project design, reduce social risks, enhance transparency, and support sustainable project implementation in line with World Bank Environmental and Social Framework requirements.

1 Introduction

Under the Government of Iraq (GoI), the Ministry of Construction, Housing, Municipalities and Public Works (MoCHMPW), acting through the Roads and Bridges Directorate (RBD) (the "Client"), has assigned EcoConServ Environmental Solutions as the Consultant to prepare the Environmental and Social Impact Assessment (ESIA) for the Iraq Transport Road Economic Corridors Project (ITREC), in accordance with the applicable Iraqi regulatory requirements and the World Bank Environmental and Social Framework, including the Environmental and Social Standards (ESSs) and relevant WBG EHS Guidelines (including Toll Roads).

The ESIA defines the Project's scope/area of influence, assesses the environmental and social risks and impacts associated with the Project during pre-construction, construction, and operation, and determines the measures required to avoid, minimize, mitigate and/or offset adverse impacts, while identifying opportunities to enhance environmental and social benefits throughout the Project life. The assessment is commensurate with the Project risk profile and covers, in an integrated manner, relevant direct, indirect, and cumulative risks and impacts across the Project phases (including design, construction/rehabilitation, operation and maintenance, and demobilization).

This introduction provides the general background to the Project, identifies the key parties involved, and summarizes the main technical components and indicative schedule, while the subsequent chapters present the baseline conditions, assessment methodology, impact assessment findings, and the required environmental and social management and monitoring measures.

1.1 Project Overview

The ITREC includes strategic road investments intended to improve road infrastructure service delivery and corridor performance in Iraq through targeted new construction and rehabilitation works the Project includes the following components:

Component 1: Safe and Resilient Road Infrastructure This component will finance the following activities related to the implementation of new or existing roads using good practices in safe systems and climate resilient standards for Iraq.

- **Subcomponent 1.1. Implementation of initial phase of Expressway 2 between Baghdad and Samarra:** This subcomponent will finance the design, construction, operations and maintenance of: (i) the initial 100 km greenfield segment from Baghdad to Samarra of the E2 corridor (out of the 504 km from Baghdad to the Turkish border), and (ii) approximately 10 km of greenfield feeder roads connecting rural areas within the vicinity of Samarra. Operation and maintenance will be delivered through a Performance-Based Contract (PBC) using good practices and standards for resilience, safety, and sustainability.[1] This subcomponent will reduce

[1] The PBC contract will incorporate localized climate resilient interventions including pavement material and equipment designed to withstand high heat stress, road geometric and drainage design to manage rainfall inundation events. Importantly, the contract will integrate climate-related performance indicators, linking contractor payments to the achievement of resilience outcomes, and thus create strong incentives for contractors to proactively maintain assets and implement climate-resilient solutions. This approach significantly enhances resilience by shifting from reactive maintenance to continuous, performance-driven management of climate risks, ensuring that road infrastructure remains functional under increasing climate stress. The new road corridor will include roadside services areas incorporating electric charging stations to support transition to electric vehicles, contributing to greenhouse gas mitigation by facilitating the transition to low-emission transport and reducing reliance on fossil fuels. The contract will also include overhead digital gantries and climate hazard communication and management plans in coordination with emergency services, improving real-time risk communication, enabling faster emergency response particularly to rural areas connected by feeder roads, and reducing disruptions and safety risks

distances and travel times between Baghdad and Iraq's northern governates and will displace traffic from other longer routes shifting a portion of non-essential traffic out of Baghdad and other villages and towns' core inner city transport networks acting to alleviate urban traffic congestion.

- **Subcomponent 1.2. Rehabilitation and maintenance of the R9B segment of Expressway 1:** This subcomponent will finance the rehabilitation and maintenance of the existing 86 km E1-R9B[2] segment, a key road corridor in Iraq, using a PBC including climate performance and recovery indicators to ensure resilience standards are maintained throughout the operation's lifecycle. The safety performance of the corridor under the PBC will be addressed by linking contractor payments to measurable performance outcomes during the operation and maintenance phases, incentivizing performance through safe engineering practices, including multi-stage safety audits, and enhanced work zone safety protocols.
- **Subcomponent 1.3. Rehabilitation and maintenance of priority road corridors in KRG:** This subcomponent comprises rehabilitation and maintenance of two existing road segments totaling approximately 77 km, including the Sulaymaniyah–Chamchamal–Kirkuk Road (about 50 km, linking to E2) and the Girsheen–Suhaila Road rehabilitation (22km) as well as Girsheen Interchange and maintenance as PBCs incorporating climate performance and recovery indicators, as well as safe and resilient standards.
- **Subcomponent 1.4. Piloting of road safety features:** This component will implement a multi-sectoral road safety corridor demonstration pilot on E1-R9B to include traffic enforcement measures focusing on speed management and other behavioral risk factors, as well as coordination with emergency healthcare services and civil society. This includes financing goods and services, such as equipment, speed cameras, traffic enforcement equipment, patrol vehicles, and evaluation study.

Component 2. Institutional Strengthening and Preparation of Future Interventions: This component will support institutional strengthening and transport sector reforms to enable the preparation, modernization and financing of Iraq's future national road network. This component will finance goods, consulting services and non-consulting services to include the following activities:

- **Subcomponent 2.1. Capacity building for road sector PPPs:** Activities will support RBD in: (i) preparing and structuring future road PPPs including the greenfield extension of E2 from Samarra to the Turkish border (approx. 404 km) as a bankable PPP transaction, (ii) developing a national tolling strategy, (iii) developing performance monitoring systems for PBCs including safety and resilience, and (iv) designing sustainable payment mechanisms for road implementation and maintenance from Payment Accounts to a future Road Fund.
- **Subcomponent 2.2. Road safety program:** Activities will include: (i) the preparation and assessment of a national-level Road Safety Mass Action Program (RS-MAP) targeting at least 1,000 km of high-risk and high-volume roads with readily implementable interventions identified

during climate-related events, and tolling systems. Toll collection can strengthen resilience by generating a predictable source of funding for road maintenance, climate adaptation measures, and post-disaster recovery, thereby improving the sustainability and reliability of transport infrastructure under increasing climate risks. The design and engineering will undergo a multi-stage road safety audit process, with specific attention to work zone safety protocols, speed management strategies, and mitigation of roadside crash hazards through compliant barrier systems and safe access provisions. This subcomponent also includes the design and rollout of Fiber Optics (FO) infrastructure along the Baghdad-Samarra corridor by adopting a "dig once" approach as appropriate and support Intelligent Transport Systems while utilizing surplus FO capacity for national and metropolitan telecom wholesale services.

[2] This segment (R9B) begins at the end of R9A, approx. at Station 40+000km (i.e., within the vicinity of Baghdad) and extends westward towards the Jordanian border. R9B is a divided highway consisting of six-lanes (each 3.75 meters wide), separated by a wide median (10 meters). Both directions of the highway feature standing/emergency lanes (2.5 meters wide) at the edge of pavement.

through network-level survey and crash data collection, and (ii) technical advisory and capacity-building support to all stakeholder agencies for improving road safety management functions, governance mechanisms, and crash data management systems.

- **Subcomponent 2.3. Strengthening Environmental, Social and Health and Safety (ESHS):** Activities will support RBD to: (i) improve ESHS risk management, grievance redress monitoring, reporting, and management, and (ii) build capacity in maintaining grievance databases, continuous stakeholder engagement, livelihood restoration, compensation, biodiversity and Occupational Health and Safety (OHS) management activities.
- **Subcomponent 2.4. Design and engineering of future road interventions:** Activities will include: (i) design and engineering of the greenfield E2 extension from Samarra to the Turkish border (approx. 404 km), (ii) field surveys, functional or conceptual plans, preliminary and detailed designs for additional road rehabilitation, maintenance, and improvements consistent with the objectives of ITREC, (iii) the development of Environment and Social Management Plans, Emergency Action Plans, and Traffic and Road Safety Management Plans, (iv) additional engineering designs for road improvements selected under the RS-MAP, and (v) improvements to the Road Asset Management System and other support systems to include road safety, climate resilience and sustainability objectives.
- **Subcomponent 2.5. Sector reform studies:** Activities will include plans and studies to: (i) maximize socio-economic benefits of road investments through job creation in agricultural, industrial, tourism and other relevant sectors, (ii) promote integrated logistics and multi-modal transport services that improve emissions and system reliability, (iii) ensure system-wide climate resilience for the transport sector, and (iv) support other reforms identified in the World Bank's Infrastructure Sector Assessment Program (InfraSAP) for Connectivity and Economic Diversification in Iraq.

Component 3: Implementation and Project Management Support: This component is estimated based on common practices for the management and supervision of road projects and the total value of the works to be implemented.

- **Subcomponent 3.1**. **Project Management Consultancy (PMC) for Implementation.** A PMC will support RBD in the management and implementation of the ITREC program according to international good practices.
- **Subcomponent 3.2. Engineering review and construction supervision for Component 1.** Professional consultants will support RBD in engineering reviews and construction supervision of all works under Component 1 of the project, including on-site material testing and workmanship supervision to ensure Contractors meets road standards and climate resilience design specifications.

Component 4: Contingent Emergency Response Component – CERC: Provision of immediate response to an Eligible Crisis or Emergency, as needed.

In addition to this ESIA, the following environmental and social (E&S) instruments will be prepared for ITREC to support compliance with the applicable Iraqi requirements and the World Bank ESF:

- Stakeholder Engagement Plan (SEP)
- Environmental and Social Commitment Plan (ESCP)
- Resettlement Plan and/or Livelihood Restoration Plan (RP/LRP)

- Labor Management Procedures (LMP)
- Site-specific ESIA/ESMP instruments for the interventions under Component 1 of ITREC
- Security Management Plan (SMP)
- SEA/SH Risk Mitigation and Response Plan
- Terms of Reference for the Construction ESMP (C-ESMP)

1.2 Purpose of the Draft ESIA

This Draft ESIA has been prepared for the ITREC to identify, assess, and manage the environmental and social risks and impacts associated with the full scope of road investments and interventions to be financed under ITREC, including new construction, rehabilitation, maintenance, and associated sector reform and implementation support activities, as applicable. The ESIA applies a systematic, internationally recognized assessment approach to support transparent, informed decision-making and to ensure consistency with applicable Iraqi requirements and the World Bank Environmental and Social Framework/Environmental and Social Standards (ESF/ESSs). The main objectives of this ESIA are to:

- Identify and assess the potential environmental and social risks and impacts associated with the ITREC Project and its subcomponents/interventions across pre-construction, construction, and operation, within the relevant areas of influence.
- Define measures to avoid, and where avoidance is not feasible, minimize, mitigate, and/or compensate adverse impacts, and to enhance positive outcomes where practicable.
- Ensure compliance with applicable Iraqi environmental and social requirements and the World Bank ESSs, as well as other relevant international good practice.
- Engage stakeholders through a transparent and inclusive process, ensuring that the concerns of affected communities, public authorities, and other stakeholders are identified, documented, and addressed.
- Integrate sustainability and risk management into project planning and design by identifying opportunities for improved environmental and social performance, with particular attention to road safety, community health and safety, worker health and safety, biodiversity and natural resource management, and cultural heritage.
- Provide the technical basis to support required approvals and permits and to inform the decision-making processes of the competent authorities and financing institution(s).
- Establish an ESMP framework that includes mitigation, monitoring, roles and responsibilities, capacity building, and reporting measures to support effective implementation throughout the ITREC Project lifecycle.

This Draft Project ESIA is prepared at the ITREC project level to provide an integrated assessment of the E&S risks and impacts associated with the ITREC Project interventions and to establish the overarching mitigation and management framework for implementation. As required by the nature, location, sensitivity, or final design of specific sub-projects or work sites, the findings of this ESIA will be further translated into site-specific ESIAs/ESMPs for the different sub-projects and other relevant E&S downstream instruments as needed. Downstream E&S instruments will set out the detailed, sub-project-specific assessment, mitigation, monitoring, supervision, and institutional requirements, tailored to the location, design, sensitivities, and implementation arrangements of each sub-project, and will be prepared, reviewed, and approved prior to commencement of the relevant works.

At the current stage of project preparation, this Draft Project ESIA is based on the concept / preliminary design information available at the time of assessment. Accordingly, while this Draft

Project ESIA identifies the principal E&S risks and impacts associated with the ITREC Project, certain risks remain subject to further refinement once detailed engineering design and site-specific implementation arrangements are finalized. This applies to impacts associated with, but not limited to, drainage and surface water management, crossings of rivers, canals, and other water environments, and biodiversity-sensitive locations. Once detailed design becomes available, the relevant impact assessment, mitigation measures, and management requirements will be further developed and reflected, as applicable, in the site-specific ESIAs/ESMPs and other relevant downstream E&S instruments to be prepared prior to commencement of the relevant works.

2 Project Description

2.1 Background Information

2.1.1 Project Overview

Iraq's economic development has been shaped by prolonged conflict, political instability, and constraints in governance and institutional capacity, alongside high reliance on the oil sector. Oil continues to dominate public revenues and national output, while diversification remains limited and infrastructure deficits constrain broader growth. Within this context, investment in transport infrastructure is a strategic priority to support reconstruction, improve connectivity, and strengthen trade and logistics links.

The transport sector is a major and growing part of Iraq's economy, but it faces persistent challenges, including increasing mobility demand and congestion in urban areas, reliance on road freight along sections of the network that require rehabilitation, and system-wide logistics inefficiencies. The roads sub-sector is critical for national connectivity, accounting for the vast majority of transport activity, and supporting domestic movement and cross-border trade through multiple land borders.

Within this context, the ITREC Project includes three key road infrastructure interventions under Component 1: (i) construction of the priority Baghdad–Samarra section of Expressway No. 2 (including the associated feeder connection in the vicinity of Samarra); (ii) rehabilitation and maintenance of the R9B corridor under Expressway No. 1 through a performance-based contracting approach; and (iii) rehabilitation and upgrade of priority road corridors in the Kurdistan Region of Iraq, including the Sulaymaniyah–Chamchamal–Kirkuk Road, the Girsheen–Suhaila Road upgrade, and the Girsheen Interchange. These interventions are shown in Table 2-1 below.

Table 2-1: Key Interventions under the ITREC Project

Intervention / Investment	Type	Length / Extent
Expressway No. 2 (Baghdad–Samarra) (including feeder connection in the vicinity of Samarra)	Greenfield (new construction)	100 km (main corridor) + 10 km (feeder road)
Expressway No. 1 (R9B corridor)	Rehabilitation & maintenance	86 km
Sulaymaniyah–Chamchamal–Kirkuk Road (KRI)	Rehabilitation and expansion/upgrade	50 km
Girsheen–Suhaila Road upgrade (KRI)	Rehabilitation & maintenance	22 km
Girsheen Interchange (KRI)	Greenfield (new construction)	N/A

The Ministry of Construction, Housing, Municipalities and Public Works is responsible for road infrastructure construction, maintenance, and rehabilitation in federal Iraq through the Roads and Bridges Directorate, which manages and supervises a substantial portion of the national road network. In the Kurdistan Region of Iraq, similar functions are undertaken by the General Directorate for Roads and Bridges under the Kurdistan Regional Government Ministry of Construction and Housing. These agencies are also responsible for design and supervision of works, and associated road management functions relevant to the applicable intervention.

2.1.2 Project Owner

The ITREC Project is implemented under the overall responsibility of MoCHMPW, acting through RBD as the lead implementing authority. A PMT shall be maintained under the MoCHMPW/RBD implementation arrangement to support Project implementation, including coordination of planning and design, procurement and contract management, construction follow-up, operation and maintenance arrangements as applicable, and management of environmental, social, health and safety requirements and reporting. For the sub-projects in the Kurdistan Region of Iraq, implementation shall be undertaken under the overall Project implementation arrangement led by MoCHMPW/RBD/PMT, in close coordination with the relevant KRG authorities, including the Ministry of Construction and Housing, GDRB, and other competent regional entities, as applicable. In this context, the relevant federal and regional authorities shall coordinate on Project implementation, approvals, compliance matters, and other requirements relevant to the applicable sub-projects.

2.1.3 Funding Agency

The Project is being prepared for financing support from the World Bank; accordingly, this ESIA is prepared to meet the World Bank Environmental and Social Framework requirements in addition to applicable Iraqi requirements, including relevant requirements applicable in federal Iraq and the Kurdistan Region of Iraq.

2.1.4 Sub-Projects Location

As mentioned, the ITREC Project comprises multiple road intervention corridors ("Sub-Projects") located in federal Iraq and in the Kurdistan Region of Iraq. The Component 1 road investments covered under this ESIA include: (i) Expressway No. 2 (Baghdad–Samarra) and the associated feeder/access road in the vicinity of Samarra; (ii) the R9B corridor under Expressway No. 1 to be rehabilitated and maintained under a performance-based contracting approach; and (iii) priority road corridors in the Kurdistan Region of Iraq, comprising the Sulaymaniyah–Chamchamal–Kirkuk Road, the Girsheen–Suhaila Road upgrade, and the Girsheen Interchange.

2.1.4.1 Expressway No. 2 (Baghdad–Samarra) and Samarra feeder/access road

Expressway No. 2 is a proposed expressway corridor between Baghdad and Samarra (Figure 2-1). The alignment extends from 34°10'50.07"N, 43°54'16.69"E to 33°23'10.93"N, 44°14'43.99"E (total length 123.7 km) and includes a new Baghdad–Samarra expressway link and a feeder/access road of approximately 10 km connecting areas adjacent to Samarra to the main corridor.

The Baghdad–Samarra expressway section commences at the planned Baghdad Ring Road No. 4 and traverses a generally flat setting. The alignment crosses irrigated cultivated areas and is characterized by agricultural land uses supported by irrigation infrastructure and associated rural settlement patterns, with villages occurring intermittently along the route. The feeder/access road to Samarra with a length of approximately 10.2 km. The setting along this feeder/access road is described as flat and desert-like, with few villages.

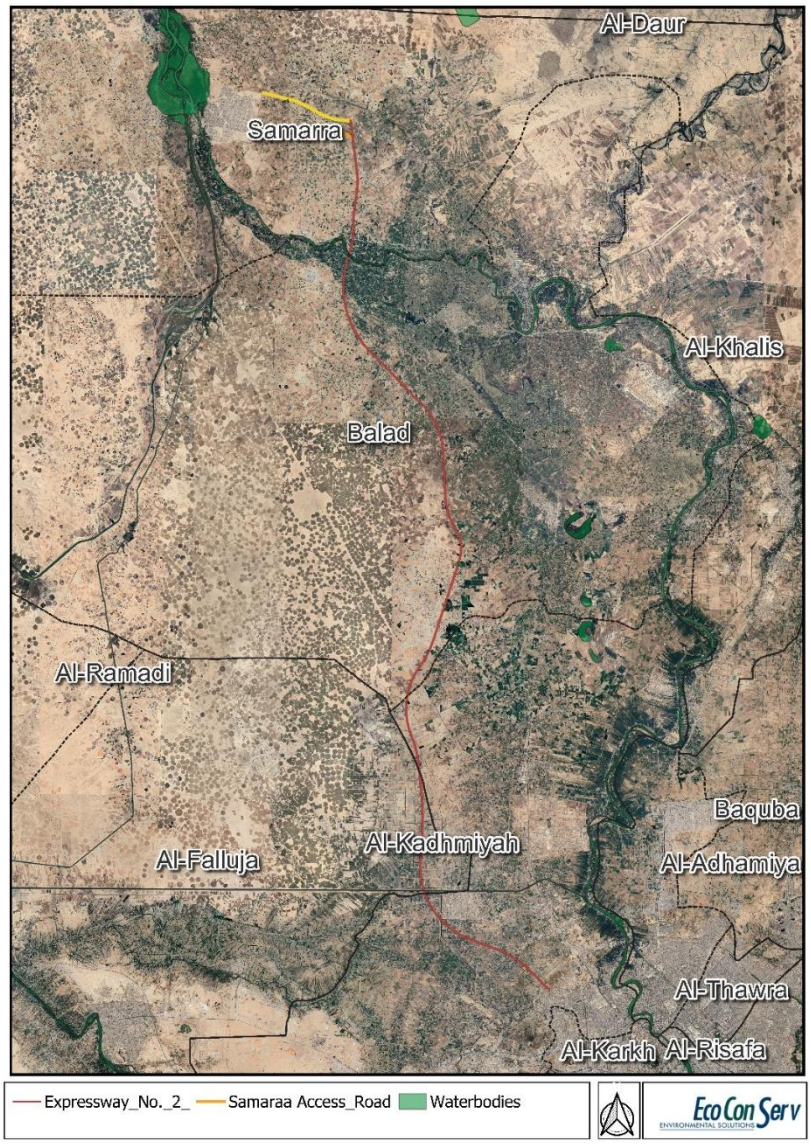


Figure 2-1: Expressway No. 2 Location (Baghdad – Samarra)

2.1.4.2 R9B Segment under Expressway No. 1

Expressway No. 1 (R9B corridor). The R9B road is a sector of the high-speed international Road No. 1 in Iraq. It extends for 85 km in the northeast part of Al Anbar Governorate between (33.399936° N, 43.736470° E) at the eastern end and (33.425275° N, 42.923170° E) at the western end (Figure 2-2). The corridor generally runs parallel to the Euphrates River and intersects with it at Ramadi before reaching its western end (Figure 2-2). The road passes through populated areas with mixed land uses, predominantly agricultural land, with multiple cities and population centers along both sides of the river. Agricultural areas are interspersed with irrigation and drainage channels and wetland features, including wetlands formed by agricultural drainage. Within the broader surrounding area, key surface-water features include the Euphrates River and the Tharthar Canal, as well as freshwater lakes such as Lake Tharthar and Lake Habbaniyah.

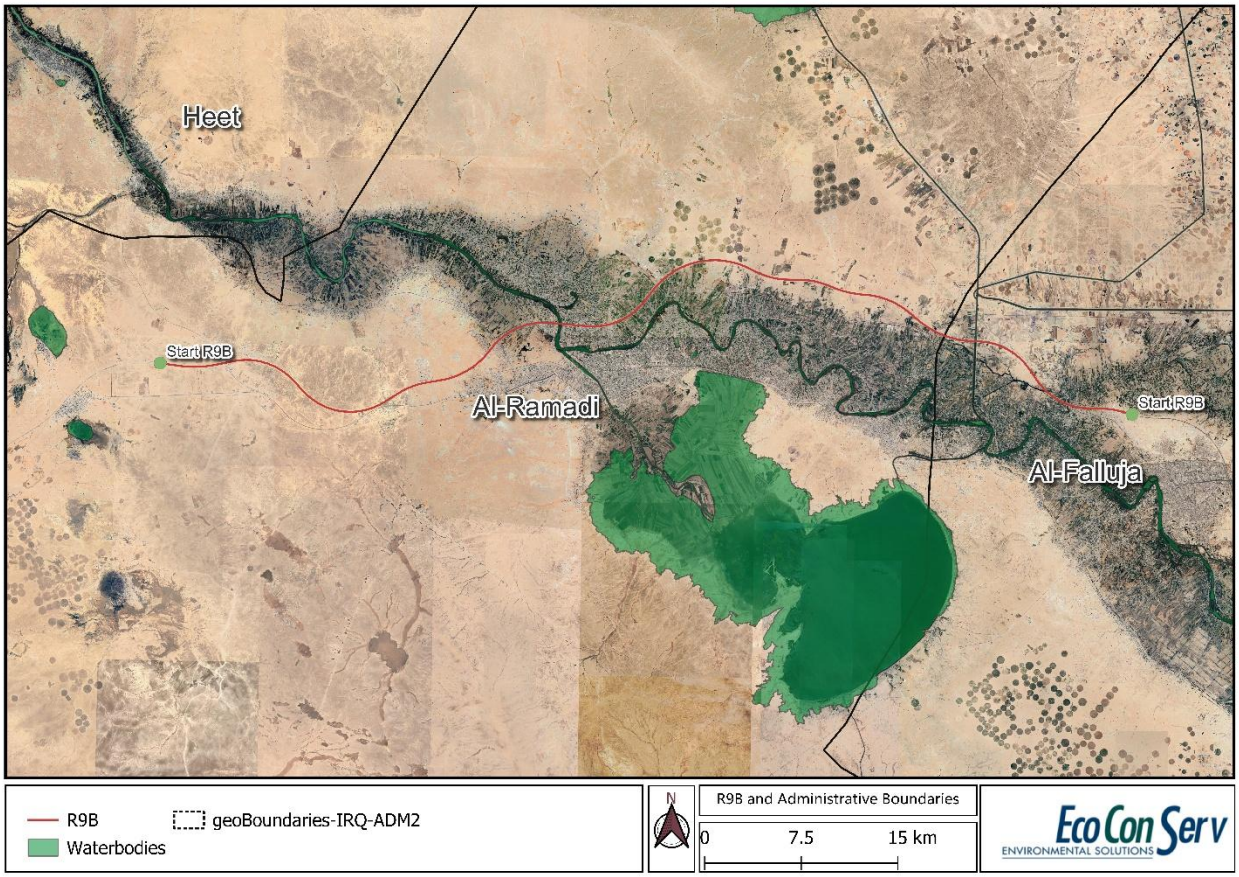


Figure 2-2: Expressway No. 1 R9B Section Location (Fallujah-Ramadi)

2.1.4.3 Sulaymaniyah–Chamchamal–Kirkuk Road (KRI)

The sub-project is located within Sulaymaniyah Governorate in the Kurdistan Region of Iraq and forms part of the primary inter-city corridor connecting Sulaymaniyah to Kirkuk. The upgraded section extends from Tasluja toward Banimaqan for a total length of **50 km**, running through a landscape that includes built-up areas, agricultural fields, open lands, and multiple access points serving nearby settlements and industrial facilities. The alignment passes in proximity to Bazian and Chamchamal districts, both of which depend on this roadway for regional mobility, commerce, and access to services. The stretch between Bazian and Chamchamal functions as one of the governorate's principal industrial belts, containing numerous small, medium, and large factories. Consequently, the corridor accommodates substantial heavy-vehicle and freight movement in addition to regular passenger and commercial traffic. The existing dual-carriageway, with two lanes in each direction, exhibits moderate pavement distress, uncontrolled access points, blocked drainage culverts, and inadequate pedestrian facilities. These conditions, combined with heavy truck volumes and age-related deterioration, necessitate comprehensive upgrading to meet current and future service levels.

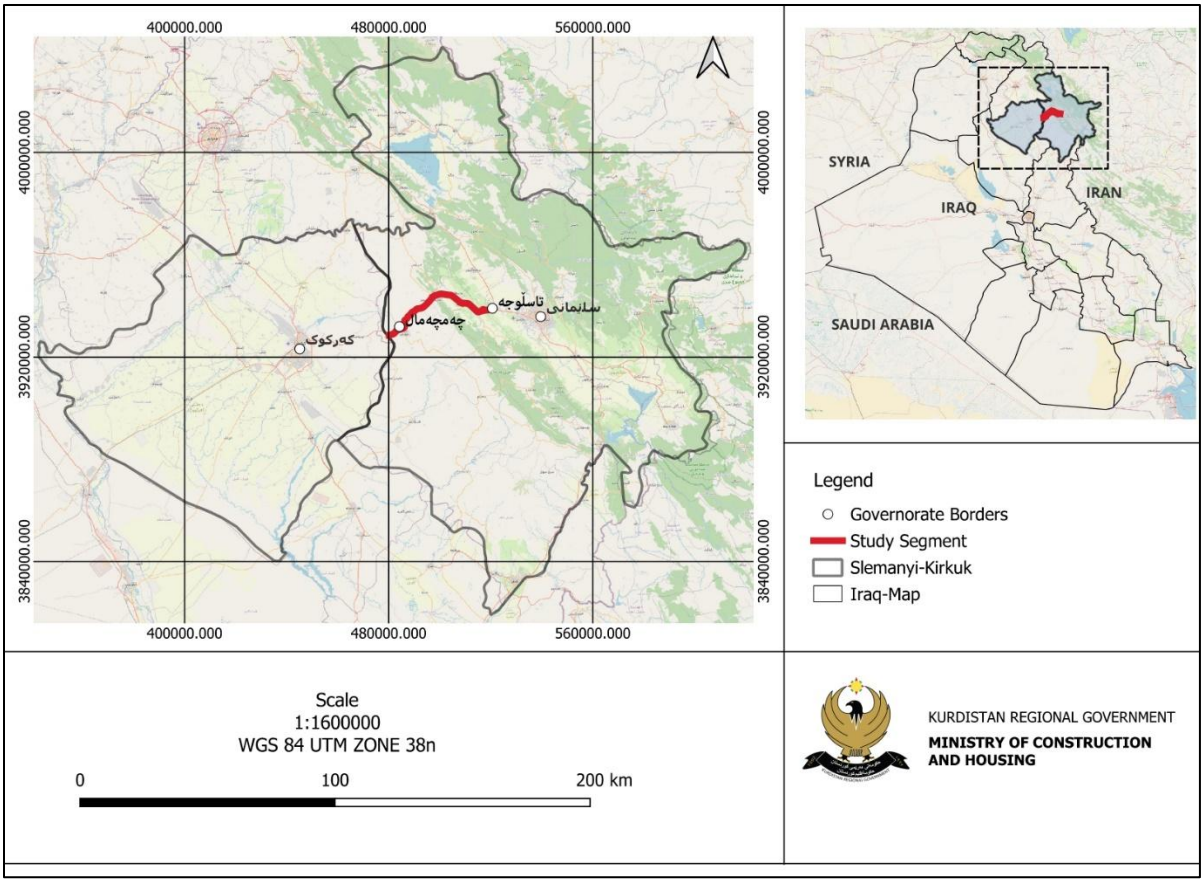


Figure 2-3: Sulaymaniyah–Chamchamal–Kirkuk Road Location

2.1.4.4 Girsheen–Suhaila Road Upgrade and Girsheen Interchange (KRI)

This sub-project is located in the Batil Sub-district of Zakho District, within Duhok Governorate in the north-western part of the Kurdistan Region of Iraq (Figure 2-4). The sub-project comprises two components: (i) the upgrading of the Girsheen–Suhaila Road, and (ii) the construction of an overpass at the Girsheen intersection along the Duhok–Zakho Road.

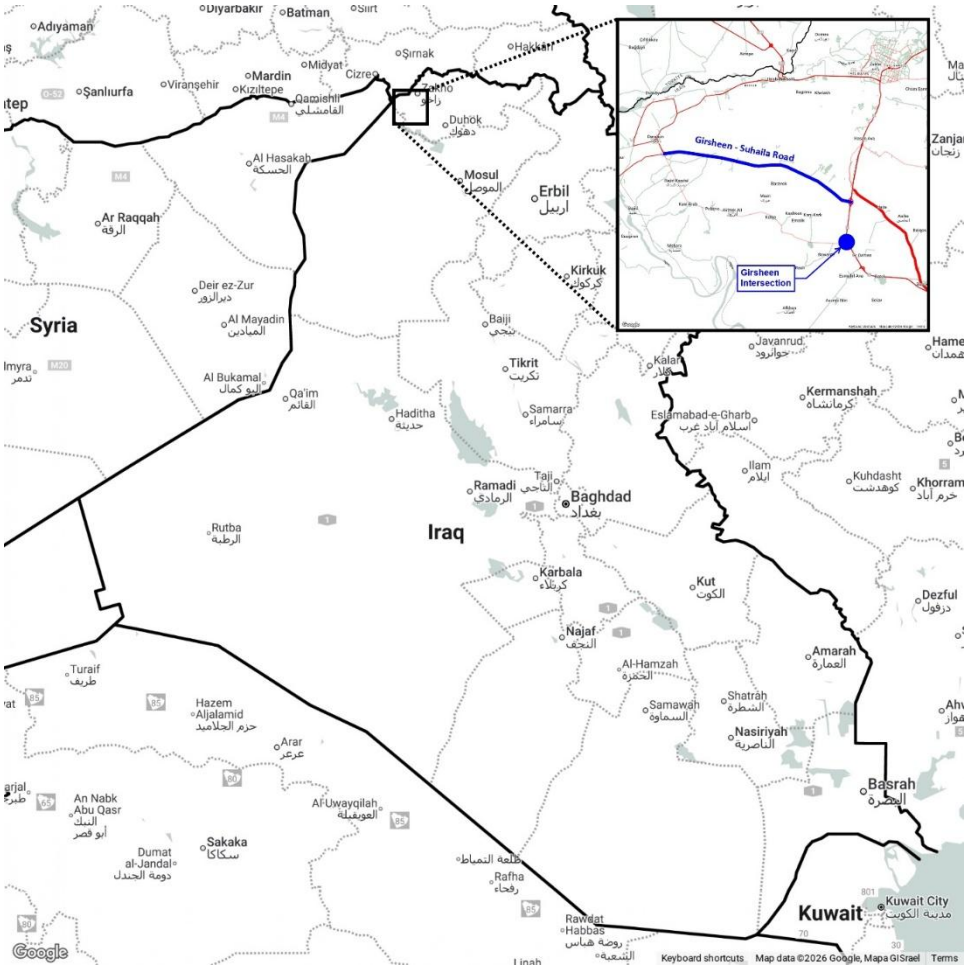


Figure 2-4: Overall Location of the Girsheen–Suhaila Road Upgrade and Girsheen Interchange

The Girsheen–Suhaila Road extends for 22 km and forms part of a strategic cross-border transport corridor connecting Duhok Governorate with the Ibrahim Khalil Border Crossing. The corridor serves significant regional and international freight movement and accommodates a high proportion of heavy trucks, in addition to regular passenger and commercial traffic. The alignment traverses undulating terrain and predominantly agricultural land use, with limited direct roadside development. Residential areas and villages are generally located at a distance from the roadway, resulting in a corridor setting that is largely rural in character, with few built-up sections immediately adjacent to the road.

The existing roadway consists of a dual carriageway with two lanes in each direction, originally completed in 2019. The road exhibits moderate pavement distress, primarily associated with age-related deterioration, heavy truck loading, and incomplete implementation of the original sub-project scope. In addition, certain road safety elements remain limited or absent, contributing to operational and safety deficiencies along the corridor.

The overpass component is located at the Girhseen intersection on the Duhok–Zakho Road, approximately 36 km north of Duhok, on the main route leading toward the Ibrahim Khalil Border Crossing. The intersection functions as a key node within the regional road network and experiences

substantial traffic demand. The overpass is intended to improve traffic flow, safety, and operational efficiency at this location. The sub-projects setting is show in Figure 2-5 below.

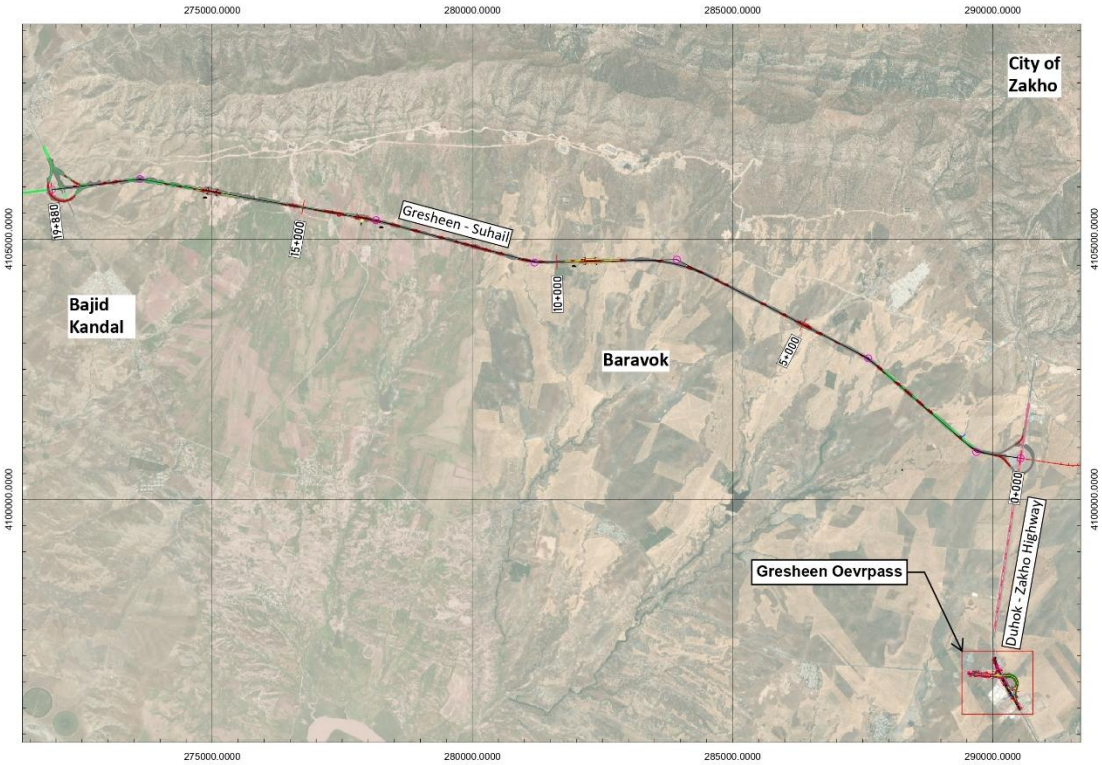


Figure 2-5: Location of the Girsheen–Suhaila Road Upgrade and Girsheen Interchange

2.1.5 Sub-Projects Layout

2.1.5.1 Expressway No. 2 (Baghdad–Samarra) and Samarra feeder/access road

The Expressway No. 2 mainline between Baghdad and Samarra is designed as a dual carriageway with six traffic lanes (three lanes per direction) and two-lane service roads on each side within the right-of-way. The right-of-way limit is 2 × 90 m (measured from the centerline to each side). The typical cross-section includes a central median and paved shoulders/emergency lanes. The terrain along this section is generally flat and the design speed is 140 km/h. Service roads are provided on both sides of the expressway and generally run parallel to the main alignment; in some locations, they merge with overpasses and other crossing features. The design speed of the service roads varies from 50 km/h to 80 km/h.

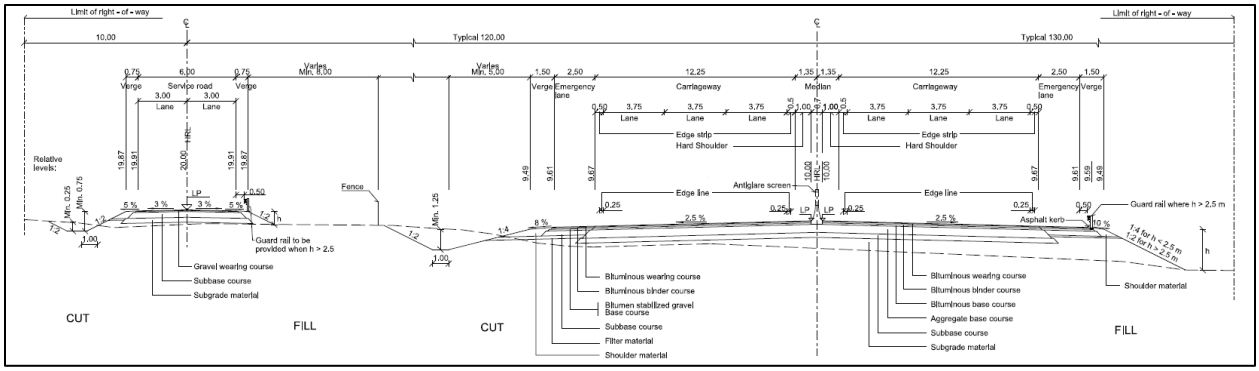


Figure 2-6: Typical Profile of Expressway No. 2

The sub-project includes major water-crossing structures, it crosses the Thartar–Tigris Canal on two parallel bridges, and a navigation clearance is provided in the central spans. Drainage and cross-drainage infrastructure is included along the alignment. The sub-project includes numerous drainage and cross-drainage structures, including underpasses. Moreover, the sub-project traverses long stretches of irrigated cultivation and it is expected that there will be multiple canal crossings and interfaces with irrigation infrastructure. Details with regard to canal crossings were not made available at the time of writing.

Expressway No. 2 is planned to be fenced along its entire length, including 100 m upstream and downstream of crossings with existing roads, and the fence height is identified as 1.4 m. Segment-by-segment fencing limits and any exceptions were not made available at the time of writing (Figure 2-7).

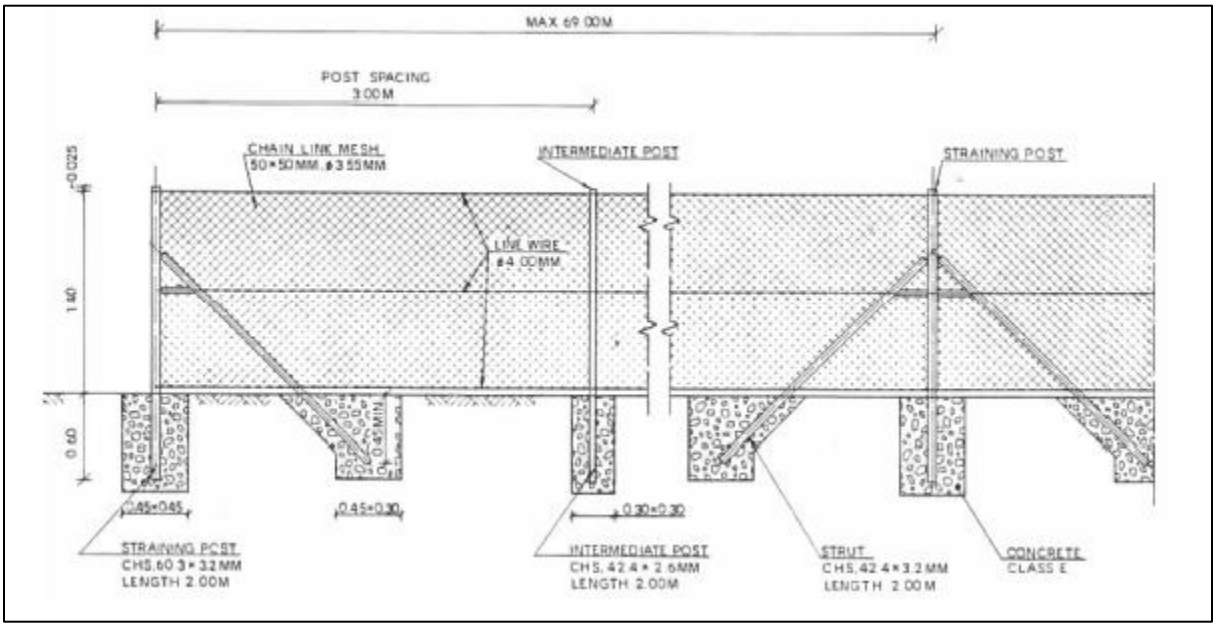


Figure 2-7: Fencing of Expressway No. 2 - Galvanized Chain Link Fence

The feeder/access road connecting areas within the vicinity of Samarra to Expressway No. 2 comprises a four-lane dual carriageway with two lanes in each direction, consistent with the Iraqi Highway Design Manual. The feeder/access road has an indicative length of approximately 10 km, and the indicative right-of-way is 50 m (total width).

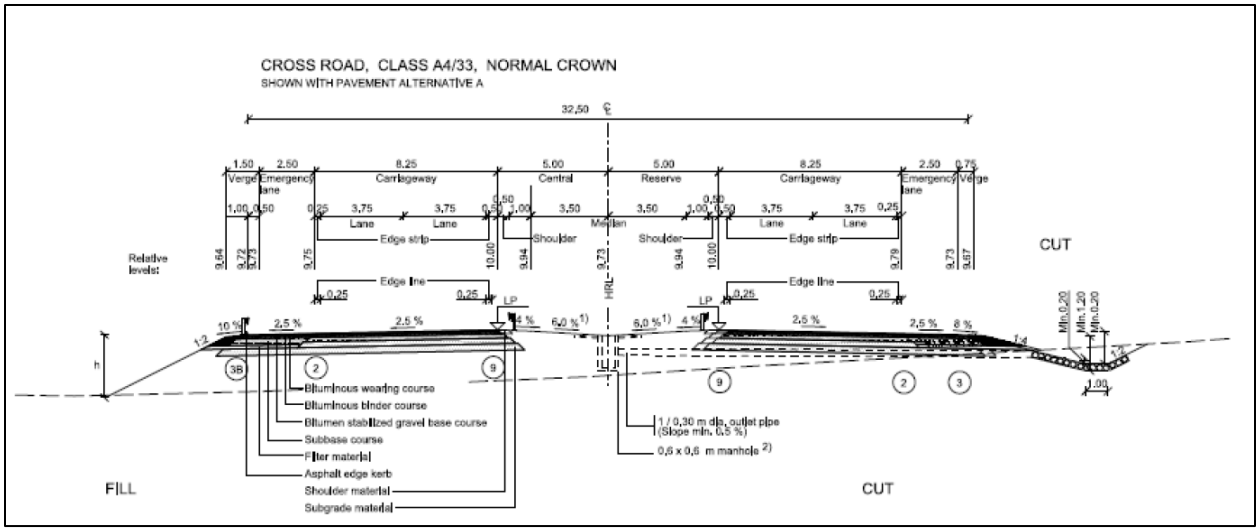


Figure 2-8: Typical Profile of Samarra Access Road

2.1.5.2 R9B Segment under Expressway No. 1

The R9B corridor is an existing dual carriageway with six lanes (three lanes per direction) that requires rehabilitation and safety upgrading to restore pavement condition, improve operational safety, and address right-of-way management and corridor-functionality issues. The works will be implemented primarily within the existing road corridor and required construction working width and will include coordinated interventions at localized constraint points (e.g., utilities crossings, access points, and roadside facilities). Key existing conditions and constraints identified along the corridor that inform the rehabilitation scope include the following:

- Encroachments within the road right-of-way, including the presence of security-related facilities in some locations, requiring coordination to confirm boundaries and manage access and safety interfaces during implementation.
- Uncontrolled access and operational safety issues, including illegal U-turns and unauthorized entrances/exits, creating safety risks and requiring access-management measures and enforcement coordination.
- Abandoned/neglected rest areas and roadside areas with accumulated solid waste, requiring clean-up and waste management controls as part of the works.
- Utilities interfaces, including pipelines and electrical/communication cables passing beneath the road through culverts, requiring coordination among relevant directorates to prevent damage and to manage unsafe crossing behavior where informal crossings occur.
- Pavement distress in localized sections (including rutting associated with heavy truck traffic), indicating the need for targeted structural pavement rehabilitation.

Based on the identified needs, the R9B rehabilitation scope will typically include:

- Localized milling/scraping of distressed pavement areas and reinstatement with asphalt, informed by condition surveys and traffic loading considerations.

- Placement of asphalt overlay layers where required to restore riding quality and structural performance, subject to final design and condition assessment.
- Refreshing/rehabilitation of road markings (including continuous and dashed lane lines) and associated traffic control devices.
- Rehabilitation and/or installation of median safety elements (as applicable) and roadside safety systems (e.g., guardrails) at priority locations.
- Right-of-way fencing and boundary controls (as applicable) to reduce unsafe access and manage encroachment risks, aligned with the access-management approach.
- Restoration, clean-up, and reinstatement of rest areas and ancillary roadside areas, including solid waste removal and housekeeping controls.

2.1.5.3 Sulaymaniyah–Chamchamal–Kirkuk Road (KRI)

The Upgrading of the Sulaymaniyah–Chamchamal–Kirkuk Road (Tasluja to Bani Maqan segment) involves the widening, rehabilitation, and safety upgrading of 50 km of an existing dual-carriageway corridor connecting Sulaymaniyah to Chamchamal and the wider Kirkuk region. The works are primarily confined to the existing road corridor and the required construction working width; accordingly, no new land acquisition is anticipated based on the current design approach. The design increases capacity from two lanes to three lanes per direction, with the additional lanes constructed toward the central median where feasible, while maintaining paved shoulders. Figure 2-9 presents the proposed typical cross-section of the Sulaymaniyah–Chamchamal–Kirkuk Road.

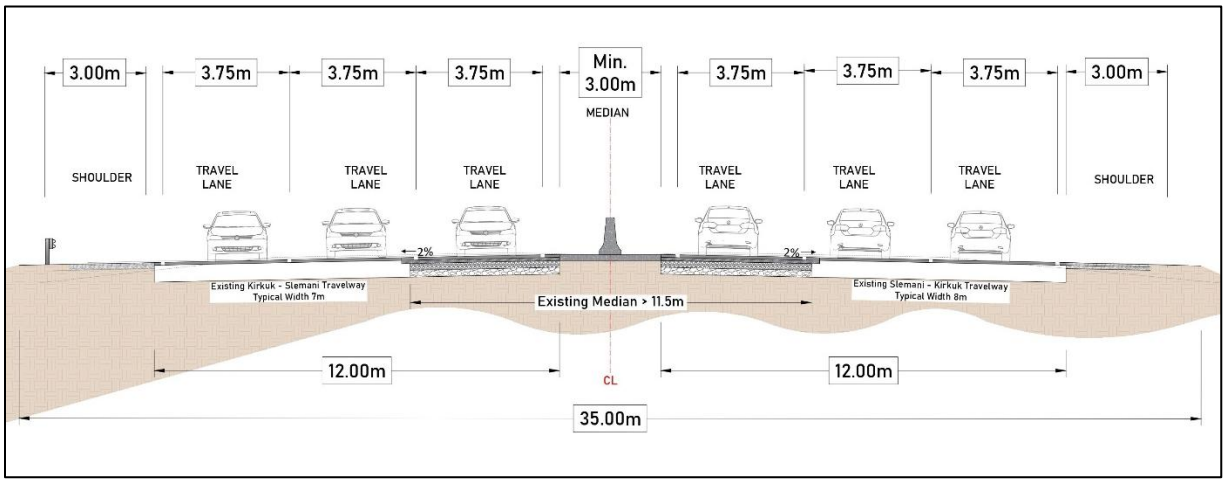


Figure 2-9: Typical Profile of Sulaymaniyah–Chamchamal–Kirkuk Road

The Sub-Project also includes pavement rehabilitation to address surface distress and structural deficiencies; improvements to drainage crossings and roadside drainage where required; access-management measures to reduce conflict points; and installation of road-safety features and traffic-control devices (including road markings, signage, barriers/guardrails where applicable), together with associated roadside infrastructure.

2.1.5.4 Girsheen–Suhaila Road Upgrade and Girsheen Interchange (KRI)

Component 1: Girsheen–Suhaila Road (Completion Works)

The Girsheen–Suhaila Road component comprises the completion of outstanding works associated with the roadway that has already been substantially constructed. The main civil works and pavement layers are in place; however, several critical elements remain unfinished, including the stone mastic asphalt wearing course, paved shoulders, roadside safety systems (such as guardrails), and electrical and lighting works. These remaining items are required to achieve the intended level of service, safety performance, and durability of the road. The completion works will be implemented within the existing right-of-way and will interface with already constructed pavement, drainage, and utility infrastructure, requiring coordinated execution to ensure continuity of the works and integration with the operational road environment. Figure 2-10 presents the road upgrade cross-section.

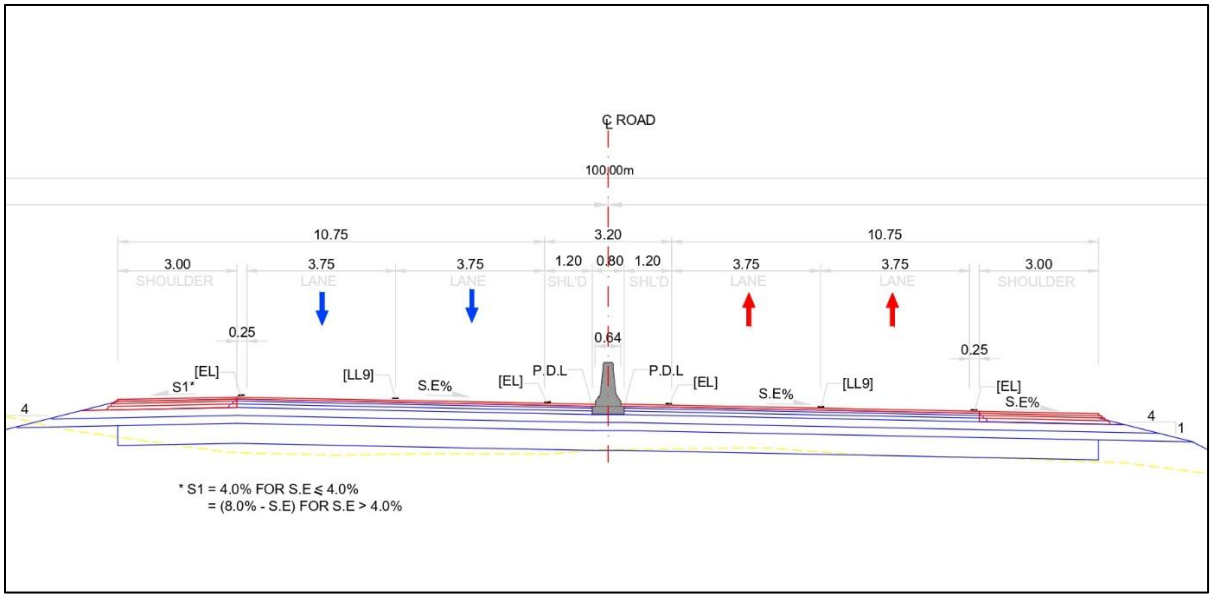


Figure 2-10: Girsheen–Suhaila Road Upgrade Profile

Component 2: Girsheen Overpass (New Construction)

The Girsheen Overpass component involves the construction of a new grade-separated structure intended to remove at-grade conflicts at a key intersection along the corridor. The overpass is intended to improve traffic operations, enhance safety, and accommodate projected traffic growth by separating through movements from local and turning traffic. The proposed concept includes a standard bridge structure with horizontal and vertical geometry consistent with applicable design standards, supported by foundations appropriate to site conditions. The overpass will be integrated with the existing road network through approach ramps and tie-in sections. Figure 2-11 presents the Girsheen overpass design.

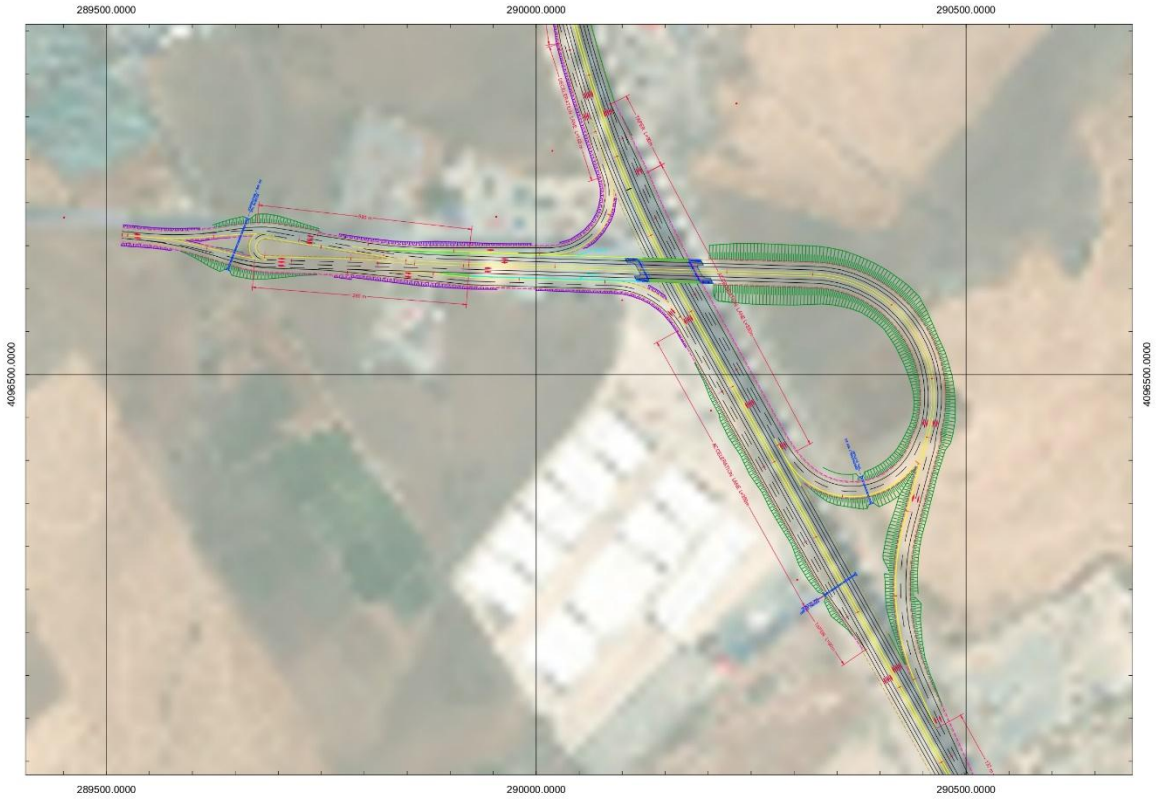


Figure 2-11: Girsheen Overpass Design and Layout

2.1.6 Sub-Projects Timeline

2.1.6.1 Expressway No. 2 (Baghdad–Samarra) and Samarra feeder/access road

The project timeline will be done in different phases/stages as shown in Table 2-2 below.

Table 2-2: Expressway No.2 Project Timeline – Staged Phases

Stage	Scope	Duration
Stage 1	Conceptual Design	20 weeks
Stage 2	Aerial Survey + Photogrammetric Mapping + DTM	3–6 months
Stage 3	Preliminary Design + Detailed Design + Tender Documents	46 weeks total
Stage 4	Construction Phase	36 months construction + 12 months maintenance

2.1.6.2 R9B Segment under Expressway No. 1

The total project duration is estimated at approximately 12 months from mobilization through demobilization. The construction works will be implemented in stages along the corridor to maintain traffic flow and minimize disruption to road users and adjacent communities.

2.1.6.3 Sulaymaniyah–Chamchamal–Kirkuk Road (KRI)

The total project duration is estimated at approximately 20 months from mobilization through demobilization. The construction works will be implemented in stages along the corridor to maintain traffic flow and minimize disruption to road users and adjacent communities.

2.1.6.4 Girsheen–Suhaila Road Upgrade and Girsheen Interchange (KRI)

The total project duration is estimated at approximately 18 months from mobilization through demobilization.

2.2 Description of Project Activities

2.2.1 Mobilization and Pre-Construction

Mobilization and site preparation activities comprise the tasks required to establish the works, confirm the approved corridor on the ground, and prepare work areas for the start of implementation. The Project includes a mix of intervention types, namely: greenfield (new construction) works (the Expressway No. 2 Baghdad–Samarra section including the feeder connection, and the Girsheen Interchange/Overpass), expansion/upgrade works within an existing corridor (the Sulaymaniyah–Chamchamal–Kirkuk Road widening and upgrade), and rehabilitation/completion works (the Expressway No. 1 R9B rehabilitation and maintenance segment, and the Girsheen–Suhaila Road completion/rehabilitation works). Mobilization includes corridor confirmation and set-out, site clearance, early earthworks and formation/subgrade preparation, localized adjustment of any existing gravel or concrete at tie-ins, setup of temporary facilities, temporary access and traffic arrangements, mobilization of plant, materials, and personnel, establishment of temporary water and power supplies, and verification of interfaces with utilities and third-party assets. The mobilization and expected site preparation activities are summarized in Table 2-3 below.

Table 2-3: Mobilization And Site Preparation Activities under the ITREC Project

Activity	Greenfield / Expansion	Rehabilitation / Completion
Site Establishment and Mobilization	– Mobilization of personnel, equipment, and materials to designated staging areas – Establishment of site offices, communication units, equipment parking areas, workshops, and material storage areas – Installation of temporary utilities including power supply, water supply, lighting, and sanitation facilities – Establishment of worker accommodation facilities (where required)	– Mobilization of personnel, equipment, and materials to designated staging areas – Establishment of site offices, communication units, equipment parking areas, workshops, and material storage areas – Installation of temporary utilities including power supply, water supply, lighting, and sanitation facilities – Establishment of worker accommodation facilities (where required)
Corridor / Work Limits Confirmation and Set-Out	– Confirm corridor/work limits against approved drawings and ground markers – Establish survey control points and benchmarks – Set out centerline, right-of-way/working limits, and offsets for works – Mark limits of temporary work areas (camps, laydown, workshops) and access points	– Verify the road centerline, work limits, and control points for setting-out works (as needed for tie-ins and rehabilitation sections)

Surveys and Site Verification	– Verification of site conditions at construction sites and interfaces prior to works – Identification and marking of existing utilities (water pipelines, telecom lines, electrical poles/lines, and ICT installations) – Inspection of existing drainage structures and culverts at crossings and interface locations	– Pavement condition checks, including localized testing to support planning – Identification and marking of existing utilities (water pipelines, telecom lines, electrical poles/lines, and ICT installations) – Inspection of existing drainage structures and culverts
Site Clearance / Preparatory Site Activities	– Removing debris, waste, and miscellaneous obstructions from work areas – Removing physical barriers restricting access and movement (where applicable) – Clearing vegetation where required within work limits – Stripping topsoil where required and stockpiling for reuse where applicable – Removing and disposing of unsuitable surface material identified during clearance – Marking and designation of temporary stockpile locations – Marking of spoil-disposal routes and locations (where applicable) – Identification of elements scheduled for removal during works	– Marking and designation of temporary stockpile locations – Marking of spoil-disposal routes and locations (where applicable) – Identification of elements scheduled for removal during works
Initial Earthworks and Platform/Subgrade Preparation	– Excavating unsuitable material encountered at formation level – Undertaking cut-and-fill to achieve formation levels and design grades – Shaping and trimming formation to required lines and levels – Compacting soil to achieve required condition for subsequent layers	– Localized surface preparation at repair locations and tie-ins (as required), including limited excavation and re-compaction to support reinstatement works
Leveling / Adjustment at Tie-ins	– Identifying locations where existing gravel or concrete occurs within work areas or tie-ins – Reworking/scarifying gravel layers to achieve a uniform platform – Breaking/trimming/planing concrete surfaces where adjustment is required – Backfilling low areas and re-compacting to achieve required level and support	– Localized leveling/adjustment at tie-ins to ensure smooth transitions with existing pavement and reinstatement works

Temporary Facilities Setup	– Preparing sites for construction camps, site offices, laydown/storage areas, and mechanical workshops – Installing temporary offices, storage containers, and worker facilities as required – Establishing workshop areas for plant maintenance and minor repairs – Establishing fuel storage and dispensing arrangements – Setting up sanitation facilities and waste collection points at camps and work areas	– Preparing sites for site offices, laydown/storage areas, workshops, and material storage areas – Installing temporary utilities including power, water, lighting, and sanitation facilities – Establishing worker accommodation facilities (where required)
Temporary Access and Internal Transport Routes Setup	– Identifying access points from existing roads to construction sites – Grading and compacting temporary access tracks to support construction traffic – Establishing internal transport routes and turning areas within work zones – Constructing temporary crossings over minor drains/ditches where required for access – Maintaining temporary tracks and transport routes to remain trafficable during early works	– Identifying and confirming access points to construction sites – Establishing and maintaining temporary access routes and internal transport arrangements within work zones
Temporary Traffic Management Setup	– Identifying tie-ins, crossings, and interface points requiring traffic control – Installing temporary signage, barriers, cones, and delineation devices – Implementing detours/diversions where required and maintaining safe access for local traffic	– Traffic staging and temporary traffic management to maintain traffic flow and safe access during rehabilitation/completion works (signage, barriers, delineation, and detours where required)
Plant and Equipment Mobilization	– Mobilizing earthmoving and grading plant to initial construction sites – Mobilizing compaction plant and water tankers for earthworks support – Mobilizing transport fleet and support vehicles – Establishing on-site maintenance capability and refueling arrangements	– Mobilizing construction plant and rehabilitation equipment to construction sites – Establishing on-site maintenance capability and refueling arrangements (as required)
Materials, Tools, and Personnel Mobilization	– Mobilizing tools, consumables, and site safety equipment	– Mobilizing tools, consumables, and site safety equipment

	– Mobilizing early materials for start-up works and staging/stockpiling as required – Establishing initial material handling arrangements at construction sites – Mobilizing management staff, supervisors, and crews for surveying, clearance, and earthworks start-up	– Mobilizing materials required for rehabilitation/completion works and staging/stockpiling as required – Mobilizing management staff, supervisors, and crews for condition verification and start-up works
Water and Power Setup	– Establishing temporary water supply for compaction, dust suppression, and early works – Setting up water distribution points for camps and work areas where required – Establishing temporary power supply for site offices, workshops, lighting, and communications (grid and/or generators) – Installing temporary site lighting where required for security or extended working hours	– Establishing temporary water and power supplies for site offices, work areas, lighting, and sanitation facilities (grid and/or generators)
Utilities Interface Verification	– Compiling available information on utilities and third-party assets within the corridor – Verifying utility locations in the field and marking utilities in advance of excavation – Coordinating protection measures and any required diversions/relocations with utility owners – Implementing temporary protection measures where required (covers, barriers, exclusion zones)	– Identifying and marking existing utilities prior to works – Coordinating protection measures and any required adjustments with relevant utility owners – Implementing temporary protection measures where required (covers, barriers, exclusion zones)

2.2.2 Construction Activities

Construction activities comprise the staged physical works required to deliver the ITREC road investments and associated structures. Given the nature of the interventions, construction tasks are grouped into three implementation types: (i) greenfield / new construction, (ii) expansion / upgrade of existing corridors, and (iii) rehabilitation / completion works on existing roads. Greenfield works generally include establishment of new roadway sections and any new grade-separated structures; expansion/upgrade works focus on widening and upgrading capacity and safety within an existing corridor; and rehabilitation/completion works focus on restoring pavement performance, upgrading safety and drainage, and completing outstanding items within an existing right-of-way. The indicative construction activities for each intervention type are summarized in Table 2-4 below.

Table 2-4: Construction Activities under the ITREC Project

Activity	New Construction	Expansion / Upgrade	Rehabilitation / Completion
Traffic management and work-zone establishment	– Establish controlled access, internal circulation, and security arrangements for active construction sites – Identify interface points requiring traffic control and implement temporary traffic management (signage, barriers, delineation, cones) – Implement detours/diversions where required and maintain safe access for local traffic	– Set out work zones along the corridor – Install temporary traffic signs, cones, barriers, delineators, and warning devices – Implement staged lane-by-lane construction and contraflow arrangements where required – Construct temporary diversions and internal access routes within the corridor – Install temporary pedestrian access routes and crossing arrangements in built-up areas (where applicable)	– Set out work zones along the corridor / construction sites – Install temporary traffic signs, cones, barriers, delineators, and warning devices – Implement staged lane-by-lane construction and contraflow arrangements where required – Construct temporary diversions and internal access routes within the corridor
Survey, setting-out, and interface verification	– Survey verification and setting-out of the works corridor and key control points – Identify interfaces with existing roads, drainage features, canals/irrigation infrastructure, utilities, and rail interfaces – Establish protection measures and interface controls at sensitive or constrained locations	– Verify the corridor geometry and control points for setting-out works – Identify and mark existing utilities including water pipelines, telecom lines, electrical poles/lines, and ICT installations – Inspect existing drainage structures and culverts and confirm widening/extension requirements	– Verify control points and key tie-ins for works sequencing – Identify and mark existing utilities and third-party assets prior to works – Inspect existing drainage structures and culverts and confirm rehabilitation / completion needs
Site clearance and enabling works	– Clearing and grubbing within approved work limits – Topsoil stripping and stockpiling where relevant for later reinstatement – Establish temporary access tracks and internal transport routes to support construction sites	– Clearing and grubbing of vegetation within construction limits – Remove median vegetation and trees required for widening – Remove debris, accumulated roadside waste, and obstructions – Dismantle/remove existing elements within the work zone where required (e.g.,	– Establish construction sites and staging areas within the existing corridor – Clear and grub vegetation within the construction footprint (where required) – Remove debris, roadside obstructions, and existing elements

	– Undertake enabling works at crossings and constrained locations to facilitate subsequent construction	damaged barriers, old signage, minor structures)	within the work zone where required
Earthworks and formation works	– Cut-and-fill operations to achieve formation levels and design grades – Construct embankments and compact in layers to meet specified requirements – Subgrade preparation, trimming, and acceptance prior to pavement construction – Handle, transport, and place excavated materials and suitable fill, including temporary stockpiles and surplus material management	– Excavate median and localized areas to form additional lanes – Excavate for culvert extensions, drainage channels, and localized widening areas – Construct embankments through filling, backfilling, and compaction – Subgrade preparation, shaping, trimming, and compaction	– Excavate in required strata for road formation, drainage elements, and structural elements as needed – Construct embankments through filling, backfilling, and compaction (where required) – Remove existing shoulder materials and prepare subgrade for pavement works
Drainage and cross-drainage works	– Construct roadside drainage features (ditches, channels, and associated structures) – Install cross-drainage culverts along the alignment and at access road sections – Install culverts and drainage structures at irrigation/drainage canal interfaces – Construct inlet/outlet structures and scour/erosion protection at drainage outfalls	– Excavate for new drains, channels, and related crossing works – Clean, clear, and rehabilitate existing drainage systems – Extend, replace, or construct culverts as required – Implement surface-drainage works in settlement areas with inadequate runoff (where applicable)	– Line and rehabilitate roadside ditches and channels (where applicable) – Rehabilitate / complete drainage structures and culverts within the corridor
Structures and crossings	– Construct interchanges, overpasses, and bridge works along the corridor	– Rehabilitate and/or widen bridge elements where required, including substructure/superstructure works	– Construct grade-separated structures (overpass) including substructure and superstructure elements (where applicable)

	– Construct river crossing structures – Construct irrigation canal crossing structures	– Undertake reinforced-concrete works including formwork, rebar placement, concrete pouring, and curing – Install structural components such as expansion joints, barriers, and protective elements	– Construct retaining walls and associated reinforced-concrete works (where applicable) – Install structural components and protective elements associated with bridge works
Pavement and roadway works	– Place and compact subbase and base layers – Apply prime/tack coats and lay asphalt pavement layers – Construct shoulders, medians, and associated roadway elements – Complete tie-ins and interfaces with existing roads	– Place and compact subbase and base-course layers – Mill and remove existing asphalt layers where required – Apply prime coat and tack coat – Place asphalt binder course and wearing course – Asphalt paving of widened sections, mainline, shoulders, and rehabilitated areas – Reconstruct the median according to the design	– Subgrade improvement and preparation works – Place pavement base and subbase layers – Place asphalt pavement layers including base, binder, and surface courses – Apply Stone Mastic Asphalt (SMA) surfacing (where applicable) – Rehabilitate selected sections of the existing pavement where required
Access management and road furniture (safety, signage, markings)	– Install road restraint systems/barriers, signage, delineation features, and road markings	– Construct designated U-turns and close informal openings – Construct formal access points for adjacent properties where applicable – Install guardrails, crash barriers, and delineators – Install road signs, pavement markings, reflectors/road studs – Install pedestrian crossing facilities where applicable	– Remove damaged existing barriers and install new median and roadside barriers – Install guardrails and crash-protection systems – Apply pavement markings and install traffic signs in accordance with approved designs
Utility relocation and protection	– Coordinate utility protection measures and any required diversions/relocations with utility owners – Implement temporary protection measures where required (covers, barriers, exclusion zones)	– Excavate for utility adjustments within the corridor – Relocate or modify electrical poles, telecom lines, fiber-optic cables, ICT installations, and irrigation wells (where applicable)	– Identify and protect existing utilities during works – Implement localized adjustments/relocations where required and reinstate disturbed areas

		– Backfill, compact, and reinstate trenches and disturbed areas	
Lighting works	– Install lighting and associated cabling at locations included in the design (where applicable)	– Install/adjust lighting and associated cabling where required (where applicable)	– Install lighting poles, luminaires, and associated cabling along the corridor and at grade-separated structures (where applicable)
Materials handling and transport	– Transport and delivery of aggregates, asphalt mix, concrete, steel, and other materials to the site – Handling, stockpiling, and internal movement of materials within designated construction areas – Loading, hauling, and removal of excavated materials – Operation of water tankers for construction-related uses (e.g., compaction support, dust suppression)	– Transport and delivery of aggregates, asphalt mix, concrete, steel, and other materials to the site – Handling, stockpiling, and internal movement of materials within designated construction areas – Loading, hauling, and removal of excavated materials – Collection and removal of construction waste from the work corridor – Operation of water tankers for construction-related uses	– Transport and delivery of aggregates, asphalt mix, concrete, steel, and other materials to the site – Handling, stockpiling, and internal movement of materials within designated construction areas – Loading, hauling, and removal of excavated materials – Collection and removal of construction waste from the work corridor – Operation of water tankers for construction-related uses
Finishing works, reinstatement, and de-mobilization	– Final grading, verge shaping, and reinstatement of disturbed areas – Remove temporary facilities, laydown areas, and temporary access arrangements – Site housekeeping and removal of wastes from construction areas, including closure and rehabilitation of temporary footprints used during construction	– Final reinstatement of disturbed areas within the corridor and associated housekeeping – Remove temporary traffic-control devices and temporary works as construction stages are completed	– Dismantle temporary facilities (camps, offices, workshops, storage yards) and remove temporary utilities – Remove temporary barriers, signs, traffic-control devices, and detours – Backfill and grade temporary access roads and storage locations (where applicable) – Remove wastes, construction debris, and surplus materials and restore disturbed areas – Repair any unintended damage to local

			roads/assets/utilities and complete final inspection and handover

2.2.3 Operation Phase

Following completion of construction and opening to traffic, the Project interventions will function as operational road corridors and associated structures. Unlike the construction phase, the operation phase does not involve intensive ground disturbance; activities are mainly limited to corridor operation (traffic use, control, and safety management) and asset upkeep (routine and periodic maintenance of the roadway and associated infrastructure). Routine operation and maintenance will be undertaken by a small workforce focused on inspections and maintenance interventions.

Operation Activities

Operation activities are expected to include:

- Maintaining safe and orderly use of the road corridors, including monitoring of corridor condition and safety at junctions/interchanges, access points, crossings, and other interface locations.
- Maintaining the functionality of operational safety features (e.g., signage, road markings, and barriers/road restraint systems).
- Coordinating with relevant local authorities in relation to operational safety and incident response, as needed.

Maintenance Activities

Maintenance will be undertaken to preserve road safety and serviceability and to maintain the performance of associated infrastructure (including drainage/cross-drainage structures and bridges/overpasses/interchanges). Maintenance activities are expected to include the following:

- **Routine maintenance**
  - Routine inspections of the pavement, shoulders, embankments, and roadside condition.
  - Cleaning and clearing of drainage features (e.g., inlets/outlets, channels, and culverts) to maintain hydraulic performance.
  - Upkeep of signage, markings, and barriers/guardrails, including replacement of damaged elements.
  - Vegetation control and general corridor housekeeping (removal of debris and waste) to maintain visibility and safety.
- **Periodic maintenance**
  - Pavement rehabilitation activities (e.g., localized repairs, resurfacing/overlay where required).
  - Periodic inspections and maintenance of bridges/overpasses/interchanges and other structures, including associated safety features and drainage elements.
- **Reactive maintenance**

- Repair of localized damage resulting from accidents, extreme weather events, or unexpected failures (e.g., damaged barriers/signage, blocked culverts, localized pavement failure).

2.2.4 Resource Requirements

2.2.4.1 Construction Phase

At the time of preparation of this ESIA, detailed information on construction resource requirements (including confirmed quantities, sources/suppliers, specific consumption rates, and final locations/arrangements for temporary facilities and services) was not available. Accordingly, the construction resource requirements described below are indicative and reflect typical needs to implement the Project interventions, including greenfield construction, rehabilitation and completion works, and rehabilitation with widening/expansion within existing corridors.

Water Requirements

Water will be required mainly for dust suppression on unpaved areas and internal transport routes, compaction activities, concrete production where applicable, and general site use, including domestic needs within camps. Water will be supplied through municipal supply connections where available and/or by water tankers, subject to approvals and coordination with the competent authorities.

Power and Fuel Requirements

Temporary power for camps, workshops, and construction sites will be provided through available grid connections where feasible and/or generator sets. Fuel will be required for construction machinery, haulage vehicles, and generators, and will be managed through controlled refueling arrangements, bunded storage where applicable, and routine equipment maintenance to minimize spills and leaks.

Materials Requirements

Construction will require typical road and structure materials, including:

- suitable fill and embankment materials
- aggregates/crushed stone for subbase and base layers
- bituminous materials (including prime and tack coats and, where applicable, stone mastic asphalt for wearing courses)
- concrete constituents (including cement types appropriate to design requirements) and precast/cast-in-place concrete elements for drainage and structural works
- steel reinforcement for culverts, bridge/overpass works, and other reinforced concrete structures
- road furniture and traffic-control materials (guardrails/barriers, signage, delineation, and road-marking materials)

Material quantities and sourcing arrangements will be finalized by the Contractor and documented in the approved construction methodology and procurement plan, with sourcing limited to licensed/authorized suppliers and facilities as applicable.

The final sources of construction materials and the mechanisms for their supply, including haulage routes and any associated facilities, shall be confirmed and assessed in the relevant site-specific ESIAs/ESMPs and other downstream E&S instruments once detailed design and procurement

arrangements are available. Construction materials shall be sourced, from government-licensed and/or officially approved facilities and suppliers, including quarries, borrow areas, asphalt plants, concrete batching plants, and other authorized material sources, in accordance with applicable legal and regulatory requirements.

Construction Equipment Requirements

The Project will utilize heavy construction equipment appropriate to the intervention type, including:

- earthmoving and excavation equipment (excavators, loaders, bulldozers, backhoe loaders) for formation works, widening works, drainage, and foundations
- paving and compaction equipment (asphalt pavers, motor graders, steel and pneumatic rollers) for pavement layers and density achievement
- production and mixing systems (off-site asphalt plants, concrete batching plants, transit mixers) where applicable
- lifting and structural equipment (crane trucks and mobile cranes) for bridge/overpass works and heavy component installation
- haulage and support fleet (dump trucks, asphalt dump trucks where applicable, fuel trucks, water tankers, mobile lighting units, compressors, welding machines, and generators)

Waste and Wastewater Requirements

Construction will generate non-hazardous wastes (e.g., domestic wastes from camps, packaging, scrap materials, inert debris, and milled asphalt where applicable) and hazardous wastes (e.g., used oils and lubricants, oily rags/filters, chemical containers, and contaminated absorbents). Wastewater will arise mainly from worker welfare facilities, camp operations, and (where applicable) equipment washing and concrete works. Wastewater will be managed through contained sanitation systems (e.g., septic tanks with periodic emptying by vacuum tankers and disposal at an approved facility) or equivalent controlled arrangements in line with applicable requirements.

Proposed spoil disposal locations for excess excavation materials shall be identified and assessed in the relevant site-specific ESIAs/ESMPs and other downstream E&S instruments, including their selection criteria, indicative capacity, access arrangements, management measures, and relevant environmental and social considerations, and disposal shall only take place at officially approved locations.

Workforce Requirements

The construction workforce will include technical and supervisory staff (including a general manager/site manager, senior road engineers, materials engineers, and other specialist engineers as needed), dedicated HSE staff, skilled operators for specialized machinery and equipment, semi-skilled and unskilled labor, drivers, and administrative/support personnel. Workforce levels will vary substantially by intervention type, work sequencing, and staging/traffic-management approach, and are expected to peak during intensive works. Indicative peak workforce estimates include:

- Greenfield expressway construction: up to 1,500 workers (indicative composition: 420 skilled, 630 semi-skilled, 450 unskilled).
- Rehabilitation and widening/expansion corridors: approximately 100–120 workers at peak.

It is important to note that at the current stage of project preparation, detailed quantification of resource requirements, including confirmed material volumes, finalized supply sources, haulage arrangements, and spoil disposal quantities and locations, is not yet available and will be finalized at subsequent design and implementation stages. Accordingly, these aspects shall be further assessed and specified in the relevant site-specific ESIAs/ESMPs and other downstream E&S instruments once detailed designs and construction methodologies are available.

2.2.4.2 Operation Phase

At the time of preparation of this Draft ESIA, detailed information on operation-phase resource requirements (including annual consumption rates, confirmed suppliers and service providers, and routine maintenance work programs) was not available. Accordingly, the resource requirements described below are indicative and reflect typical needs for operation and maintenance of an expressway.

Water Requirements

Water requirements during operation are expected to be limited and mainly associated with staff welfare facilities and periodic cleaning and minor maintenance activities. Where operational facilities are established, water supply will be secured through connection to the local water supply network where available. Where network connection is not available at a given location, water may be supplied through controlled arrangements such as water tankers.

Power and Fuel Requirements

Electricity demand during operation is expected to be limited and mainly associated with any operational facilities and routine maintenance activities. Where operational facilities are established, electricity supply will be secured through connection to the national grid where available. Where grid connection is not available at a given location, electricity may be supplied through generator sets. Fuel will be required for patrol and maintenance vehicles and for maintenance equipment and will be managed through controlled refueling arrangements.

Materials Requirements

Operation and maintenance will require limited quantities of materials compared to construction, typically including asphalt and aggregates for localized pavement repairs, materials for shoulder and verge upkeep, and replacement parts for road furniture (e.g., barriers/guardrails, signs, delineators) and drainage elements (e.g., repairs to inlets/outlets and culvert components).

Waste and Wastewater Requirements

Wastes generated during operation will mainly include collected litter and debris from the corridor, damaged or replaced road furniture components, and maintenance-related wastes (e.g., packaging and scrap materials). Small quantities of hazardous wastes may arise from equipment servicing (e.g., oily wastes, used filters, contaminated absorbents) and will be managed through controlled storage and transfer arrangements. Wastewater generation during operation is expected to be limited and mainly associated with staff welfare facilities, where present, and will be managed through contained

sanitation systems (e.g., septic tanks with periodic emptying by vacuum tankers) or equivalent controlled arrangements.

Workforce Requirements

Operation and routine maintenance are expected to be undertaken by a small workforce, comprising corridor inspection/patrol staff, maintenance technicians, and supervisory personnel, supported as needed by specialized contractors for periodic maintenance interventions.

2.3 Associated Facilities

Under the World Bank ESS 1, associated facilities are facilities or activities that are not financed as part of the Project and that meet all of the following conditions: (a) they are directly and significantly related to the Project; (b) they are carried out, or planned to be carried out, contemporaneously with the Project; and (c) they are necessary for the Project to be viable and would not have been constructed, expanded, or conducted if the Project did not exist as shown in Figure 2-12 below.

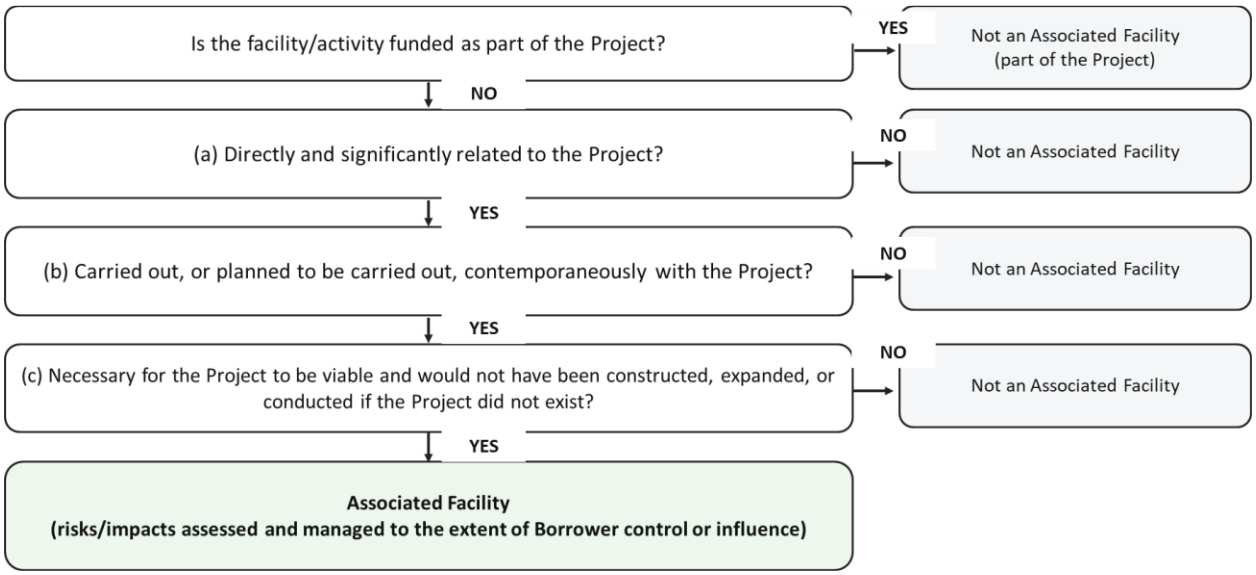


Figure 2-12: Definition of Associated Facility According to WB ESF

The associated facilities screening is applied to facilities and activities that may be used for, or support, construction and operation of the ITREC Project interventions, but fall outside the financed Project scope. The screening applies across the range of intervention types under ITREC, including greenfield (new construction), rehabilitation/completion, and expansion/upgrading works, implemented in federal Iraq and the Kurdistan Region of Iraq. Where any facility or activity is screened in as an associated facility, its environmental and social risks and impacts will be addressed in the ESIA to the extent of the Borrower's and implementing agencies' control or influence over the associated facility.

It is important to note that the remaining segments of Expressway No. 2 along the broader north–south corridor linking the Baghdad Ring Road to the Turkish border do not qualify as Associated Facilities under ESS1 for the purposes of this ESIA. While these segments form part of the broader corridor concept, they are not necessary for the viability of the Project components assessed under this ESIA, are not being implemented as contemporaneous supporting facilities to those components,

and will be subject to separate planning, financing, design, and environmental and social assessment processes, as applicable.

Specific associated facilities for the ITREC Project are not available at this stage and will be confirmed based on the final design, procurement approach, and construction delivery arrangements. Associated facilities may include the following, where they meet the ESS1 criteria.

Construction Phase

- Contractor construction camps and worker accommodation facilities
- Temporary site offices, storage/laydown yards, and mechanical workshops established off-site to support construction
- Borrow pits, quarries, sand/gravel extraction areas, and crusher operations supplying construction materials
- Temporary access roads, transport roads, and detours developed outside the Project footprint to support construction logistics
- Utility connections, diversions, or upgrades undertaken by third parties to support construction (power, water, telecommunications), where required for Project delivery
- Authorized hazardous waste treatment/disposal facilities used for management of hazardous wastes generated during construction, including transport by licensed carriers where required

Operation Phase

- Tolling facilities and associated equipment and power supply infrastructure (if implemented)
- Operation and maintenance depots, maintenance yards, and materials storage areas supporting routine and periodic maintenance
- Rest areas and other roadside service facilities required for operation

2.4 Project Alternatives

This section presents the principal alternatives considered for the ITREC Project at the current stage, including the no project alternative, the project alternative, and local alignment and design development options identified during conceptual design and subsequent screening.

2.4.1 "No Project" Alternative

Under the no project alternative, the ITREC road interventions would not be implemented. Travel demand for passenger and freight transport would continue to be accommodated on the existing road network, including existing strategic corridors and urban and peri-urban links that currently experience capacity, safety, and reliability constraints. Under this alternative, the intended benefits of the ITREC investments—covering (i) greenfield construction of new links/structures where applicable, (ii) rehabilitation and maintenance of strategic corridors, and (iii) widening/expansion and safety upgrading of existing corridors—would not be realized. As a result, constraints related to travel time reliability, logistics efficiency, road safety performance, asset condition, and connectivity to regional economic centers, border crossings, and key services would likely persist. The intended benefits associated with the ITREC interventions are summarized in Table 2-5.

Table 2-5: Associated Benefits with the ITREC Project

Benefit Area	Description
Strategic corridor connectivity and network performance	ITREC investments are intended to strengthen connectivity across strategic corridors and key inter-city routes by improving network continuity, reducing bottlenecks, and enhancing travel time reliability for passenger and freight movements. Under the no project alternative, corridor constraints and variability in travel conditions would remain.
Trade, freight, and logistics efficiency	Rehabilitation and targeted upgrades are intended to reduce transport costs and logistics frictions through improved pavement condition, reduced delays, improved operating speeds (where safe), and better corridor predictability for heavy vehicles and supply chains. Under the no project alternative, vehicle operating costs associated with poor pavement condition, unmanaged access, and recurring congestion points would continue.
Road safety and access management	ITREC interventions are intended to improve safety performance through upgraded geometric features (where applicable), improved drainage and roadside conditions, upgraded signing/markings, improved roadside protection (barriers/guardrails), and more controlled access at high-risk locations. Under the no project alternative, existing safety deficiencies (including informal access points and unsafe turning movements in rehabilitation corridors) would remain.
Asset preservation and lifecycle costs	Rehabilitation and maintenance investments are intended to preserve existing road assets and reduce lifecycle costs by addressing pavement distress, rutting, localized failures, and drainage deficiencies. Under the no project alternative, deterioration would continue and may accelerate under heavy traffic loading, increasing future rehabilitation costs and service disruptions.
Community access and mobility	Improvements are intended to enhance access to services and markets by improving corridor function and safety, particularly for communities and economic activities along the intervention corridors. Under the no project alternative, communities would continue to experience constraints related to unreliable travel conditions, safety risks, and localized access challenges near high-traffic segments.
Industrial and commercial activity support	Upgraded inter-city and industrial-belt corridors are intended to improve access for industrial operations, commercial movement, and distribution activities (including heavy-vehicle routes), supporting regional productivity. Under the no project alternative, road condition and operational constraints that affect supply chains and workforce mobility would persist.
Agriculture and farm-to-market logistics	Where corridors traverse agricultural landscapes, improved road condition and corridor reliability are intended to support movement of agricultural inputs and outputs and reduce spoilage and delays. Under the no project alternative, transport inefficiencies affecting farm-to-market connectivity would remain.
Employment and local economic effects	ITREC investments are expected to generate direct construction employment and indirect employment through supply chains, services, and corridor-related economic activity (e.g., transport services, roadside services where relevant). Under the no project alternative, these employment and localized economic stimulus effects would not occur.
Climate and resilience co-benefits (operational reliability)	Drainage rehabilitation, culvert maintenance/upgrading, and improved asset condition are intended to reduce disruption risks during heavy rainfall events and improve corridor service continuity. Under the no project alternative, existing drainage constraints and related service interruptions would be more likely to persist.

2.4.2 Route Alignment

At the current stage of Project development, route alignment alternatives were principally considered for the greenfield Expressway No. 2 (Baghdad–Samarra) corridor and for the Girsheen Interchange, where alignment and layout selection have the greatest influence on land acquisition, physical displacement, and impacts on productive land uses and local access. The alignment development process sought to identify technically feasible solutions that would achieve the Project objectives while minimizing adverse environmental and social impacts, particularly impacts on residential structures, agricultural land, fish farms, orchards, roadside economic activities, and other livelihood-related assets.

For Expressway No. 2, three alignment options within the same general corridor were assessed compared during conceptual design and early screening. The comparative assessment focused primarily on land acquisition and livelihood implications, including impacts on buildings, project-affected persons (PAPs), schools, fish farms, and agricultural land uses. In line with the mitigation hierarchy, the preferred option was the one that best avoided and minimized physical and economic displacement while remaining technically feasible from an engineering and road-function perspective.

For the Girsheen Interchange, alignment and layout development likewise focused on identifying a technically feasible overpass and tie-in arrangement that would minimize impacts on agricultural land, local access, and roadside economic activities in the immediate junction area.

Detailed assessment and final refinement of route alignment and layout alternatives for the relevant sub-projects will be further developed and discussed, as applicable, in the site-specific ESIAs/ESMPs and other relevant downstream instruments prepared prior to commencement of the relevant works.

2.4.3 Design Options

In addition to route alignment considerations, design development for the ITREC interventions has also sought to optimize the engineering footprint and reduce environmental and social impacts within the selected corridors. For the rehabilitation and upgrade sub-projects, the preferred design approach prioritizes use of existing road corridors and rights-of-way to the extent feasible, thereby reducing the need for new land acquisition and minimizing impacts on adjacent land uses and roadside activities. For structures and localized footprint areas, including the Girsheen Interchange, design development will continue to consider opportunities to reduce impacts on agricultural land, roadside economic activities, access arrangements, and other sensitive receptors while maintaining the required traffic function, safety, and engineering performance of the sub-projects.

At the current stage of Project preparation, the detailed assessment of specific design alternatives and final optimization measures remains subject to subsequent engineering development. Accordingly, design-option refinement and the related environmental and social implications will be further assessed, as applicable, in the site-specific ESIAs/ESMPs and other relevant downstream instruments prepared for the different sub-projects.

2.4.4 Construction Methods

Alternative construction approaches may influence the scale and duration of temporary environmental and social impacts, particularly in relation to traffic disruption, access restrictions, dust and noise generation, erosion and runoff, waste generation, and disturbance to nearby communities and sensitive receptors. In general, the Project will seek to apply staged construction, controlled work zones,

temporary traffic management, and progressive reinstatement in order to reduce temporary impacts during implementation.

However, at the current stage of Project preparation, detailed construction methods, sequencing, work-front arrangements, traffic diversion approaches, and site-specific temporary works requirements have not yet been finalized. These matters, including the environmental and social implications of alternative construction approaches, will therefore be further assessed and defined, as applicable, in the site-specific ESIAs/ESMPs, Contractor ESMPs, method statements, and other relevant downstream instruments prepared prior to commencement of the relevant works.

3 Institutional and Legal Framework

This section presents the key World Bank and national environmental and social requirements relevant to the ITREC Project. The applicability of specific requirements will be reassessed as the Project design and associated activities are further detailed. In addition, Iraq has signed and ratified several international conventions that form an integral part of the national environmental and social legislative framework and are therefore considered where relevant. The assessments and plans produced under this Assignment will meet the requirements of the following:

- **Laws, regulations, and policies of Iraq,** including Kurdistan region (KRI), pertaining to environmental protection, environmental assessment and management; labor rights and working conditions; health and safety requirements; land acquisition; and social development goals.
- **World Bank Group requirements**, in accordance with:
    - WB Environmental and Social Standards (ESS) (2018)
    - World Bank Group (WBG) Environmental, Health and Safety (EHS) General Guidelines
    - WBG EHS Guidelines for Toll Roads (2007)
    - Access to Information Policy
- **Relevant Good International Industry Practice (GIIP)**, including Guidance Notes referenced in this ESIA and associated instruments.
- **Applicable international conventions and protocols.**

Where applicable, national requirements are benchmarked against the World Bank Group Environmental, Health, and Safety Guidelines, including the General EHS Guidelines and sector-specific guidance relevant to roads and toll road operations. These guidelines reflect GIIP and provide technical reference performance levels and measures that are generally acceptable.

The Project has been classified as a **Substantial Risk** project under the World Bank Environmental and Social Risk Classification, as significant risks and impacts are anticipated; however, these are expected to be largely temporary, predictable, and/or reversible, with lower effects on areas of high value or sensitivity, and with more readily available and reliable mitigation and/or compensatory measures.

The Project shall comply with the applicable World Bank ESSs and relevant national legal provisions and requirements. Where gaps are identified between the World Bank ESSs and the national legal framework, the more stringent environmental and social provisions shall apply.

3.1 Project Categorization

Under the World Bank Environmental and Social Risk Classification, the ITREC Project falls within the High/Substantial risk category, reflecting the scale of the works and the potential for significant environmental and social risks and impacts during construction and operation.

In parallel, the Project will be screened and permitted in accordance with the applicable Iraqi environmental assessment and approval requirements. The environmental approval (and any associated conditions) will be obtained from the competent authorities following submission and

review of the ESIA package, and this ESIA will be updated as needed to reflect any final permitting requirements and commitments.

3.2 Domestic Legal Framework

Table below summarizes the principal Iraqi policies, laws, and regulations including requirements in the Kurdistan Region of Iraq (KRI) relevant to the Project and to the preparation of this ESIA. The table is organized by topic and identifies the key legal instruments applicable to environmental protection and permitting, waste and hazardous materials management, air quality, noise, water and wastewater, cultural heritage, labor and working conditions, occupational health and safety, and land acquisition. These requirements provide the national legal framework that informs the impact assessment and the mitigation and management measures presented in subsequent chapters.

Table 3-1: Policies, Laws, and Regulations in Iraq Relevant to the Project

No.	Topic	Legislation	Year	Description
Laws and Regulations in Federal Iraq				
1	Environmental Laws	Law No. 27	2009	Protecting and improving the environment through mitigating existing or potential damage; requires an environmental impact assessment for new developmental sub-projects; addresses air pollution, noise reduction, wastewater effluents, soil protection, biodiversity conservation, hazardous waste management, and controls on chemicals; includes penalties for violations.
2	Environmental Laws (Institutions)	Law No. 37	2008	Defines the institutional arrangements of the Ministry of Environment and outlines roles and responsibilities toward environmental protection.
3	Waste (Hazardous)	National Instruction No. 3	2015	Organizes hazardous waste management by generators/transport/treatment; includes conditions on handling and transboundary movement consistent with the Basel Convention; includes provisions relevant to contaminated areas and POPs management.
4	Waste	Instruction No. 2	2014	Protecting the urban environment through proper waste management (including municipal-type wastes and construction waste, as applicable).
5	Waste (Debris)	Law No. 29	2009	Regulating debris collection areas; described as updating Directive No. 67 (1986).
6	Waste (Debris)	Directive No. 67	1986	Regulating debris collection areas; requires disposal in areas with stable geology and avoiding siting near vulnerable/sensitive

				ecosystems and groundwater/surface water resources.
7	Chemicals	Instruction No. 4	1989	Safe storage and handling of chemicals.
8	Noise	Law No. 41	2015	Noise protection and control; identifies maximum permissible noise limits during daytime and nighttime for different zones.
9	Noise	Law No. 21	1966	Prevention of excessive noise in public places.
10	Air Quality	Regulation No. 471	2012	Assigns responsibility for preserving and improving air quality to the Ministry of Environment; establishes nationwide air quality monitoring, recording, and evaluation of emissions from certain sources.
11	Air Quality	Regulation No. 4	2012	Protection of ambient air quality; requires sources emitting air pollutants to comply with national limits and use monitoring equipment; prohibits burning of waste indoors or in open air near residential areas or near water bodies.
12	Air Quality	Clean Air Act	1979	Establishes air quality standards/limits framed as medium-term policy targets considering feasibility and practicability (as described in the reference text).
13	Water and Wastewater	Law No. 50	2008	Establishes the Ministry of Water Resources and provides the legal and technical framework for institutionalizing water resources management.
14	Water and Wastewater	Law No. 2	2001	Prohibits discharge of effluent into public water unless criteria/specifications are met; allows issuance of restrictions pertaining to public water quality and discharges to public waters, sewage systems, or rainwater.
15	Water and Wastewater	Instruction No. 1	—	Specifies wastewater discharge concentration limits.
16	Community Health	Public Health Law No. 89 (as amended in 2001)	1981	Includes provisions related to public health protection, including drinking water safety and drinking water quality standards.
17	Water and Wastewater	River Protection Instrument (No. 25)	1967	Regulation for the protection of rivers and public water bodies; regulates wastewater discharges and provides physical, biological, and chemical guidelines for water quality;

				includes provisions to protect public water bodies from pollution.
18	Cultural Heritage	Law No. 55	2002	Antiquities and Heritage Law; requires preservation of archaeological/heritage/historical sites and written approval from the antiquity's authority for relevant projects; includes procedures where projects conflict with archaeological sites (including excavation arrangements).
19	Labor and Working Conditions	Labor Law No. 37	2015	Governs employment relationships ("workers"), hiring and termination, leave, wages, collective bargaining, and avenues for complaints and redress; sets employer/employee rights and duties; distinguishes foreign and Iraqi workers; includes provisions on minimum age for employment (15 years) and protections for female workers, including non-discrimination and prohibition of sexual harassment and other offensive/intimidating behavior; includes workplace health and safety provisions.
20	Occupational Health and Safety	Instructions No. 12	2016	Provides OHS procedures/requirements to be adopted at workplaces; includes implementation arrangements referenced in the Project source text (including technical inspection functions and related workplace safety measures).
21	Occupational Health and Safety	Law No. 6	1988	Establishes the National Commission for Occupational Hygiene and Safety and governs enforcement of OHS regulations, including workplace inspections and inspection reports, and employer/worker duties related to OHS.
22	Land Acquisition	Law No. 12	1981	Governs expropriation/acquisition for public benefit and entitlements/compensation; relevant to land acquisition, restrictions on land use, and compensation planning where applicable.
Additional Laws and Regulations from the KRI Region				
23	Environmental Laws (KRI institutions)	KRG Environmental Protection and Improvement Law No. 8	2008	Establishes the legal framework for environmental protection in KRI and defines the authority of the Environmental Protection and Improvement Board (EPIB) for environmental permitting, compliance monitoring, and enforcement.

24	Air Quality (KRI)	KRG Instruction No. 2 on Ambient Air Quality	2011	Establishes ambient air quality standards and related compliance requirements applicable in KRI.
25	Noise (KRI)	Noise Limits Instruction No. 1 (KRG)	2011	Defines permissible noise limits (including for construction activities) and requirements applicable to sensitive receptors in KRI.
26	Cultural Heritage (KRI)	KRG Cultural Heritage Protection Law No. 5	2021	Requires archaeological clearance and defines procedures for managing chance finds and cultural heritage protection during project implementation in KRI.
27	Roads, Land Use, and Right-of-Way (KRI)	Public Roads Law No. 35 (KRG)	2002	Governs road construction and rehabilitation activities and right-of-way management requirements applicable in KRI.

3.3 Applicable International Conventions

Iraq has signed and ratified a number of international conventions committing the country to the conservation of environmental resources and protection of workers' health and safety and labour rights. The following table lists the key conventions.

Table 3-2: Relevant International Conventions and Agreements Ratified by Iraq

No.	Name of Multilateral Agreement	Abbreviation	Date
1	Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal	Basel	2011
2	Stockholm Convention on Persistent Organic Pollutants	Stockholm	2016
3	Convention on Biological Diversity	CBD	2009
4	United Nations Convention to Combat Desertification	UNCCD	2010
5	Convention on Wetlands of International Importance (Ramsar Convention)	Ramsar	2008
6	Convention Concerning the Protection of the World Cultural and Natural Heritage	WHC	1974
7	United Nations Framework Convention on Climate Change	UNFCCC	2009
8	Kyoto Protocol to the UNFCCC	KP	2009
9	Paris Agreement under the UNFCCC	PA	2021

Moreover, the ILO Core (Fundamental) Labor Standards are based on five core principles and rights at work: (i) freedom of association and collective bargaining; (ii) elimination of forced labor; (iii) abolition of child labor; (iv) elimination of discrimination in employment and occupation; and (v) a safe and healthy working environment. Iraq has ratified **9 of the 10** ILO Core Conventions (all except **C155**) as shown in the following table.

Table 3-3: ILO Core Conventions – Ratification Status (Iraq)

ILO Core Convention	Status	Date
C087 Freedom of Association and Protection of the Right to Organize (1948)	Ratified	2018
C098 Right to Organize and Collective Bargaining (1949)	Ratified	1962
C029 Forced Labour (1930)	Ratified	1962

C105 Abolition of Forced Labour (1957)	Ratified	1959
C138 Minimum Age (1973)	Ratified	1985
C182 Worst Forms of Child Labour (1999)	Ratified	2001
C100 Equal Remuneration (1951)	Ratified	1963
C111 Discrimination (Employment and Occupation) (1958)	Ratified	1959
C155 Occupational Safety and Health (1981)	Not ratified	—
C187 Promotional Framework for Occupational Safety and Health (2006)	Ratified	2015

3.4 World Bank Environmental and Social Framework

Since October 2018, all World Bank-financed Investment Project Financing (IPF) operations are required to apply the World Bank ESF to better manage E&S risks and improve development outcomes. The ESF consists of ten ESSs that set out the E&S requirements and the Borrower's responsibilities throughout the Project life cycle, including the identification and assessment of E&S risks and impacts associated with the Project. The ESSs are designed to avoid, minimize, reduce, or mitigate adverse environmental and social risks and impacts.

The ITREC Project is expected to fall within the High/Substantial Environmental and Social Risk Classification, given the scale and nature of greenfield road development and the potential for material E&S risks and impacts during construction and operation. These risks and impacts will be addressed through application of the mitigation hierarchy: (1) anticipate and avoid; (2) minimize or reduce; (3) mitigate; and (4) compensate and/or offset significant residual impacts, where applicable.

The ESIA will evaluate environmental and social risks and impacts in the Project area of influence, including those related to labor and working conditions, occupational health and safety, community health and safety, land acquisition and involuntary resettlement, biodiversity and habitat disturbance, pollution and waste generation, resource use, and cultural heritage. The ESIA will also describe the arrangements for stakeholder engagement and information disclosure, grievance management, and monitoring and reporting requirements, consistent with the ESF and the applicable ESSs.

3.4.1 Environmental and Social Standards (ESS)

Table summarizes the World Bank ESSs and provides a screening-level statement of their relevance to the ITREC Project. The table is intended to guide the scope of the ESIA by identifying the standards that apply to the Project and highlighting the main areas of environmental and social risk and impact that will be assessed in subsequent chapters.

Table 3-4: World Bank ESS Relevance to the ITREC Project

ESS	Relevance	Justification
ESS1: Assessment and Management of Environmental and Social Risks and Impacts	Relevant	ESS1 is applicable to all World Bank-financed projects. For the ITREC Project, the ESIA will assess construction and operation risks across the area of influence and apply the mitigation hierarchy to address material risks associated with greenfield earthworks, structures, utilities interfaces, borrow/material sources, and traffic operations.
ESS2: Labor and Working Conditions	Relevant	The ITREC Project will require a sizeable construction workforce and multiple contractors/subcontractors. Key risks

		include inadequate working conditions, OHS incidents (traffic interface, heavy equipment, excavations, asphalt works), labor influx–related pressures, SEA/SH risks, child labor risks within subcontracting chains, and worker accommodation risks where camps are used.
ESS3: Resource Efficiency and Pollution Prevention and Management	Relevant	Construction is expected to generate dust, emissions, noise/vibration, wastewater from sites/camps, and hazardous and non-hazardous wastes. Risks include spills from fuels/oils, asphalt/bitumen handling, and improper waste disposal. Operation will increase vehicle emissions, operational noise, and routine maintenance wastes.
ESS4: Community Health and Safety	Relevant	Major risks relate to construction traffic and public road interfaces, increased accident risk, temporary access restrictions, and nuisance (dust/noise). During operation, traffic and road safety risks are central (speed, crossings, interchanges, service areas). Community exposure to construction hazards and emergency events (fires, spills, crashes) will also be assessed, including risks to vulnerable receptors (schools, markets, clinics, densely settled areas).
ESS5: Land Acquisition, Restrictions on Land Use and Involuntary Resettlement	Relevant	The ITREC Project is expected to require permanent land acquisition for the corridor and associated facilities and temporary land take for construction areas, detours, camps, and materials handling. This may cause physical and/or economic displacement, including loss of agricultural land and impacts on livelihoods, businesses, and access to assets/services. The ESIA will define the risk profile and key sensitivities that drive displacement and compensation needs.
ESS6: Biodiversity Conservation and Sustainable Management of Living Natural Resources	Relevant	Greenfield sections may fragment habitats and affect natural or modified habitats, including vegetation clearance, disturbance (noise/light), and wildlife movement constraints. The ESIA will assess biodiversity sensitivities in the corridor, including any proximity to protected areas, key biodiversity areas, wetlands, or other sensitive ecosystems, and identify avoidance and minimization opportunities.
ESS7: Indigenous Peoples / Historically Underserved Traditional Local Communities	Not relevant (expected)	Indigenous Peoples as defined under ESS7 are not expected to be present in the Project area of influence. This will be confirmed through baseline work and engagement during the ESIA.
ESS8: Cultural Heritage	Relevant	The ITREC Project traverses areas with known and potential cultural heritage sensitivity. Risks include direct impacts from earthworks and structures, indirect impacts from vibration and access changes, and chance finds during excavation. The ESIA will identify known cultural heritage sites within the area of influence and define measures to avoid or minimize impacts and manage chance discoveries.
ESS9: Financial Intermediaries	Not relevant	The Project is not expected to be implemented through a financial intermediary arrangement requiring ESS9.
ESS10: Stakeholder Engagement and Information Disclosure	Relevant	The ITREC Project affects multiple communities along the corridor and at access/feeder connections. Stakeholder engagement is required to identify location-specific issues (land

		impacts, access severance, community safety hotspots, vulnerable groups) and to ensure disclosure and feedback mechanisms are accessible throughout preparation and implementation.

3.4.2 World Bank Group Environmental, Health, and Safety (EHS) Guidelines

In addition to the ESSs, the Project will use the World Bank Group (WBG) EHS Guidelines as a technical reference for Good International Industry Practice. The WBG EHS Guidelines provide internationally recognized performance levels, monitoring approaches, and mitigation measures that inform how environmental, occupational health and safety, and community health and safety risks are prevented and controlled across the Project life cycle. In practice, they serve as a benchmarking tool to support the development of appropriate, implementable mitigation measures and to define performance expectations for contractors and operators. For the ITREC Project, the applicable WBG EHS Guidelines include:

- **WBG General EHS Guidelines (2007)**
    - Environmental management measures for control of dust and exhaust emissions; management of wastewater and water quality; management of hazardous and non-hazardous wastes; spill prevention and response; and noise and vibration controls.
    - Occupational health and safety measures covering hazard identification and risk assessment; worksite safety controls for traffic interfaces, heavy equipment, excavation works, lifting operations, and work at height; worker training and competency; personal protective equipment; incident reporting; and emergency preparedness and response.
    - Community health and safety measures addressing public exposure to construction hazards, safe access around work sites, community notification and signage, and emergency preparedness, including coordination with relevant services where applicable.
- **WBG EHS Guidelines for Toll Roads (2007)**
    - Construction-phase controls for managing traffic diversions and work-zone safety; maintaining local access and safe crossings; controlling nuisance impacts (dust, noise, vibration); and managing spoil, materials storage, and borrow activities to prevent pollution and safety risks.
    - Operational road safety expectations, including safe design and management of interchanges, merging/diverging sections, and roadside environments; attention to high-risk locations; speed management considerations; and operation and maintenance practices that support safe conditions over time.
    - Roadside facilities and services, including waste management, wastewater and sanitation services, fuel/chemical handling, fire safety, and emergency response arrangements.

Where national requirements differ from the WBG EHS Guidelines, the Project will apply the more stringent provisions to achieve performance consistent with Good International Industry Practice (GIIP).

3.4.3 World Bank Policy on Access to Information

The World Bank Policy on Access to Information governs public access to information in the World Bank's possession. The World Bank allows access to any information in its possession that is not included in a defined list of exceptions. The policy is intended to promote transparency, accountability, and informed participation by enabling stakeholders to obtain information about World Bank-financed operations and the environmental and social issues associated with them. This Policy is based on five principles:

- Maximizing access to information
- Setting out a clear list of exceptions
- Safeguarding the deliberative process
- Providing clear procedures for making information available
- Recognizing requesters' right to an appeals process

In the context of the ITREC Project, the Policy underpins the approach to disclosure of key Project information, including environmental and social assessment documentation and other relevant information disclosed through World Bank channels. Disclosure will be undertaken in a manner that is understandable and accessible to stakeholders, taking into account language needs, literacy levels, and the accessibility requirements of vulnerable groups. Information disclosure will also be coordinated with stakeholder engagement activities to ensure that affected parties have a reasonable opportunity to review disclosed information and provide feedback.

The Project will also account for the Policy's exception framework, including the treatment of information that is commercially sensitive, security-related, or otherwise restricted under the World Bank's disclosure exceptions. Where information cannot be disclosed, the disclosure approach will apply the relevant exception provisions while maintaining transparency to the extent permissible.

3.4.4 World Bank Labour Influx Guidance Note (2016)

This Guidance Note was developed to support the World Bank in identifying risks to, and impacts on, local communities associated with temporary labor influx and in defining appropriate measures to manage those risks. It includes a set of toolkits and methods that can be used to assess and manage labor influx. The Guidance Note highlights typical impacts associated with labor influx, including the risk of social conflict, illicit behavior, and crime, among others.

3.4.5 Labor Management Procedures (LMP)

The project will employ various categories of workers—skilled, unskilled, full-time, part-time, temporary, contractors, and technical experts. Risks include occupational hazards, unfair labor practices, discrimination, harassment, and potential forced or child labor. A standalone Labor Management Procedures (LMP) document has been prepared to be publicly disclosed to address recruitment, employment terms, occupational health and safety (OHS), as well as labor and working condition matters, ensuring compliance with national legislation and ESS2 requirements. The LMP covers all workers, outlines OHS measures per WBG guidelines, specifies working hours, mandates weekly rest, prohibits forced labor, and sets the minimum employment age at 18. It includes grievance mechanisms for workers, including sensitive and anonymous complaints (SEA/SH). Code of Conduct and SH/SEA training will be provided. Contractors must implement these procedures through the Construction Environmental and Social Management Plan (C-ESMP).

3.4.6 Good Practice Note – Addressing Sexual Exploitation and Abuse and Sexual Harassment (SEA/SH) in Investment Project Financing (2020)

The World Bank developed this Good Practice Note to assist Task Teams in identifying and addressing risks of SEA/SH in Investment Project Financing involving major civil works contracts, and to advise Borrowers on how to manage such risks effectively. The Good Practice Note focuses specifically on SEA/SH risks (as distinct from all forms of gender-based violence that may arise) and builds on World Bank experience, relevant international instruments, and good international industry practices, including those applied by other development partners.

3.5 Institutional Framework

3.5.1 Overview of Institutional Framework

The institutional framework for the planning, construction, and operation of the ITREC Project involves coordination between the Ministry of Construction, Housing, Municipalities and Public Works (MoCHMPW), the Roads and Bridges Directorate (RBD), the Project Management Team (PMT), relevant federal and regional authorities, and the consultants and contractors appointed for Project implementation.

For the ITREC Project, MoCHMPW has overall responsibility for the Project, and RBD, through MoCHMPW, is the lead implementing authority responsible for overseeing Project implementation and reporting. A PMT shall be maintained to support implementation of the Project and management of environmental, social, health and safety (ESHS) risks and impacts across both the Federal Iraq and Kurdistan Regional Government (KRG) sub-projects.

The PMT shall support coordination of E&S instruments, follow-up of ESCP commitments, environmental and social monitoring and reporting, stakeholder engagement, grievance management, labor and occupational health and safety matters, and coordination with competent authorities on relevant approvals and compliance requirements.

For the KRG sub-projects, implementation shall be undertaken under the overall Project implementation arrangement led by MoCHMPW and RBD, in close coordination with the KRG Ministry of Construction and Housing, GDRB, and other relevant regional authorities, as applicable.

To strengthen implementation capacity, the PMT shall be supported by a Project Management Consultant (PMC) at the coordination and systems level, including support for tracking ESCP commitments, coordinating preparation and updating of E&S instruments, consolidating E&S reporting, and providing on-the-job capacity building. In parallel, Engineering Supervision Consultants (ESCs) shall provide day-to-day field-level supervision of contractors' ESHS performance, including on-site monitoring, compliance verification, and follow-up of corrective actions and non-compliance measures.

3.5.2 Key Institutions and Expected Roles

The table below summarizes the key institutions expected to have roles during planning, construction, and operation of the Project. For the ITREC Project, MoCHMPW has overall responsibility for the Project, and RBD, through MoCHMPW, is the lead implementing authority responsible for overseeing Project implementation and reporting. A PMT shall be maintained to support Project implementation, including the management of environmental, social, health and safety risks and

impacts across both the Federal Iraq and KRG sub-projects. The PMT shall be supported by a Project Management Consultant (PMC) at the coordination and systems level, while Engineering Supervision Consultants (ESCs) / Resident Engineers shall provide day-to-day field-level supervision of contractors' ESHS performance. For the KRG sub-projects, implementation shall be undertaken under the overall Project implementation arrangement led by MoCHMPW/RBD, in close coordination with the relevant KRG authorities, including the Ministry of Construction and Housing, GDRB, and other competent regional entities, as applicable.

Table 3-5: Key Institutions and Expected Roles for the ITREC Project

Institution	Expected Role for the ITREC Project
Key Institutions and Expected Role from Federal Iraq	
Ministry of Construction, Housing, and Public Municipalities (MoCHPM)	Overall responsible ministry for the ITREC Project. Provides the institutional mandate and overall Project oversight, and oversees implementation through the Roads and Bridges Directorate (RBD), including coordination with relevant federal entities and, as applicable, with the relevant authorities in the Kurdistan Region of Iraq for Project implementation, compliance, and reporting.
Roads and Bridges Directorate (RBD)	Lead implementing authority for the ITREC Project through MoCHMPW. Responsible for overseeing Project implementation and reporting, including planning and design coordination, procurement and contract management, construction follow-up, operation and maintenance arrangements as applicable, and coordination with relevant federal and regional authorities on permits, land, utilities, compliance, and implementation requirements. The Project is implemented through the Project Management Team (PMT) under the overall MoCHMPW/RBD structure.
Project Management Team (PMT)	Project-level implementation and coordination structure maintained under the MoCHMPW/RBD implementation arrangement to support management of environmental, social, health and safety (ESHS) risks and impacts of the Project activities in Federal Iraq and the Kurdistan Region of Iraq. The PMT shall include qualified ESHS staffing and shall be responsible for supporting follow-up of ESCP commitments, coordination of the preparation, updating, and implementation follow-up of E&S instruments, consolidation of E&S monitoring and reporting, coordination with the Project Management Consultant (PMC), Engineering Supervision Consultants (ESCs), contractors, and relevant federal and regional authorities, and follow-up of stakeholder engagement, grievance management, labor, occupational health and safety, and other ESHS requirements during Project implementation.
Project Management Consultant (PMC)	Provides project-level implementation support to the PMT, including support for ESHS coordination, monitoring and reporting, follow-up of ESCP commitments, and capacity building for PMT staff.
Engineering Supervision Consultants (ESCs)	Provide day-to-day field-level supervision of contractors' ESHS performance, including site monitoring, compliance follow-up, and implementation of corrective actions where needed.
Ministry of Transport (MoT)	Responsible for management, planning, and policy of the country's transport system except for highways. For sub-components in Federal Iraq, MoT is not expected to be the implementing authority, but may be a coordination

	stakeholder on transport-sector policy interfaces, freight/passenger movement considerations, and intermodal connectivity (as relevant).
Ministry of Water Resources	Relevant where the alignment interfaces with rivers, canals, irrigation/drainage assets, embankments, and bridge/culvert crossings, including review of design provisions and coordination on protection measures and approvals, as applicable.
Ministry of Planning	For investment-budget roads/bridges, supports project listing/registration and typically requires a simple environmental report at the time of inclusion in the investment plan. May establish monitoring teams whose reporting addresses E&S in a limited manner, with stronger emphasis on occupational safety. For loan-funded projects, coordination requirements are typically more detailed, consistent with the applicable financing procedures.
Ministry of Finance	Relevant to public financing arrangements for sub-components in Federal Iraq (budget allocations and, where applicable, loan/credit arrangements and related financial oversight linked to public contracts and payments).
Ministry of Interior	Relevant for internal security and policing, which affects site security, protection of workers, and incident response during construction and operation. It also oversees traffic police functions, so it is typically involved in approving and enforcing traffic management measures such as diversions, temporary road closures, and work-zone safety controls.
Ministry of Environment (MoEn)	Competent authority where an environmental approval is required. In practice for road projects, approvals may be sought case-by-case (e.g., when establishing an asphalt plant). Where asphalt is supplied from existing plants under supply/lease arrangements or works are in open areas, approvals may not always be pursued. Where required, MoEn is the authority for environmental approval and associated conditions.
Ministry of Culture, Tourism and Antiquities	Responsible for protection of cultural heritage resources. For sub-components in Federal Iraq, expected to provide guidance on identification and management of cultural heritage sensitivities along the corridor, support required clearances where applicable, and oversee implementation of chance finds procedures during earthworks. Engagement of this stakeholder is prioritized where cultural heritage risks are relevant.
Ministry of Health	Responsible for community health and safety along the corridors, including emergency medical response to traffic accidents, surveillance of health impacts related to construction and operation, and coordination on health promotion measures for affected communities and road users.
Ministry of Labor and Social Affairs	Regulates labour conditions and workers' rights, oversees occupational health and safety standards, and may support monitoring and enforcement of labour and OHS requirements for contractors and sub-contractors
Ministry of Agriculture	Responsible for agricultural land and livelihoods that may be affected by land acquisition, severance or changes in access; provides data and guidance on crop patterns, irrigation systems and mitigation measures for impacted farmers and land users.
Ministry of Oil	Confirms the locations of existing oil and product pipelines intersecting or running near the corridors, and is responsible for agreeing protection measures, rerouting or relocation of pipelines and associated facilities where required for the Project.
Governorates / Districts / Sub-districts	Iraq is divided into governorates (muhafadat), then districts (qada), then sub-districts (nahia). These administrations provide the primary local interface for sub-components in Federal Iraq, including facilitation of access for surveys and consultations, local coordination on permits and construction interfaces,

	support to land and compensation processes as applicable, and engagement with local councils and communities.
Additional Key Institutions and Expected Role from the KRI Region	
General Directorate of Roads and Bridges (GDRB) – Erbil	Regional coordination and implementation counterpart for the KRG sub-projects, working in close coordination with the MoCHMPW/RBD/PMT implementation structure and the relevant KRG authorities on sub-project implementation, local coordination, and follow-up. road corridor.
Environmental Protection and Improvement Board / Directorate of Environment (KRI)	Environmental authority responsible for reviewing environmental assessments, issuing environmental approvals, conducting inspections, and monitoring compliance during construction.
Directorate of Antiquities – Sulaymaniyah	Responsible for archaeological and cultural heritage protection, pre-construction archaeological surveys, and oversight of chance finds under Law No. 5 of 2021.
Directorate of Traffic - Bazian and Chamchamal Districts	Responsible for approving traffic management arrangements, including detours, lane closures, speed limits, and relocation of traffic enforcement cameras and ICT monitoring equipment.
Directorate of Water Resources - Bazian and Chamchamal Districts	Responsible for water supply infrastructure including water pipelines, wells, and groundwater extraction points within or adjacent to the project corridor.
Directorate of Agriculture - Bazian and Chamchamal Districts	Responsible for agricultural land, irrigation channels, vegetation management, and coordination regarding median trees and roadside vegetation.
Directorate of Electricity - Bazian and Chamchamal Districts	Responsible for relocation, adjustment, and protection of electrical distribution infrastructure including overhead poles and electrical lines.
Municipalities of Sulaymaniyah, Bazian, and Chamchamal	Responsible for drainage systems, roadside ditches, culverts under municipal jurisdiction, solid waste management.
District Administrations - Bazian and Chamchamal	Local administrative authorities overseeing coordination between communities and sectoral directorates, local infrastructure coordination.

4 Environmental and Social Baseline

This section presents a brief description of the existing environment, including the physical environment, ecological resources, and socio-economic conditions within the ITREC Project's Area of Influence. It summarizes key baseline aspects across environmental parameters such as geography and land use, climate and meteorology, topography and physiography, geology and seismology, hydrology including drainage and flood risk considerations, ambient air quality, background noise environment, biodiversity and habitat features, as well as socio-cultural and economic characteristics that may be directly or indirectly affected by implementation of the ITREC sub-projects during pre-construction, construction, and operation.

As the ITREC Project comprises multiple sub-project corridors across different administrative areas, the baseline characterization covers the relevant governorates and the districts and sub-districts that the corridors pass through, with emphasis on communities and sensitive receptors located within the Area of Influence.

4.1 Project Area of Influence

An area surrounding the ITREC sub-project corridors has been delineated as the study area, reflecting the anticipated extent of project impacts on air quality, noise, biodiversity, water resources, and the socio-economic environment. This constitutes the Project's Area of Influence (AoI), encompassing the direct project footprint as well as the immediately surrounding environment along the alignment. The AoI covers all project activities together with their direct and indirect impacts and primarily includes the alignment footprint, construction areas (including material storage areas, temporary access routes, etc.), and the adjacent communities and sensitive receptors along the alignment. When defining the AoI, the following is taken into consideration.

Table 4-1: Considerations for the Area of Influence (AoI)

Category	Description
Physical Environment	The corridor footprint, immediate vicinity, access connections, and surrounding areas are considered within a study area defined along the ITREC sub-project corridors. Specific impact ranges include: • Air emissions including fugitive dust and vehicle-related emissions are typically observed within 100–200 m from active construction/operation areas but may extend up to 500 m to capture all sources, including vehicular movement on detours, temporary access routes, and transport roads. • Noise levels are considered up to 500–1,000 m from the alignment, recognizing that noise and vibration impacts decrease with distance from the source. Applying standard attenuation (approximately 6 dB per distance doubling), noise levels decrease progressively with distance; assessment focuses on the nearest sensitive receptors along the alignment. • Land and water environment (soil, surface water, groundwater) is typically assessed within 100 m of the footprint where direct disturbance may occur but may extend up to 1 km where drainage pathways, discharge points, irrigation features, or other sensitive features warrant a wider area.

Biological Environment	The AoI for terrestrial ecology is defined as a 1 km buffer from the alignment footprint. This captures the zone where dust, noise, disturbance from vehicle movement, lighting, and human presence is expected to affect terrestrial fauna and flora: • Where ecological sensitivities are identified (e.g., riparian habitats, wetlands, or habitat linkages), the AoI is extended as needed to include the relevant habitats and ecological receptors potentially affected.
Social And Socio-Economic Environment	Defined as the area within a 5 km buffer of the alignment footprint, encompassing settlements, land uses, and communities that may experience changes in access, traffic patterns, road safety risks, nuisance impacts, or livelihood disruption. Areas beyond 5 km are also included where a direct project linkage is identified (e.g., construction camps/contractor facilities, receptors affected by project-related traffic, etc.).

Given the above, the Consultant delineated two separate AoIs: a Primary AoI and a Secondary AoI. The Primary AoI, defined as a 1 km area from the ITREC sub-projects corridors which encompasses the area where the majority of direct impacts are anticipated. The Secondary AoI, extending to a 5 km radius from the expressway alignment, is, mainly associated with the ecological and socio-economic environments.

4.2 Physical Environment

4.2.1 Climate And Meteorology

4.2.1.1 Regional Climate

According to the Köppen–Geiger climate classification, Iraq is divided into distinct climate regions based on the spatial distribution of temperature and precipitation. The Federal sub-projects, are located within the hot desert climate (BWh). This region is mainly controlled by the prolonged presence of subtropical high pressure for most of the year, with only a limited number of low-pressure systems reaching the area; those that do are typically shallow and have lost much of their moisture during their passage from the Mediterranean. As a result, temperatures are generally mild in winter and extremely hot in summer.

In contrast, the KRI sub-projects are located within the Mediterranean hot-summer climate (Csa) zone. This climate is characterized by hot, dry summers and cooler, wetter winters, with rainfall occurring predominantly in the cooler season, influenced by frontal systems and local topography. Accordingly, compared to the Federal BWh corridors, the KRI corridors typically experience a more pronounced wet season and higher seasonal rainfall, while dry periods may still drive dust generation during construction and maintenance activities.

Figure 4-1 shows the climate regions of Iraq and the approximate locations of the sub-projects under ITREC.

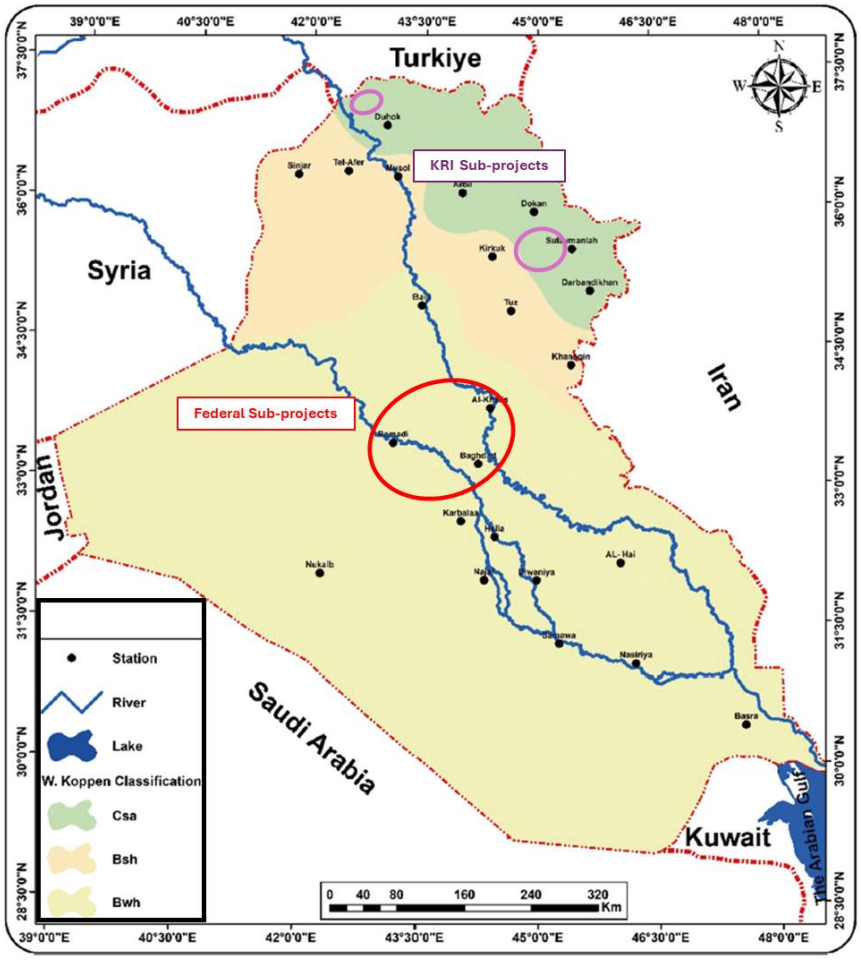


Figure 4-1: Boundaries of the climatic regions in Iraq according to the Koeppen classification for the period (2000–2020). Note that Warm temperate climate with dry summers (Mediterranean climate region) (Csa), semi-arid climate (steppe region) (Bsh), and dry desert climate region (Bwh). Modified after Muslih and Abbas, 2024).

4.2.1.2 Temperature and Rainfall

Air temperatures in Iraq exhibit substantial diurnal, seasonal, and interannual variability, reflecting the country's latitudinal extent (approximately 29°05'–37°22'N) and its predominantly continental setting. As a result, Iraq experiences pronounced continental temperature ranges, with very hot summers and cooler winters. Temperature patterns are also influenced by local topography and synoptic conditions, including elevation effects and the seasonal dominance of different air masses. For central Iraq, including the Federal sub-project corridors, the referenced baseline indicates average annual temperatures in the range of 22.2–23.6°C (Figure 4-2). In contrast, the KRI sub-project corridors fall within cooler average annual temperature zones, in the range of 19.3–20.7°C (Figure 4-2).

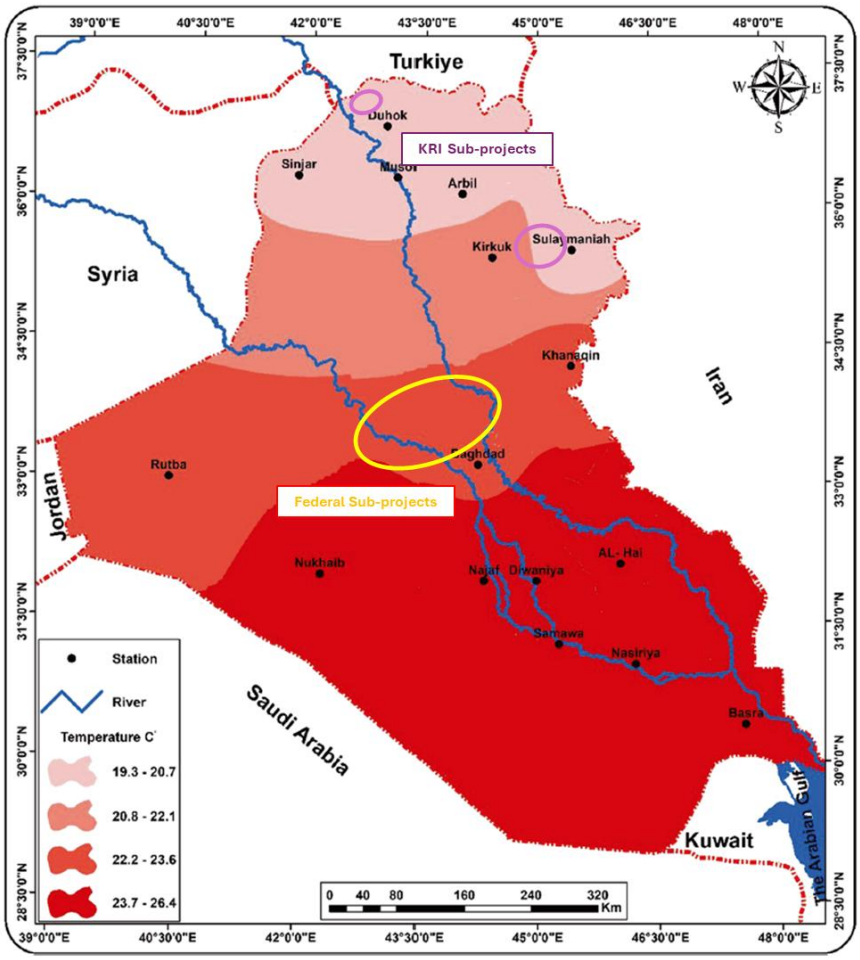


Figure 4-2: Average annual air temperatures in Iraq from 1978 to 2020. (Modified after (Muslih and Abbas, 2024)

Rainfall in Iraq is highly variable across years and months, and individual events can be concentrated into short periods, which can result in localized flooding and other water-related impacts. Spatially, precipitation generally increases toward the north and northeast and decreases toward central and southern Iraq. This spatial pattern is reflected in the mapped mean annual precipitation classes (Figure 4-3 A). Along the Federal sub-project corridors, which are located in the central part of Iraq and are broadly comparable to the Baghdad setting, mean annual precipitation in the area around the corridors is reported to range from 95.0 to 211.4 mm/year, increasing northward into the 211.5 to 327.8 mm/year zone in the vicinity of Samarra. In contrast, the KRI sub-project corridors, which are located in northern Iraq and are broadly comparable to the Sulaymaniyah setting, fall within higher precipitation zones, in the range of 444.3 to 677.0 mm/year.

Monthly rainfall patterns further illustrate the strong seasonal concentration of precipitation (Figure 4-3B). Precipitation increases from October, peaks during the winter period (approximately December to March), and then declines toward May, with very low rainfall by June. Consistent with the north–south gradient, Sulaymaniyah shows substantially higher winter monthly precipitation than Baghdad, indicating that the KRI corridors typically experience wetter winter conditions and higher event

rainfall totals, while the Federal corridors experience comparatively lower seasonal rainfall. These patterns are relevant for drainage and erosion management, as short-duration rainfall events during the wet season can generate localized runoff and flooding, particularly where drainage pathways or crossings are constrained.

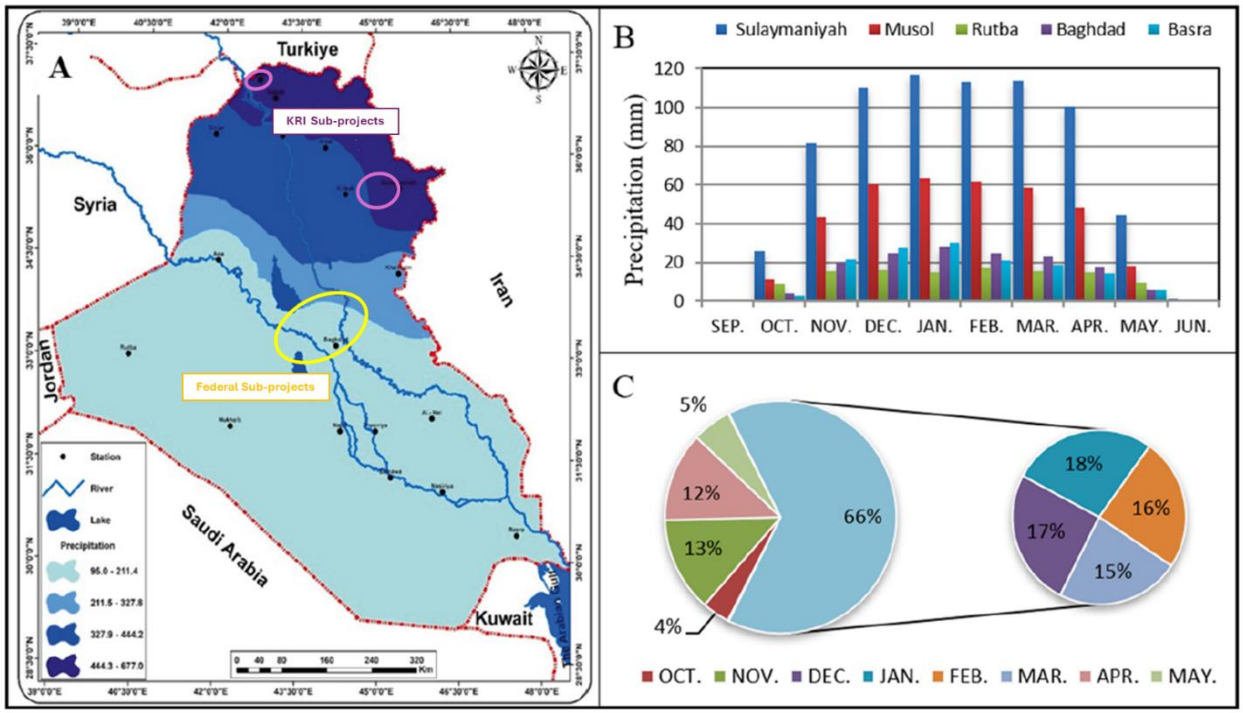


Figure 4-3: Mean annual precipitation in Iraq (a). Average monthly precipitation in selected stations in Iraq (b). Percentage of winter month's precipitation (DJFM) compared to annual precipitation in Iraq (c). (Modified after Muslih and Abbas, 2024)

The following sections describe the temperature and rainfall conditions for the different sub-projects.

Expressway No. 2 (Baghdad–Samarra)

Figure 4-4 presents the long-term monthly climate pattern for Baghdad and Samarra, which together provide representative conditions along the Expressway No. 2 Baghdad–Samarra section. For both locations, temperatures follow a clear seasonal cycle, with very hot summers and mild winters. The highest mean daily maximum temperature occurs in July and August, reaching about 46°C in Baghdad and about 45°C in Samarra. The lowest mean daily minimum temperature occurs in January, at about 7°C in Baghdad and 6°C in Samarra. Overall, Samarra is marginally cooler than Baghdad across most months (both for daytime maxima and nighttime minima).

Precipitation is highly seasonal. The driest period extends from roughly June to September, with little to no precipitation. Rainfall is concentrated in the cooler season, with the highest monthly precipitation occurring in winter and early spring (approximately November through March/April), while autumn and late spring months generally receive limited rainfall compared to the winter peak.

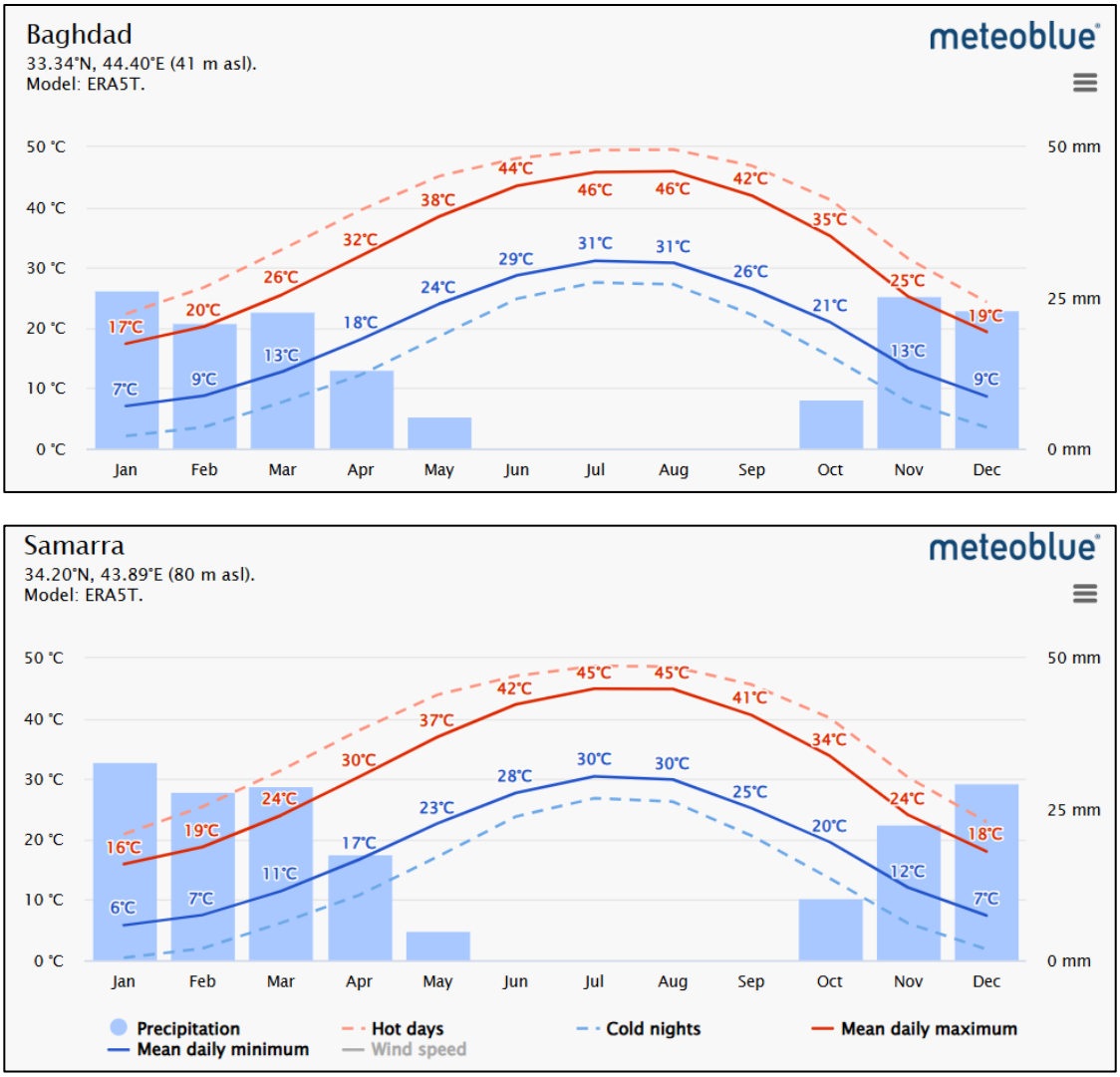


Figure 4-4: Average Monthly Temperature (Mean Daily Maximum and Mean Daily Minimum) and Precipitation (Baghdad and Samarra) - Source: Meteoblue

R9B Corridor Expressway No. 1 (Fallujah-Ramadi)

Figure 4-5 presents the long-term monthly climate pattern for Ramadi, which provides representative conditions along the R9B corridor. Temperatures follow a clear seasonal cycle, with very hot summers and mild winters. The highest mean daily maximum temperature occurs in July and August, reaching about 44°C. The lowest mean daily minimum temperature occurs in January, at about 6°C (rising to about 8°C in December and February). Daytime temperatures increase rapidly from March onward (mean daily maximum of about 24°C in March and 30°C in April), with peak summer conditions persisting through June–September.

Precipitation is highly seasonal. The driest period extends from roughly June to September, with little to no precipitation. Rainfall is concentrated in the cooler season, with the highest monthly precipitation occurring in December and January (on the order of 20–25 mm/month), and relatively

wet conditions also evident in February–March. Precipitation then declines sharply through April–May, transitioning into the dry summer period.

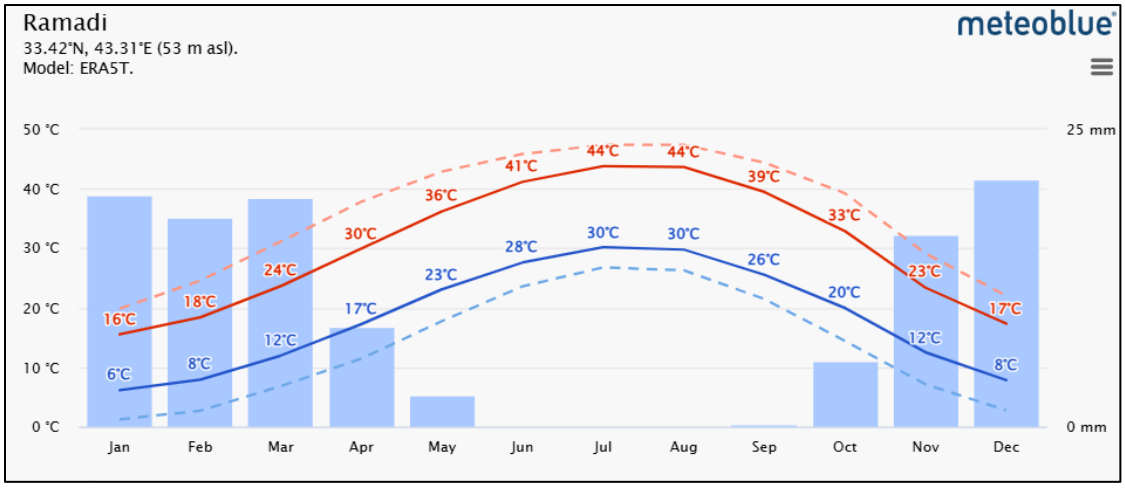


Figure 4-5: Average Monthly Temperature (Mean Daily Maximum and Mean Daily Minimum) and Precipitation (Ramadi – Al Anbar Governorate) – Source: Meteoblue

Sulaymaniyah–Chamchamal–Kirkuk Road (KRI)

Figure 4-6 presents the long-term monthly climate pattern for the Sulaymaniyah–Chamchamal–Kirkuk Road (KRI) based on the NASA POWER dataset. Temperatures show a clear seasonal cycle, with cool winters and hot summers. Mean temperature increases from about 8°C in January to approximately 33°C in July–August, then declines toward winter. Mean monthly maximum temperature peaks at around 45°C in July, while the mean monthly minimum temperature is lowest in January–February at approximately 0–1°C, rising to around 22–23°C in July–August.

Precipitation is strongly seasonal. Rainfall is concentrated in the cooler season and early spring, with the wettest month shown as March (approximately 50 mm), followed by January (about 40 mm) and April (about 40 mm). Precipitation decreases markedly from May onward, with a pronounced dry period extending from approximately June through September, when rainfall is near zero (only minimal rainfall is shown during these months). Rainfall increases again in October (about 15 mm) and November–December (about 40 mm each).

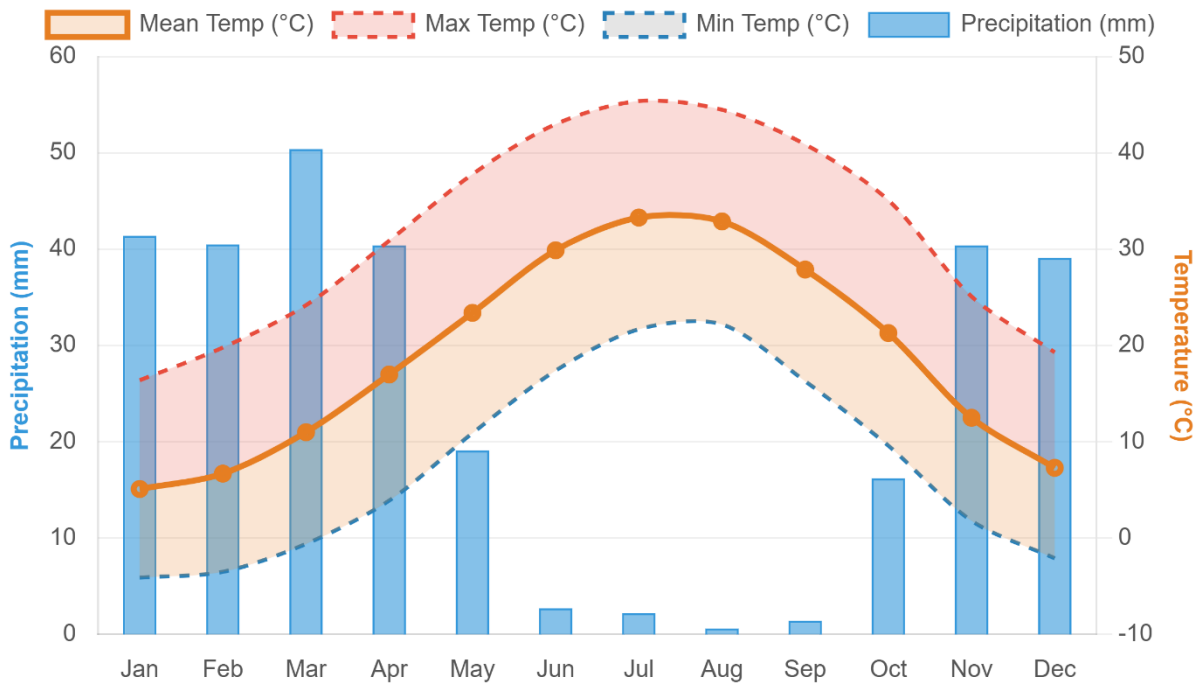


Figure 4-6: Average Monthly Temperature (Mean Daily Maximum and Mean Daily Minimum) and Precipitation (Sulaymaniyah–Chamchamal–Kirkuk) – Source: NASA

Girsheen–Suhaila Road Upgrade and Girsheen Interchange (KRI)

Figure 4-7 presents the long-term monthly climate pattern for the Duhok sub-project area, based on the NASA POWER dataset. Temperatures show a clear seasonal cycle, with cool winters and hot summers. Mean temperature increases from about 6°C in January to approximately 35°C in July–August, then declines toward winter. Mean monthly maximum temperature peaks at around 46°C in July (remaining above 40°C across much of June–September), while the mean monthly minimum temperature is lowest in January–February at approximately 0–1°C, rising to around 24–25°C in July–August.

Precipitation is strongly seasonal. Rainfall is concentrated in the cooler season and early spring, with the wettest month shown as March (approximately 110 mm). Winter months are also relatively wet (approximately 75 mm in January and 70–75 mm in December, with 55 mm in February and November). Precipitation decreases markedly from May onward, with a pronounced dry period extending from approximately June through September, when rainfall is near zero.

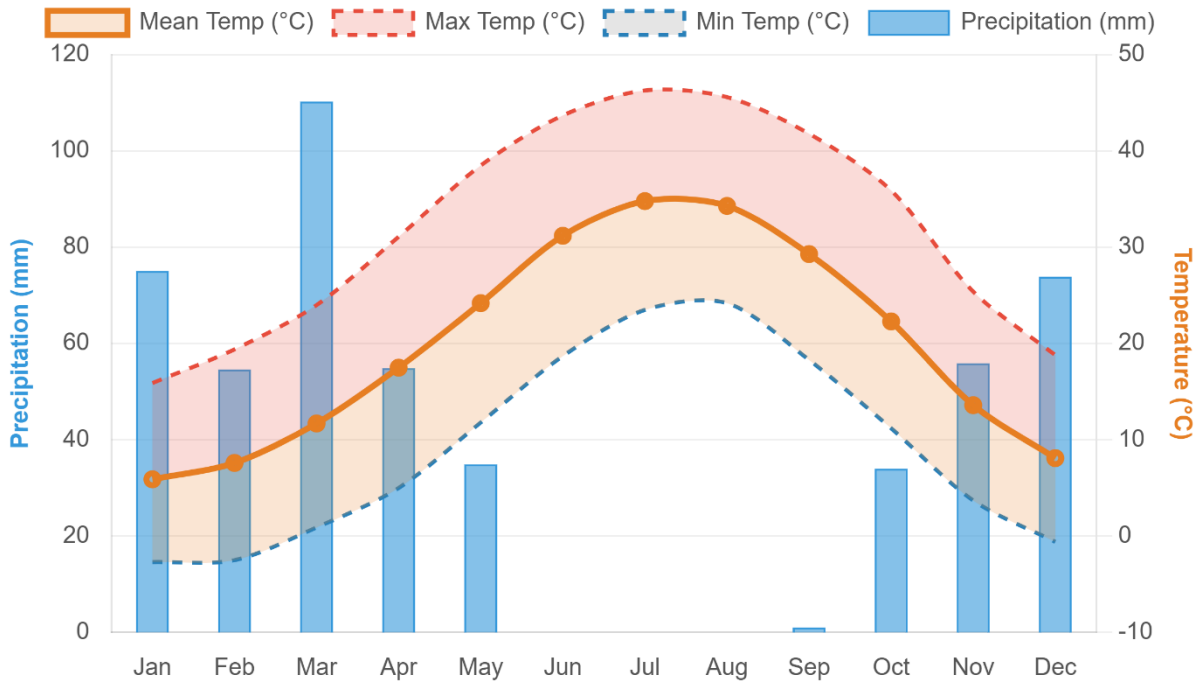


Figure 4-7: Average Monthly Temperature (Mean Daily Maximum and Mean Daily Minimum) and Precipitation (Girsheen–Suhaila Road Upgrade and Girsheen Interchange) – Source: NASA

4.2.1.3 Wind

Wind conditions in Iraq are primarily controlled by regional synoptic patterns, including the passage of cyclones and anticyclones originating from surrounding regions. Local terrain can further modify wind regimes, particularly in northern Iraq. The spatial distribution of long-term average near-surface wind speeds (Figure 4-8) reflects the influence of topography, with the highest wind speeds occurring across southern Iraq and parts of the western desert (approximately **3.1–4.1 m/s**), and lower wind speeds generally reported toward the north and northeast.

For the Federal sub-project corridors, including the Expressway No. 2 Baghdad–Samarra section and the R9B corridor, wind speeds are mapped predominantly within the 2.0–3.0 m/s class (Figure 12). Higher mapped values (up to 3.1–4.1 m/s) occur further south and across parts of the western desert, outside the main ITREC Federal corridor settings.

For the KRI sub-project corridors, the wind regime is spatially variable. The Duhok area falls predominantly within the 2.0–3.0 m/s wind-speed class, indicating a relatively windier setting compared to other KRI locations. In contrast, areas around Mosul, Kirkuk, Sulaymaniyah, and Khanaqin are mapped mainly within the 1.3–1.9 m/s class, reflecting lower long-term average near-surface wind speeds associated with northern and northeastern highland conditions.

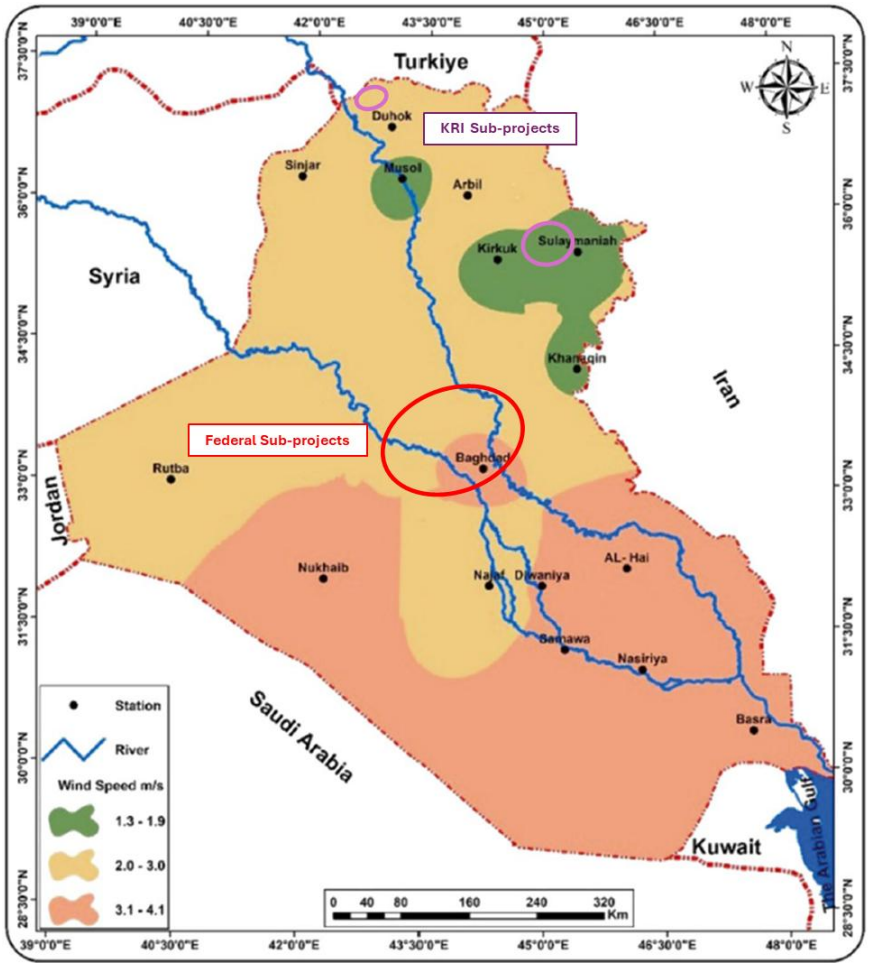


Figure 4-8: Average annual wind speed over Iraq from 1978 to 2020. (Modified after Muslih and Abbas, 2024)

Expressway No. 2 (Baghdad–Samarra)

Wind conditions in the Baghdad–Samarra section of Expressway No. 2 are characterized by a clear prevailing northwesterly flow. In both Baghdad[3] and Samarra[4], winds most frequently originate from the WNW–NW–NNW sector, with a secondary contribution from the N–NNW sector. Winds from the eastern and southeastern quadrants occur but are comparatively infrequent.

In terms of wind speed, the dominant wind directions are most commonly associated with speeds in the 10–20 km/h and 20–30 km/h ranges, while higher-speed events in the 30–40 km/h range occur less frequently. Overall, the two locations show a consistent wind regime, with Baghdad exhibiting a slightly more pronounced NW peak compared to Samarra (Figure 4-9).

[3] https://www.meteoblue.com/en/weather/historyclimate/climatemodelled/baghdad_iraq_98182
[4] https://www.meteoblue.com/en/weather/historyclimate/climatemodelled/samarra_iraq_91597

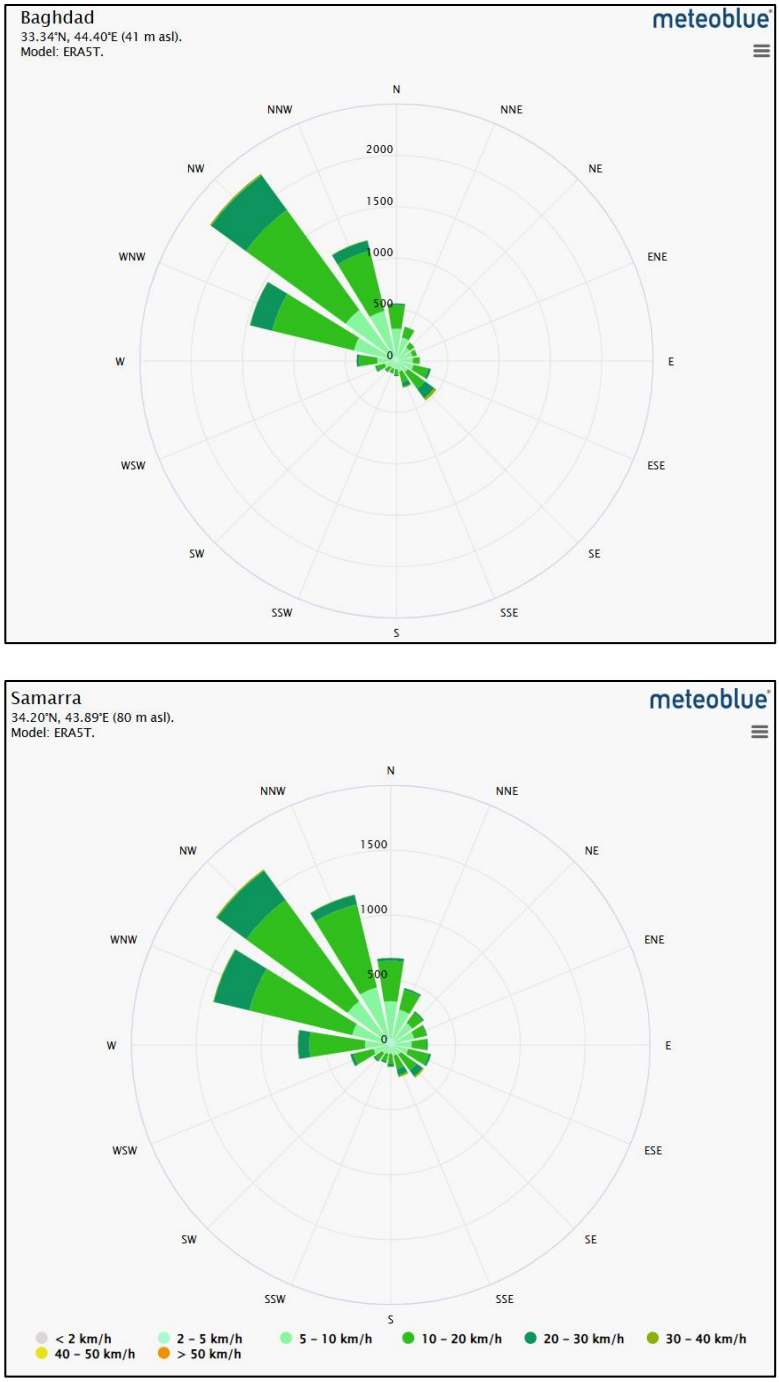


Figure 4-9: Wind Rose (Baghdad and Samarra) – Source: Meteoblue

R9B Corridor Expressway No. 1 (Fallujah-Ramadi)

Wind conditions for the R9B (Ramadi) corridor show a strong prevailing northwesterly regime (Figure 4-10). The wind rose for Ramadi indicates that winds most frequently originate from the NW sector, with notable contributions from the WNW and NNW directions. Winds from the eastern and southeastern quadrants are comparatively infrequent.

In terms of wind speed, the dominant NW-sector winds are most commonly associated with speeds in the 10–20 km/h and 20–30 km/h ranges, while 30–40 km/h events occur less frequently and are concentrated mainly within the NW sector. Overall, the Ramadi wind rose indicates a clear and persistent NW-driven wind regime.

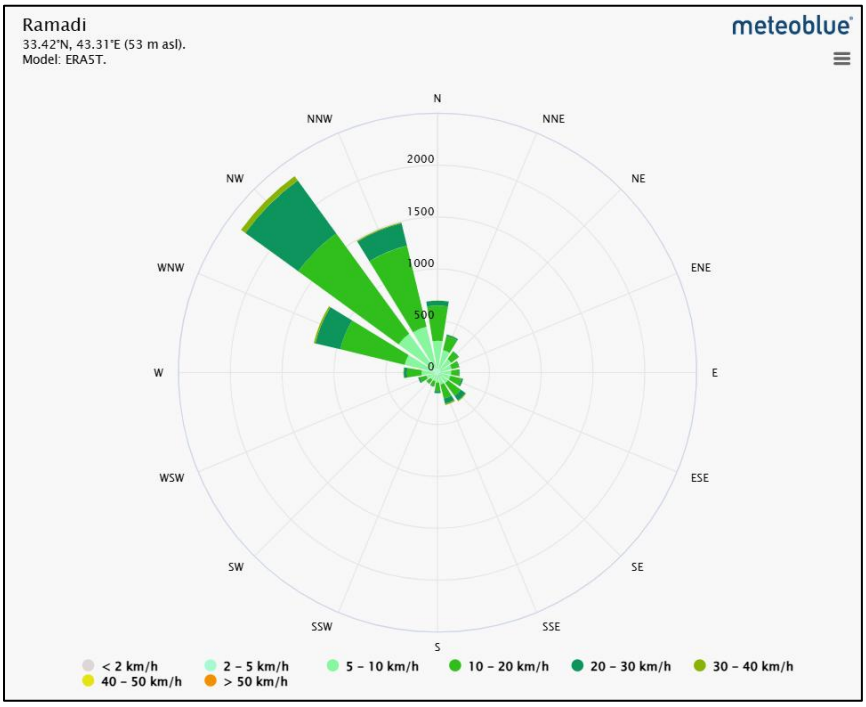


Figure 4-10: Wind Rose (Ramadi – Al Anbar Governorate) – Source: Meteoblue

Sulaymaniyah–Chamchamal–Kirkuk Road (KRI)

Wind conditions for the Sulaymaniyah–Chamchamal–Kirkuk Road (KRI) show a wind regime that differs from the Federal sub-project settings and is characterized by a strong northeasterly dominance (Figure 4-11). The wind rose indicates that winds most frequently originate from the NNE–NE sector, with a secondary contribution from the ENE–E sector. Winds from the western and northwestern quadrants occur but are comparatively less frequent.

In terms of wind speed, the dominant NE-sector winds are most commonly associated with 5–10 km/h, with a substantial proportion also within the 2–5 km/h range. Higher wind speeds (10–20 km/h) occur less frequently and are distributed across multiple directions, including parts of the NE and SW quadrants. Overall, the wind rose indicates a persistent NE-driven flow with generally moderate wind speeds.

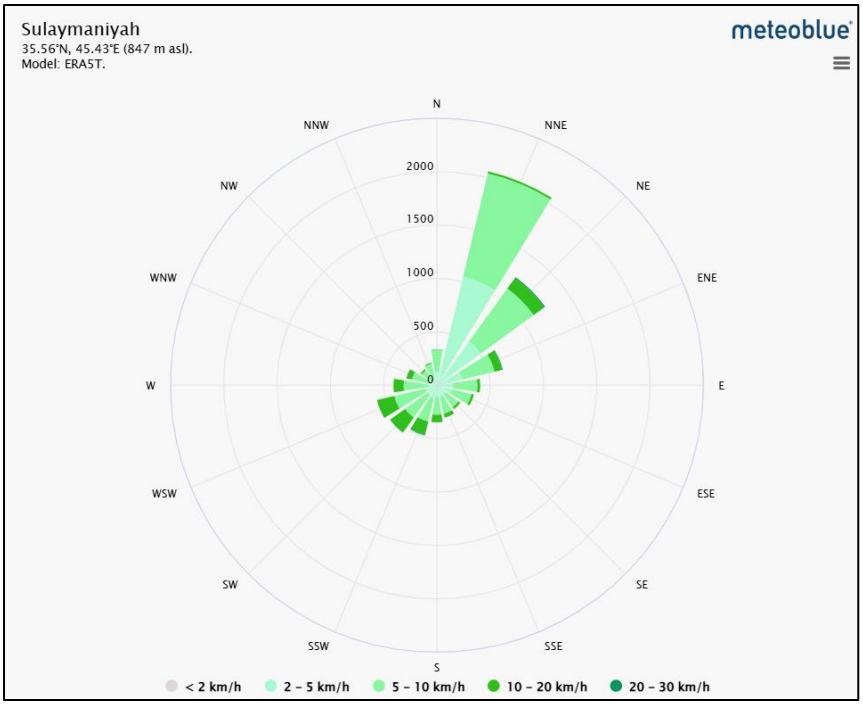


Figure 4-11: Wind Rose (Sulaymaniyah) – Source: Meteoblue

Girsheen–Suhaila Road Upgrade and Girsheen Interchange (KRI)

Wind conditions for the Girsheen–Suhaila Road Upgrade and Girsheen Interchange (KRI) indicate a wind regime with a dominant northeasterly component and a secondary westerly component (Figure 4-12). The wind rose shows that winds most frequently originate from the NNE–NE sector, with additional contributions from the ENE–E sector. A clear secondary peak is also evident from the W–WNW sector, indicating that westerly winds occur with notable frequency in this area.

In terms of wind speed, the prevailing NE-sector winds are most commonly associated with 5–10 km/h, with frequent occurrences also in the 2–5 km/h range. Compared to the Sulaymaniyah setting, the Zakho wind rose shows a more noticeable contribution of 10–20 km/h winds across multiple directions (including NE and W), with occasional 20–30 km/h events and rare 30–40 km/h events. Overall, the wind regime in the Zakho/Duhok area is characterized by frequent NE winds and a meaningful westerly contribution, with intermittent higher-speed periods.

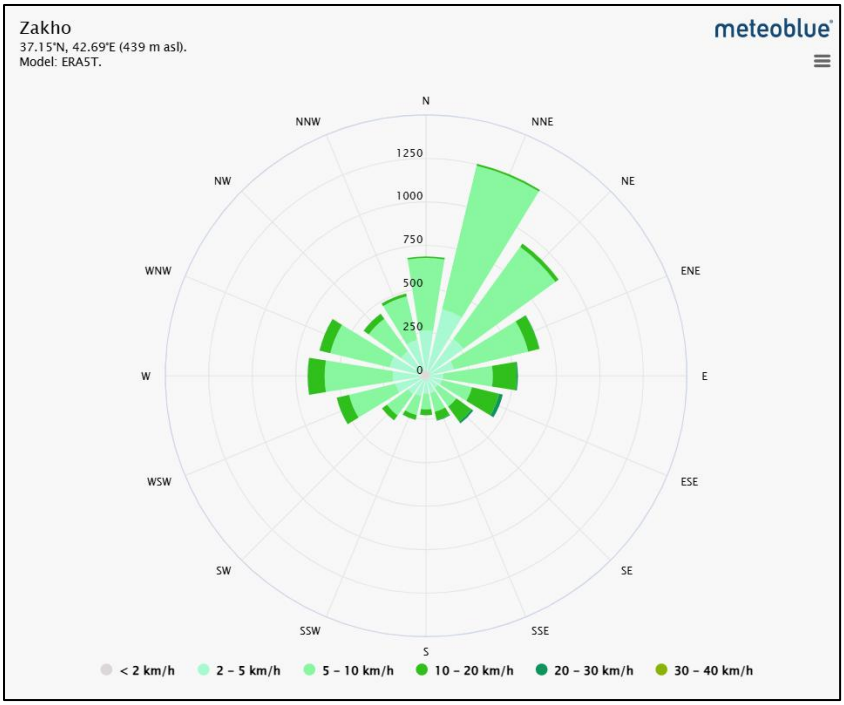


Figure 4-12: Wind Rose (Dohuk) – Source: Meteoblue

4.2.2 Ambient Air Quality and Existing Sources of Air Emissions

4.2.2.1 Federal Sub-projects

Ambient air quality data in Iraq remain sparse and discontinuous, with routine instrumented monitoring largely concentrated in Baghdad. Available secondary information consistently identifies fine particulate matter (PM2.5) as the dominant pollutant of concern, reflecting the combined influence of regional sand and dust storms, re-suspension of road dust, combustion sources (traffic and generators), and episodic local burning.

For the ITREC sub-projects in Federal Iraq, the baseline receptor setting is predominantly agricultural and peri-urban, where short-term PM2.5 peaks are expected to be driven primarily by dust-storm conditions and high-wind events, with additional contributions near settlements and transport nodes. Reported data from the "Baghdad Air Quality Monitor – U.S. Embassy" indicate very high short-term PM2.5 peak concentrations in recent years. These peak concentrations are substantially higher than commonly used health-based reference values for 24-hour PM2.5, indicating that acute particulate episodes can reach levels associated with elevated short-term health risk, particularly for sensitive groups. The monitoring data can be found in Table 4-2 below.

Table 4-2: Baghdad U.S. Embassy Monitor Reported PM2.5 Peak Concentrations

Year	PM2.5 Registered Peak Value (µg/m³)
2019	197
2020	224
2021	284
2022	354

A notable point-source emission next to the Expressway No.2 Corridor is the Samarra Diesel Power Plant, which is located around 2.5 km from the Expressway No.2 and was observed during field

reconnaissance with visible stack emissions. The facility was photographed from two locations along the corridor on November 24, 2025 (N 34°06'58.66697", E 44°00'30.595") and November 26, 2025 (N 34°04'40.49148", E 44°00'49.93214"), indicating an operating combustion source within the Project's baseline airshed. Publicly available infrastructure profiles and sector reporting describe the facility as an operating 340 MW oil-/diesel-fired power station comprising multiple reciprocating generating units. As a diesel/HFO-fired plant, the primary air emission constituents typically associated with routine operation include nitrogen oxides (NO_x), sulfur dioxide (SO_2) (fuel-sulfur dependent), particulate matter (PM_{10}/$PM_{2.5}$), carbon monoxide (CO), and non-methane volatile organic compounds (NMVOCs), alongside carbon dioxide (CO_2) as the principal greenhouse gas. In the Project context, the plant represents a local point-source contributor to the baseline airshed in parts of the alignment.

Figure 4-13: Photographs of Samarra Diesel Power Plant

4.2.2.2 KRI Sub-projects

Sulaymaniyah–Chamchamal–Kirkuk Road (KRI)

Ambient air quality along the project corridor is influenced by a combination of factors, including emissions from high-volume traffic, resuspended road dust, and significant industrial activity in the Bazian to Chamchamal area. The wider airshed contains around 100 medium to large-scale industrial facilities, including cement plants, steel factories, brick factories, a refinery, power-generation units, and various other industries, all of which contribute to elevated particulate levels in the region.

To obtain an initial indication of existing conditions, short-term ambient air measurements were conducted at five representative locations along the corridor, including roadside points, a mosque, and two schools located further from the roadway. Measurements were taken during daytime hours under clear, sunny conditions. Each location was monitored for approximately 60 minutes, using five sequential readings. The results are presented in Table 4-3 below.

Table 4-3: Ambient Air Quality Measurements (Sulaymaniyah–Chamchamal–Kirkuk Road)

Location	Distance from CL	Station	Average $PM_{2.5}$ ($\mu g/m^3$)	Average PM_{10} ($\mu g/m^3$)	CO_2 (ppm)
Roadside point 1	20	18+300	34.8	39.8	452.4

Roadside point 2	20	02+760	33.4	37.4	463.0
Mosque Slemana Grda Village	30	06+220	29.0	31.5	437.3
Wanawsha School in Tainal	60	10+800	31.0	38.8	446.5
Allayi School	85	02+760	33.0	34.8	445.0
Average			**32.2**	**36.5**	**448.8**

Measured $PM_{2.5}$ concentrations ranged from 29 to 35 µg/m³, with an overall average of 32.2 µg/m³. Although based on short-term sampling rather than 24-hour or annual averages, these values exceed the World Bank EHS 24-hour guideline of 25 µg/m³ and fall within the WHO Interim Target-3 range (≤37.5 µg/m³). When viewed in relation to annual guideline levels (10 µg/m³), the measured concentrations correspond to the upper part of WHO Interim Target-1 (up to 35 µg/m³), indicating a chronically elevated background typical of industrial corridors.

Average PM_{10} concentrations measured 36.5 µg/m³. For 24-hour standards, this is below the EHS guideline of 50 µg/m³. For annual standards, the measured value exceeds the EHS guideline of 20 µg/m³ and WHO Interim Target-3 (30 µg/m³), corresponding to Interim Target-2.

The Figures below summarizes the EHS guideline values used in interpreting the measurement results.

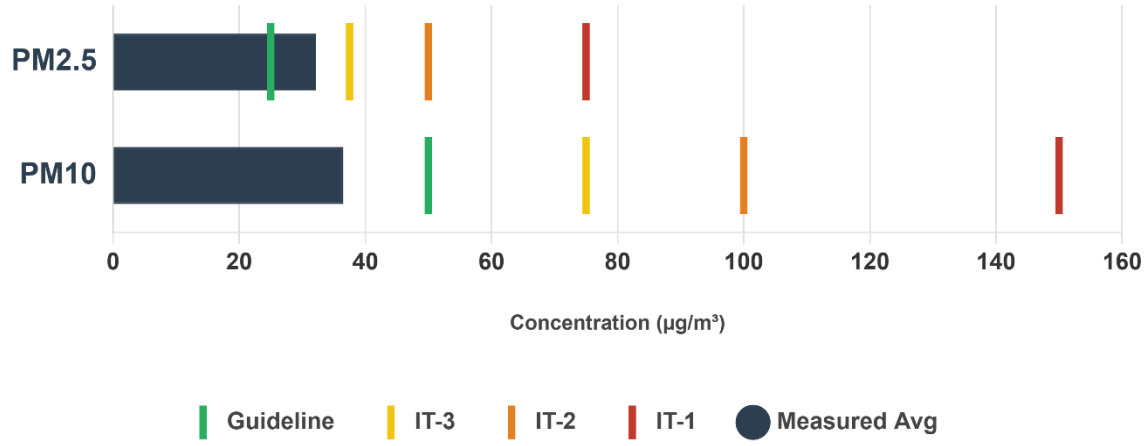


Figure 4-14: Air Quality Results (Sulaymaniyah–Chamchamal–Kirkuk Road)

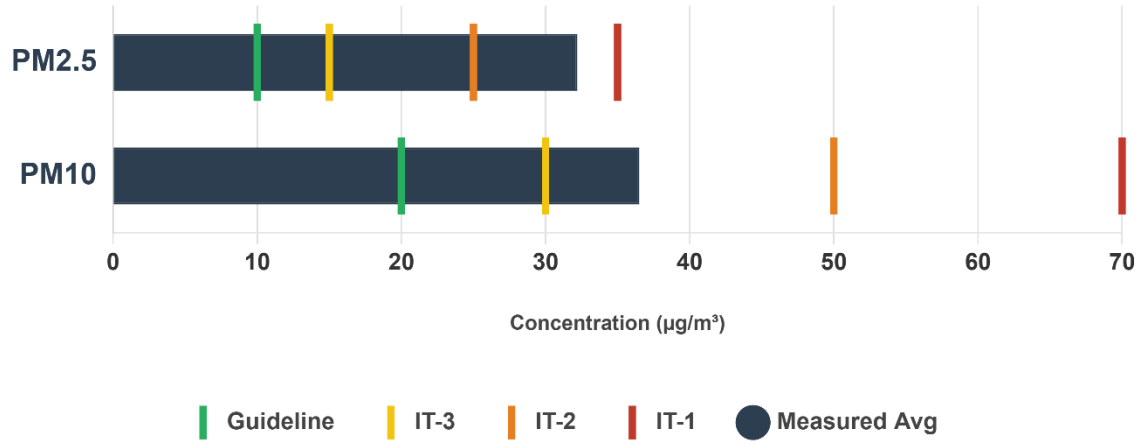


Figure 4-15: Air Quality Results (Sulaymaniyah–Chamchamal–Kirkuk Road)

Girsheen–Suhaila Road Upgrade and Girsheen Interchange (KRI)

Ambient air quality along the project corridor is influenced primarily by vehicular emissions, resuspended road dust, and wind-blown dust from surrounding agricultural and open lands.

To obtain an indicative snapshot of existing air quality conditions, short-term ambient air measurements were conducted at a representative roadside location near the Girsheen overpass. The measurements were conducted on a clear day with no noticeable wind, following a recent rainfall event, which may have temporarily reduced ambient particulate concentrations through wet deposition and reduced dust resuspension.

Table 4-4: Air Quality Measurement Results (Girsheen Overpass)

No.	Time	CO2	PM2.5	PM10	Temp (deg C)	Humidity (%)
1	14:00:00	610	31	35	19	45
2	14:10:00	600	38	46	19	43
3	14:20:00	550	36	40	18.5	43
4	14:45:00	560	27	27	18.5	41
5	15:00:00	575	26	24	18.5	45
6	15:10:00	580	30	32	17.5	44
7	15:20:00	588	28	31	17	44
8	15:45:00	585	31	35	17.5	44
9	16:00:00	590	27	27	17.5	43
Average	**2 hours**	**582.0**	**30.4**	**33.0**	**18.1**	**43.6**

Measured $PM_{2.5}$ concentrations ranged between 26 and 38 µg/m³, with an average value of 30.4 µg/m³, while PM_{10} concentrations ranged between 24 and 46 µg/m³, with an average of 33.0 µg/m³. These results represent short-term measurements only and are not directly comparable to 24-hour or annual average standards.

Nevertheless, Figure 4-16 below summarizes the comparison between the EHS guidelines value of 24 hours and the 2-hour measurement results.

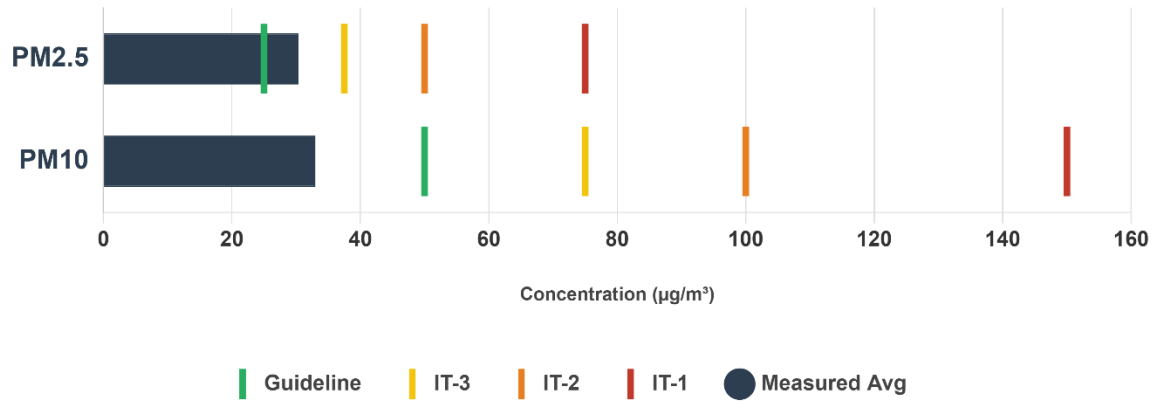


Figure 4-16: Air Quality Results (Girsheen Overpass)

4.2.3 Background Noise

4.2.3.1 Federal Sub-projects

Published environmental noise monitoring in Iraq is limited and is concentrated in urban Baghdad. A Baghdad-wide study based on 51 locations monitored during July–December 2012 reported equivalent continuous noise levels (Leq) spanning 43.4–102.2 dBA across residential, commercial, and industrial settings, with active commercial streets reported as exceeding 72 dBA and industrial locations reaching approximately 102 dBA (Hussain, 2014).

Additional Baghdad intersection measurements report typical traffic-intersection sound levels in the high-70s to mid-90s dBA range, with a reported maximum of 94 dBA at Al-Tahrir Square and minima of about 77–80 dBA at lower-noise intersections (Almankoshy, 2022).

More recent intersection-focused monitoring at three signalized intersections in Baghdad (Dar Al-Azia, Al-Nakheel, and Hama) carried out in October–November 2024 reported maximum levels on the order of 83–89.5 dBA, depending on location and peak period (Ghassak et al 2025).

Table 4-5: Summary Of Published Environmental Noise Measurements In Baghdad

Study / Locations	Monitoring Context	Reported Range
Hussain, 2014; Baghdad citywide (multiple land uses)	51 locations; residential/commercial/industrial; day/night sampling	43.4–102.2 dBA; commercial streets reported >72 dBA; industrial up to 102 dBA
Almankoshy, 2022; Baghdad major intersections	20 intersections (Al-Rusafa and Al-Karkh)	77–94 dBA; max 94 dBA
Ghassak, 2025 Baghdad selected signalized intersections	Peak-period monitoring (Oct–Nov 2024)	83–89.5 dBA

The published Baghdad ranges indicate that urban roadside/intersection environments commonly exceed the WBG/IFC General EHS Guidelines values for noise-sensitive receptors and, in some cases, exceed the industrial/commercial guideline value. This comparison is indicative rather than determinative because some published measurements represent on-street conditions and may not be directly comparable to LAeq,1hr at the nearest receptor/façade or property boundary under the EHS framework.

4.2.3.2 KRI Sub-projects

Sulaymaniyah–Chamchamal–Kirkuk Road (KRI)

The acoustic environment along the project corridor is dominated by road traffic noise from continuous flows of light vehicles, heavy trucks, and oil tankers. To characterize baseline noise conditions, measurements were conducted at several points along the corridor during daytime, including roadside positions and sensitive receptors such as schools and a mosque, at distances ranging from 10 to 75 meters from the nearest traffic lane.

Table 4-6: Noise Measurements (Sulaymaniyah–Chamchamal–Kirkuk Road)

Location/Receptor	Distance from Nearest Lane (m)	Measured LAeq dB(A)
Roadside point 1	10	77.6
Roadside point 2	10	73.5
Mosque Slemana Grda Village	20	71.6
Wanawsha School	50	64.6
Allayi School	75	60.9

The reduction in measured noise with distance corresponds with the empirical formula of approximately 3 to 4.5 dB decrease per doubling of distance, though this relationship is most reliable within the first 150 meters.

World Bank Group EHS Guidelines (2007) establish daytime limits of 55 dB(A) for residential, institutional, and educational receptors, and 70 dB(A) for industrial and commercial areas. The measured sensitive receptors (mosque and schools) exceed the residential/institutional guideline of 55 dB(A). Residential receptors within approximately 100 to 150 meters of the corridor may experience noise levels exceeding this guideline. Commercial areas generally meet the commercial guideline of 70 dB(A).

Girsheen–Suhaila Road Upgrade and Girsheen Interchange (KRI)

Ambient noise levels along the project corridor are dominated by road traffic. At Girsheen overpass location, where traffic volumes are high and heavy trucks account for approximately 26% of total traffic, short-term daytime noise measurements recorded levels of around 78–80 dB(A). Along the Girsheen-Suhaila road section with significantly lower traffic volumes, measured daytime noise levels were lower, generally in the range of 67–70 dB(A). These measurements reflect existing traffic conditions and indicate higher noise exposure at locations with concentrated traffic flow and heavy-vehicle movement.

4.2.4 Regional/Local Waste Management Infrastructure[5]

4.2.4.1 Federal Sub-projects

Municipal solid waste (MSW) management capacity along the federal sub-project corridors is constrained by high generation rates in major urban centers and reliance on non-engineered disposal facilities. In the wider Iraq context, MSW collection and disposal performance varies by governorate and municipality, with persistent challenges related to collection coverage, transfer logistics, and environmentally controlled final disposal.

For the Baghdad metropolitan area (which provides the dominant MSW management context for the Baghdad–Samarra section and associated federal corridors), the reported collected MSW amount is approximately 9,385 tons/day, with a collection coverage of about 90%, implying a generated waste amount of approximately 10,427 tons/day. The system includes nine transfer stations with environmental approval and routes waste primarily to large disposal facilities, including the Nabaai disposal facility and the Nahrawan disposal facility. Within the federal corridor setting toward Samarra and other intermediate towns, MSW services are typically managed at the municipal level, with more limited fleets, variable service regularity, and continued dependence on basic dumping practices.

During site visits, occurrences of uncontrolled waste disposal have been observed along the ITREC sub-projects in Federal Iraq and constitute a recurring feature within the project setting (Figure 4-17).

[5] https://openjicareport.jica.go.jp/pdf/12367256.pdf

Figure 4-17: Uncontrolled disposal of waste along Expressway No. 2

4.2.4.2 KRI Sub-projects

For the KRI sub-project corridors, MSW services are likewise led by municipal authorities, but system performance can be comparatively stronger in major urban centers where collection systems and disposal routing are more established. For Erbil, the generated MSW amount is estimated at approximately 1,796 tons/day, with an MSW collection rate of approximately 98%. The principal disposal destination is the Kani Qirzhala disposal facility, which also receives waste from surrounding towns. While KRI urban centers may demonstrate relatively high collection performance, the disposal chain remains dependent on centralized disposal facilities and consistent transport operations. Along KRI road corridors, localized pressures can still occur where roadside dumping, limited containment at interim storage points, or inadequate control of non-municipal wastes affects corridor cleanliness and drainage features, particularly during periods of higher waste generation or disrupted collection/transport logistics.

4.2.5 Geology and Soils

4.2.5.1 Surface Geology

The Baghdad–Samarra section of Expressway No. 2 is located within the Mesopotamian Plain, which is regionally characterized by extensive young surficial deposits associated with the Tigris–Euphrates river systems. At the national scale, the project area falls within the broad central Iraq belt where Quaternary deposits dominate the mapped surface geology, reflecting widespread late Cenozoic sediment cover across the plain (Figure 4-18).

In contrast, the R9B segment is situated at the transition between the Mesopotamian Plain and the Western Desert zone, where mapped surface units shift from Quaternary deposits toward the east (consistent with the Mesopotamian Plain setting) to Tertiary units toward the west (consistent with the Western Desert setting). Accordingly, the R9B segment lies along/near the Quaternary–Tertiary boundary and reflects a mixed surface-geology context across the corridor (Figure 4-18).

The KRI sub-projects, including the Girsheen–Suhaila Road Upgrade and Girsheen Interchange (KRI) and the Sulaymaniyah–Chamchamal–Kirkuk Road, are located within the folded belt of northeastern Iraq, where the mapped surface geology is dominated by Tertiary units relative to the Quaternary-dominated central plain. This distribution is consistent with the structural–tectonic setting

of the folded zone and the prevalence of older exposed sedimentary sequences compared to the Mesopotamian Plain and Western Desert settings (Figure 4-18).

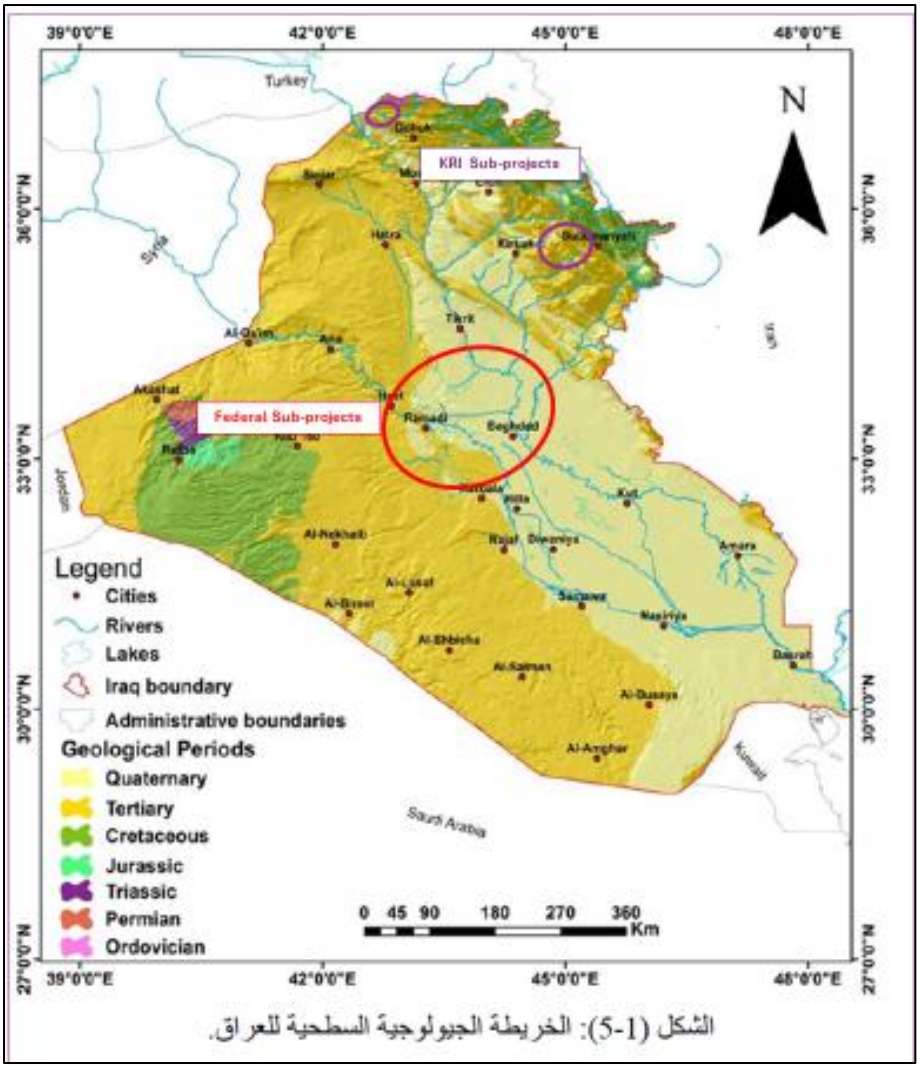


Figure 4-18: Geology of Iraq and Location of ITREC Sub-Projects (Jassem and Goff, 2006)

Expressway No. 2 (Baghdad – Samarra)

At the Mesopotamian Plain scale, the surface geology is primarily composed of Quaternary fluvial depositional environments (e.g., floodplain and related units), with mapped variations reflecting local depositional settings and proximity to river channels and distributaries. In central and eastern Iraq, surficial deposits are mapped as widespread units across much of the plain, consistent with the large-scale accumulation of river-derived sediments and reworked materials (Figure 4-19).

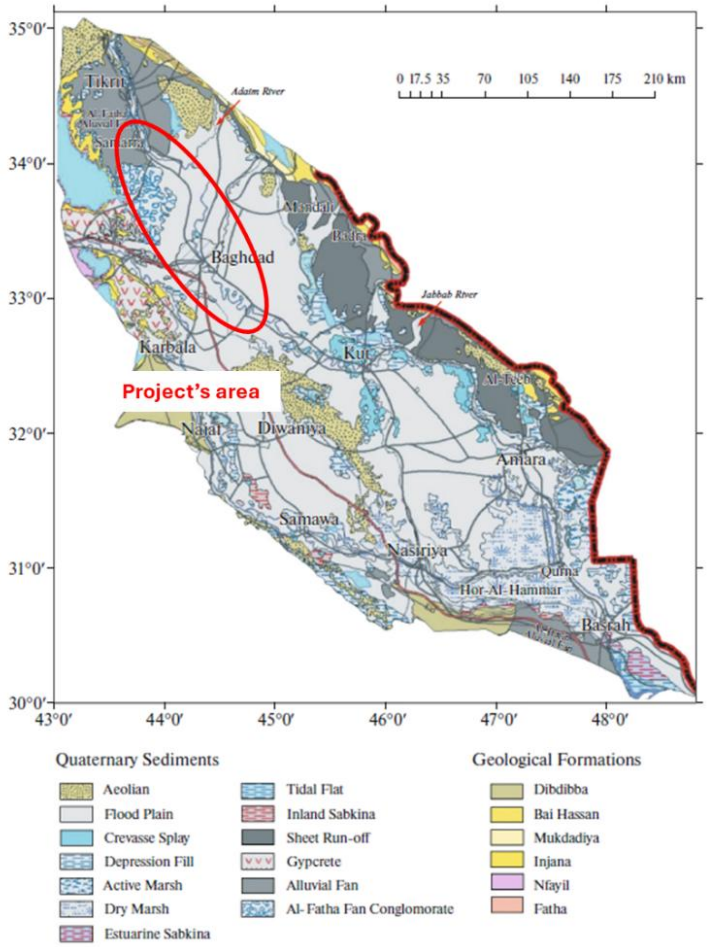


Figure 4-19: Geological map of the Mesopotamian Plain. (Yacoub et al., 2011)

Most published interpretations indicate that the principal geological and hydrogeological characteristics of the Mesopotamian Plain are largely associated with Pleistocene-age development. However, certain sedimentary bodies, such as alluvial fans along the eastern margin of the plain and early river-terrace stages, may locally include sediments older than the Pleistocene, potentially extending into the Late Pliocene. This interpretation is commonly linked to the regional age of the Bai Hassan Formation (Pliocene–Pleistocene), which is considered broadly equivalent to some of the oldest sediments within these mapped units. Due to limited application of absolute dating techniques in Iraq, assigned ages are commonly inferred through stratigraphic correlation and reference to broader chronostratigraphic frameworks.

Pliocene–Early Pleistocene Rock Units

Three rock units are mapped as exposed within the Mesopotamian Plain (Figure 4-20) the Bai Hassan Formation, the Dibdibba Formation, and the Mahmudiya Formation (all Pliocene–Pleistocene). The Bai Hassan Formation comprises alternating beds of conglomerate, claystone, pebbly sandstone, and siltstone. Reported exposed thickness is variable; for example, measurements of 11.5 m and 16 m have been reported in the northeast of Tikrit.

Pleistocene Sediments

Pleistocene sediments are widespread across the Mesopotamian fluvial basin, extending from north of Baghdad toward the Basrah area. During the Pleistocene, repeated glacial and interglacial climatic phases, together with neotectonics activity, influenced the development and distribution of fluvial sediments across the plain. The upper contact with overlying Holocene sediments is commonly diachronous and may be indistinct in places. Three main types of Pleistocene sediments are recognized across the plain and are summarized in the following subsection.

R9B Segment under Expressway No. 1

The R9B segment is located in the eastern part of Al-Anbar Governorate and crosses two distinct surficial units of differing age and lithology. South of the alignment, outcrops of the Nfayil Formation are present, comprising alternating beds of green marl and limestone and assigned to the Middle Miocene. North of the alignment, the surface geology transitions to Mesopotamian Plain deposits dominated by Holocene fine-grained sediments (primarily silt and clay). Local topographic depressions may contain finer, organically enriched soils developed within silt–clay substrates. These low-lying deposits are reported to contain elevated organic content (Figure 4-20).

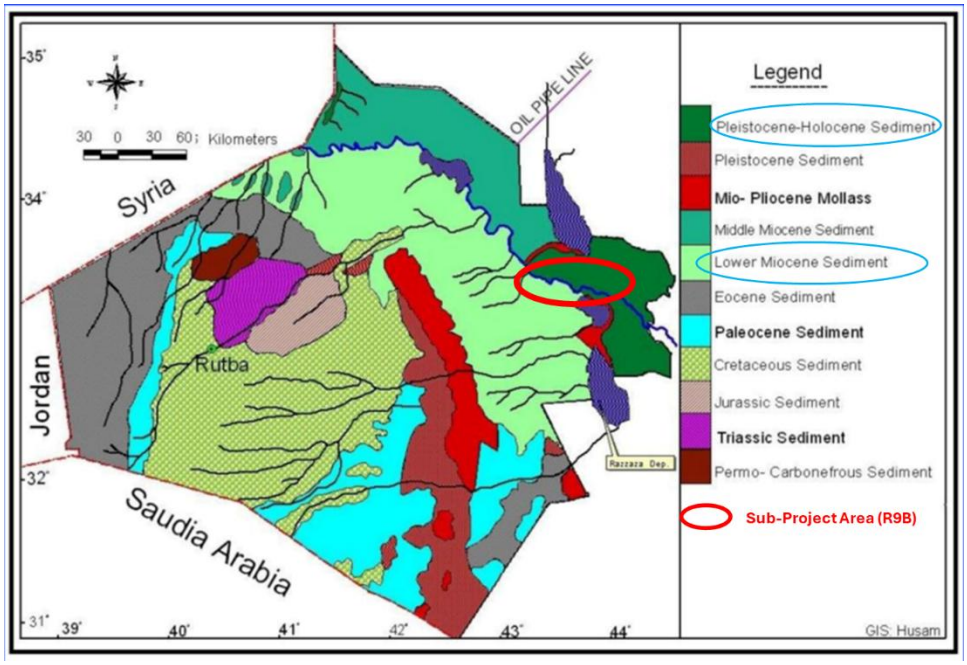


Figure 4-20: Geological map of Al-Anbar government. (Sissakian and Salih, 1994)

Sulaymaniyah–Chamchamal–Kirkuk Road (KRI)

Surface geology consists mainly of sedimentary formations, including limestone, marl, shale, and interbedded clay layers, while the valley floors contain younger alluvial deposits of gravel and silty clay. These conditions are typical of the Chamchamal to Bazian area and present no unusual geological constraints for road widening.

Girsheen–Suhaila Road Upgrade and Girsheen Interchange (KRI)

The area sits within a region of tectonic compression where the Arabian and Eurasian Plates converge, forming the Zagros Belt. The stratigraphic column includes thick Jurassic and Cretaceous successions composed of carbonates, shale, and anhydrates. Key formations include the Sargelu formation (bituminous limestone and shale) and the Allan Anhydrate formation, which serves as a regional seal while the immediate surface geology of the corridor is characterized by Quaternary alluvial deposits according to Pollastro, R.M., 1998, Bedrock geology of the Arabian Peninsula and selected adjacent areas.

4.2.5.2 Soil Quality

Expressway No. 2 (Baghdad – Samarra)

Baghdad Region

Baghdad is located within the central Mesopotamian alluvial plain adjacent to the Tigris River, with the Euphrates approximately 40 km to the west. As a result, near-surface sediments in the Baghdad area are dominated by relatively recent Quaternary alluvial deposits. Regional studies describe Baghdad soils as largely derived from Mesopotamian plain and desert source areas and deposited through fluvial and related sedimentary processes. Reported soil conditions are heterogeneous, and soils are generally described as alkaline with low permeability (NCCL, 1986; Karim and Schanz, 2006; Buringh, 1960).

Published stratigraphic descriptions typically identify three main units: (i) a surface fill layer comprising cohesive and non-cohesive materials; (ii) an upper natural subsoil layer dominated by clay, brown silty clay, or clayey silt, locally with sand and minor gravel; and (iii) a deeper natural layer of medium-dense to very dense sand (brown to grey) mixed with gravel and occasional lenses of clay or silty clay (NCCL, 1986; Karim and Schanz, 2006). These depositional conditions, together with human activities, influence both the physical and chemical properties of soils across the Baghdad area and result in pronounced lateral and vertical variability (Figure 4-21).

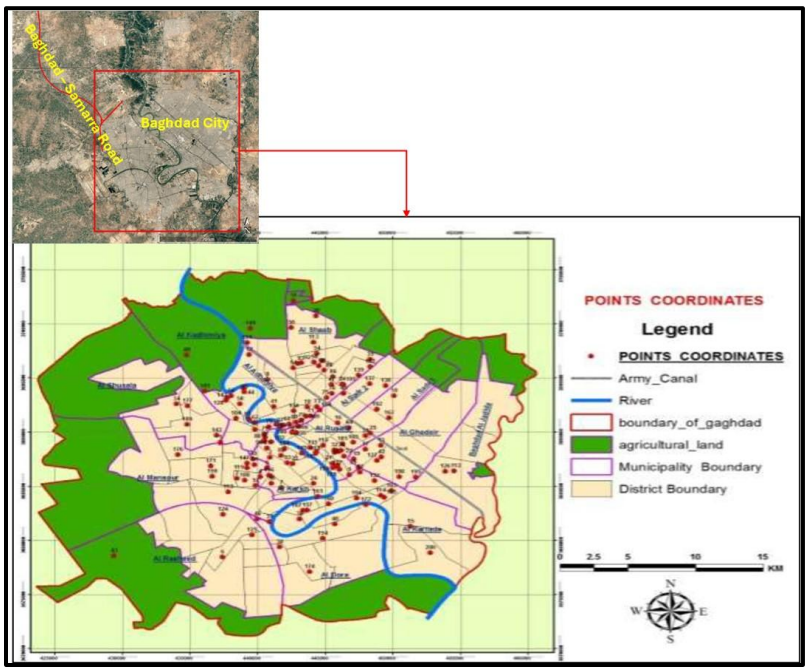


Figure 4-21: Site Points Location (after Karim and Wadaa, 2017)

To characterize this variability at the city scale, Karim and Wadaa (2017) mapped the thickness of the fill layer as an indicator of near-surface variability (Figure 4-22). Fill materials are described as mixed anthropogenic deposits containing variable soil fractions and inclusions (e.g., brick/ceramic fragments and other debris). The reported fill-layer thickness ranges from 0.3 to 9.5 m, with >80% of measurements within 0.3–2.5 m, and an average of approximately 1.8 m. Thicker fill layers are reported in older urban areas and in locations closer to the Tigris, with thickness generally decreasing farther from the river.

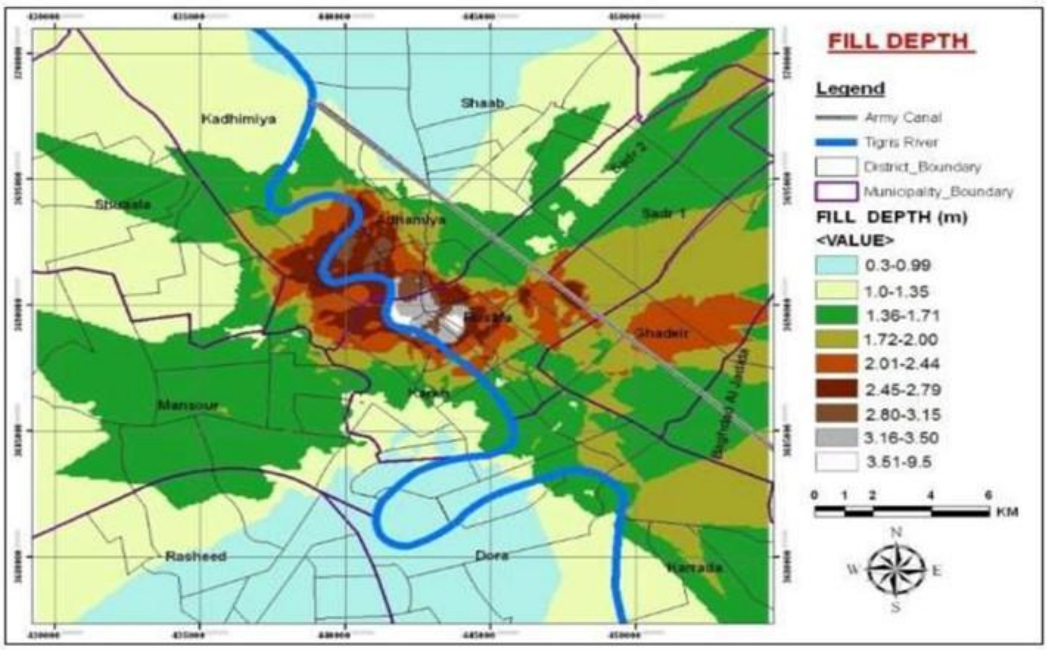


Figure 4-22: Fill Layer Depth for Baghdad City (after Karim and Wadaa, 2017)

In addition to fill thickness, Karim and Wadaa (2017) report that the relative proportions of clay, silt, sand, and gravel vary substantially across Baghdad and with depth, consistent with layered alluvial sequences:

- Clay: At shallow depths (2–8 m), higher clay contents are reported on the western bank of the Tigris compared to the eastern bank; at intermediate depths (14–16 m) clay contents decrease near the river; at deeper intervals (22–24 m and deeper) clay increases again, particularly toward the southwest.
- Silt: At 2–8 m, higher silt contents are reported to the east of the Tigris; at 10–18 m, higher silt contents shift toward the west; below 22–24 m, silt generally decreases with localized higher values along the river.
- Sand: Sand contents are generally higher to the west than the east at shallow depths, with relatively higher values along the river corridor and in the southern part of the city; patterns vary with depth but reflect alternation between finer and coarser alluvial layers.

- Gravel: Gravel is generally low at shallow depths (2–4 m) and becomes more evident with depth, particularly from 10–12 m downward, with higher gravel contents reported in western areas at deeper intervals.

Samarra Region

Fadhil et al. (2019) investigated near-surface soil properties in Samarra City based on four specimens collected from trial pits at different depths across four districts: Tal El-Eleg, Al-Mutawakel, Gebria 1, and Salahaddin (Figure 4-23). The study area is located within the Mesopotamian Plain and is underlain by Quaternary-age sediments dominated by fluvial and slope-related deposits. Topography is generally low-relief with a gentle regional gradient from north to south. The regional geological setting is associated with the Arabian Plate and the Mesopotamian foredeep, as described by Jassim and Goff (2006).

Particle-size distribution reflects the relative proportions of gravel, sand, silt, and clay. Based on ASTM procedures (Das, 2014), Fadhil et al. (2019) reported that sand is the dominant fraction in most samples, with sand contents ranging from 68.50% to 98.92%, silt ranging from 3.85% to 26.21%, and clay ranging from 5.29% to 11.81% (Figure 4-23; Table 4-7). On this basis, soils in the sampled locations are generally described as sandy soils that are predominantly poorly graded, with the exception of the Tal El-Eleg location, which is reported as well-graded in the study (Table 4-7). Overall, the results are consistent with Quaternary depositional settings dominated by alluvial and slope-derived sediments.

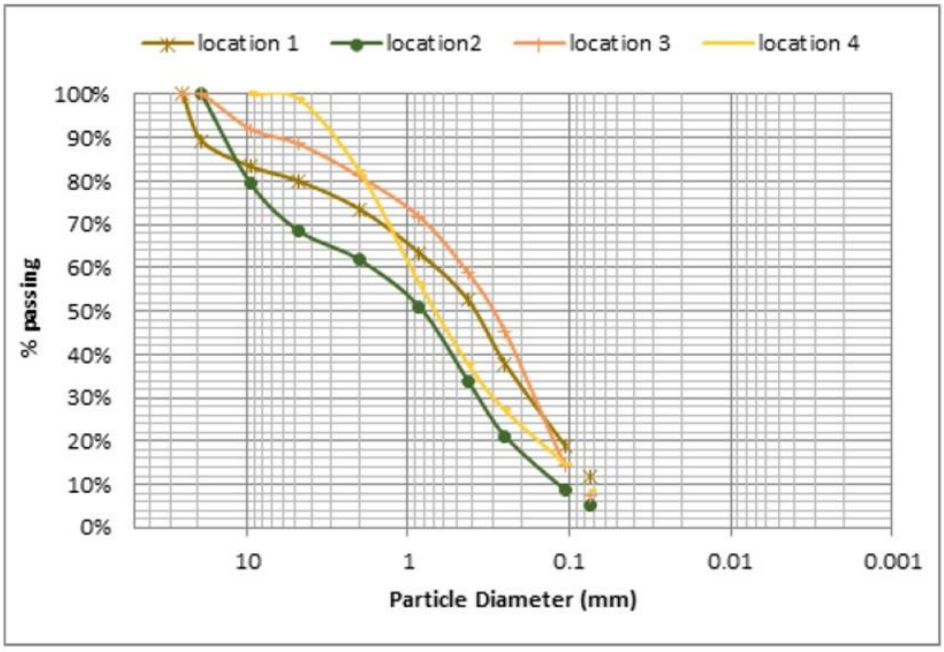


Figure 4-23: Soil Particle Size Analysis (Fadhil et al., 2019)

Table 4-7: Results of Physical Tests for the Four Specimens (after Fadhil et al., 2019)

Sample No	Particle size			Depth (m)	Location
	Clay %	Silt %	Sand %		
1	11.81	8.19	80	6	Al-Mutawakil

2	5.29	26.21	68.5	4	Salahaddin
3	7.59	3.85	88.56	5	Gebria 1
4	55	8.27	7.19	4	Tal El-Eleg

Fadhil et al. (2019) analyzed chemical parameters relevant to soil salinity and potential interactions with buried concrete and reinforcement, including gypsum, total dissolved salts, chlorides, sulphates (reported as SO_3), calcium carbonate, electrical conductivity, and pH (Table 4-8). Gypsum content averaged 12.13% (range 4.19–21.36%), indicating locally gypsiferous conditions and classified by the authors as "medium" gypsum soil. Total dissolved salts were low (0.109–0.150%; average 0.124%) and below the 0.5% reference threshold cited by Baver (1972). Chlorides were also low (0.011–0.022%; average 0.017%). Sulphates ranged from 0.11% to 1.126% (average 0.119%), while calcium carbonate ranged from 0.061% to 0.089% (average 0.073%). Electrical conductivity averaged 2.49 dS/m (2.19–3.01 dS/m) and pH averaged 7.95 (7.88–8.04), reflecting mildly alkaline soil conditions.

Table 4-8: Chemical Test Results for Soil Specimens (after Fadhil et al., 2019)

Sample No.	Gyp%	TDS %	CL %	SO3 %	CaCo3 %	EC (ds/m)	PH
1	4.19	0.15	0.022	0.126	0.061	3.01	7.88
2	16.8	0.11	0.016	0.11	0.089	2.2	8.04
3	21.36	0.109	0.011	0.114	0.064	2.19	7.94
4	6.15	0.128	0.017	0.125	0.079	2.56	7.92

Overall, the physical test results indicate soils dominated by sand and generally poorly graded (SP), with the Tal El-Eleg location reported as a well-graded sandy soil with finer material present (SW/SC) (Fadhil et al., 2019). Chemical results indicate moderate gypsum levels (average 12.13%), low TDS values (average 0.124%), mildly alkaline conditions (average pH 7.95), and EC in the range 2.19–3.01 dS/m, with reported chlorides and calcium carbonate remaining at comparatively low percentages.

R9B Segment under Expressway No. 1

Available literature indicates that soil conditions in areas adjacent to the R9B alignment have been characterized for both physical and chemical properties. Sayel et al. (2024) assessed soil characteristics across Ramadi District, which covers much of the R9B track influence area (Figure 19). The study evaluated particle-size distribution and key soil chemistry parameters, including pH, electrical conductivity (EC), organic matter (OM), gypsum content, and calcium carbonate ($CaCO_3$), and presented the results as spatial distribution maps. Figure 4-24 presents the location of the soil sampling points used in Sayel et al. (2024).

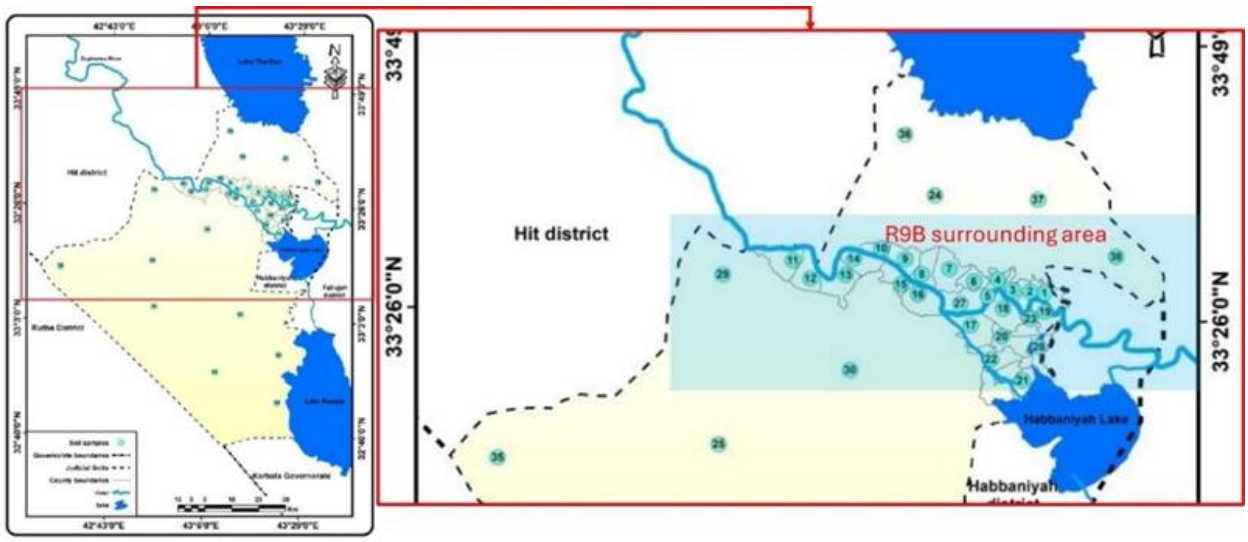


Figure 4-24: Location of the soil samples. (Modified after Sayel et al., 2024)

Physical properties

- Sand content varies spatially across the corridor influence area. Sayel et al. (2024) report sand contents ranging from 15–33% in one portion of the study area and 33–42% in another, indicating local variability in soil texture (Figure 4-25a).
- Silt content in soils close to the road is reported within the range 36–53% (Figure 4-25b).
- Clay content in soils close to the road is reported within the range 11–20% (Figure 4-26a).
- Based on the combined particle-size distribution, soil texture in the area close to the road varies from sandy loam in some locations to silty clay loam in others.
- Bulk density in the eastern part of the R9B sector near the Ramadi area ranges from 1.18–1.34 Mg/m^3, increasing eastward to about 1.4 Mg/m^3, consistent with the reported increase in sand content (Figure 4-26b).

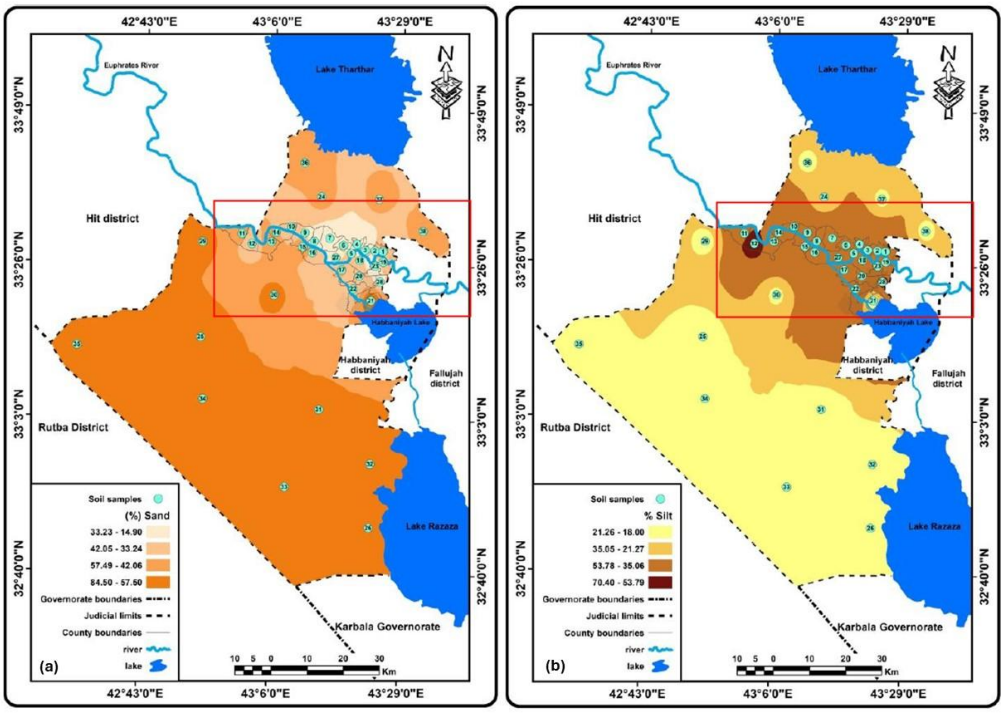


Figure 4-25: Maps of spatial distribution of; (a) Soil sand content and (b) Soil silt. (Sayel et al., 2024)

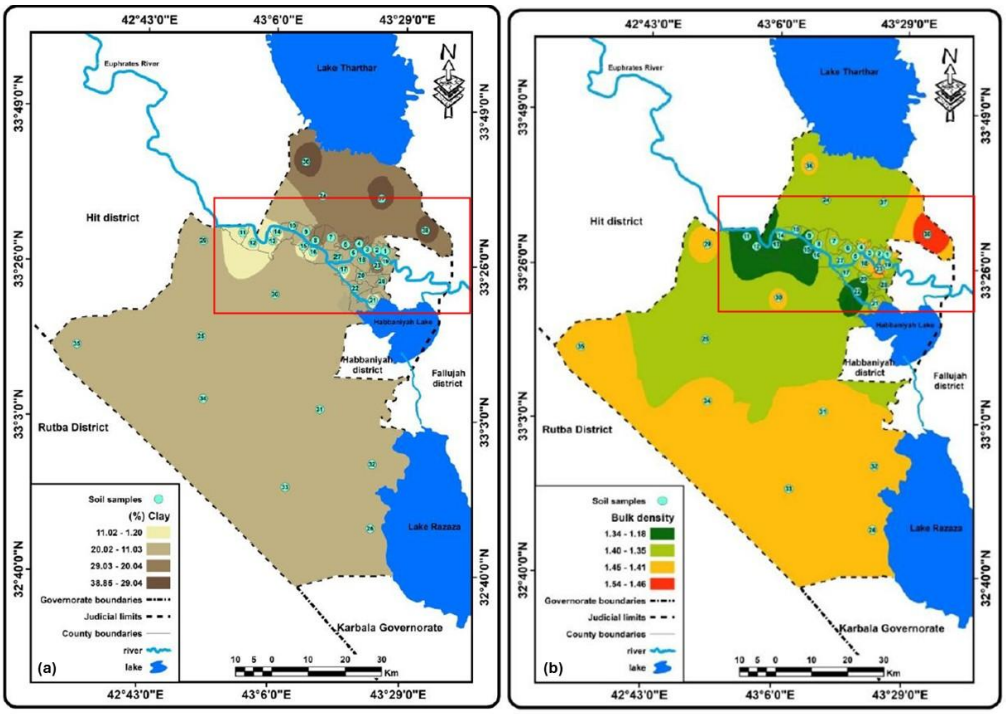


Figure 4-26: Maps of spatial distribution of; (a) Soil clay content and (b) Soil bulk density. (Sayel et al., 2024)

Chemical properties

- Soil pH in the area close to the R9B sector ranges from 7.2–7.4, corresponding to neutral to slightly alkaline conditions (Figure 4-27a) (USDA, 2017).
- Electrical conductivity (EC) indicates soil salinity conditions in the range 4.45–10.27 dS/m across parts of the study area (Figure 4-27b). Sayel et al. (2024) note lower salinity values toward the west near Ramadi, decreasing to about 4.44 dS/m.
- Organic matter (OM) content ranges from 2.1–8.5 g/kg, with higher values reported toward the west near the Ramadi area (Figure 4-28a), reflecting spatial variability in vegetation cover and local soil conditions.
- Gypsum content is generally low to moderate, ranging from 0.5–28.7 g/kg across most of the study area (Figure 4-28b), with localized higher values reported toward the east, potentially associated with limited drainage effectiveness and wetland formation.
- Calcium carbonate ($CaCO_3$) content is reported as high (Figure 4-29). The presence of carbonates in this part of Al-Anbar is attributed to parent-material characteristics and sediment transport processes associated with the Euphrates River system (Hammad et al., 2024).

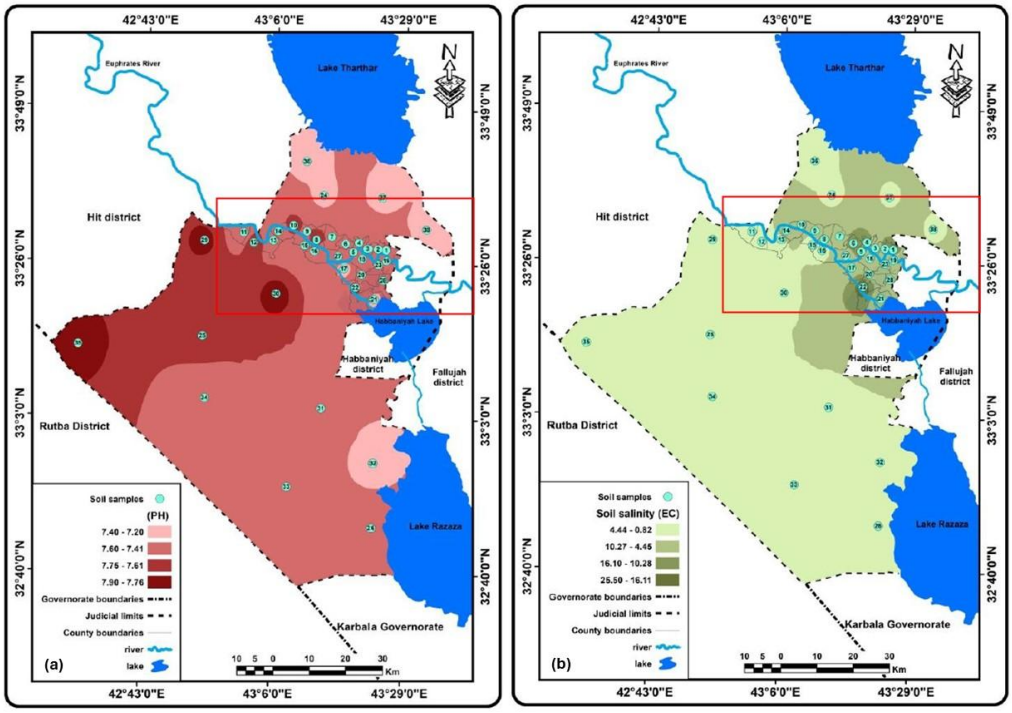


Figure 4-27: Maps of spatial distribution of; (a) Soil pH content and (b) Soil Ec density. (Sayel et al., 2024)

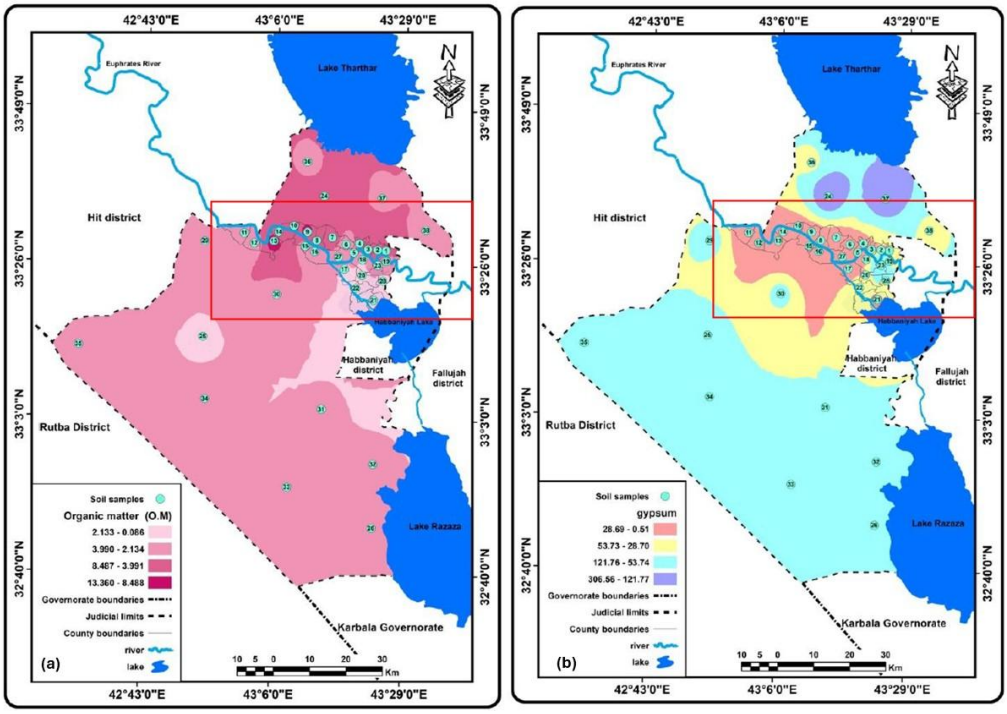


Figure 4-28: Maps of spatial distribution of; (a) Soil Organic Matter (OM) content and (b) Soil gypsum density. (Sayel et al., 2024)

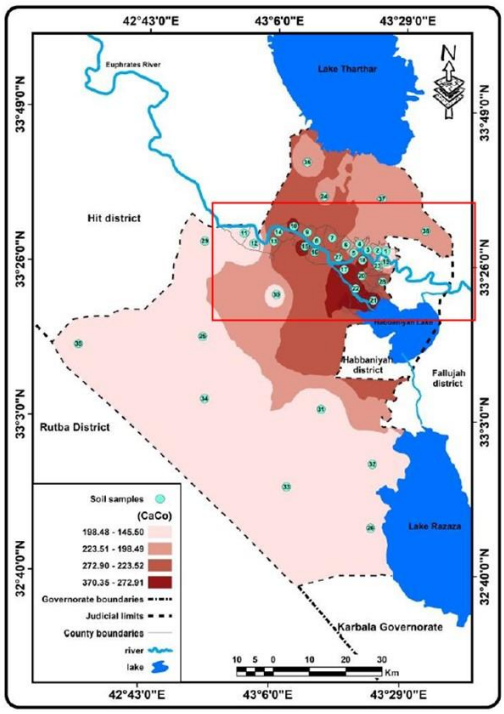


Figure 4-29: Maps of spatial distribution of Soil Calcium carbonate. (Sayel et al., 2024)

Sulaymaniyah–Chamchamal–Kirkuk Road (KRI)

Soils along the project corridor reflect the natural transition between the upland limestone foothills near Bazian (eastern end) and the wider alluvial basin approaching Chamchamal (western end). In the Bazian segment, soils are typically shallow, stony, and calcareous due to the dominance of underlying limestone and marl formations. These soils often contain gravel and small rock fragments, particularly on or near slopes, and tend to have low moisture retention during the long dry season.

Moving westward, the terrain opens into a broader valley where deeper fine-grained soils are present. These soils, composed mainly of clay and silty clay, result from long-term deposition in low-lying areas and seasonal water pathways. No saline soils or problematic geochemical conditions are known within the project area.

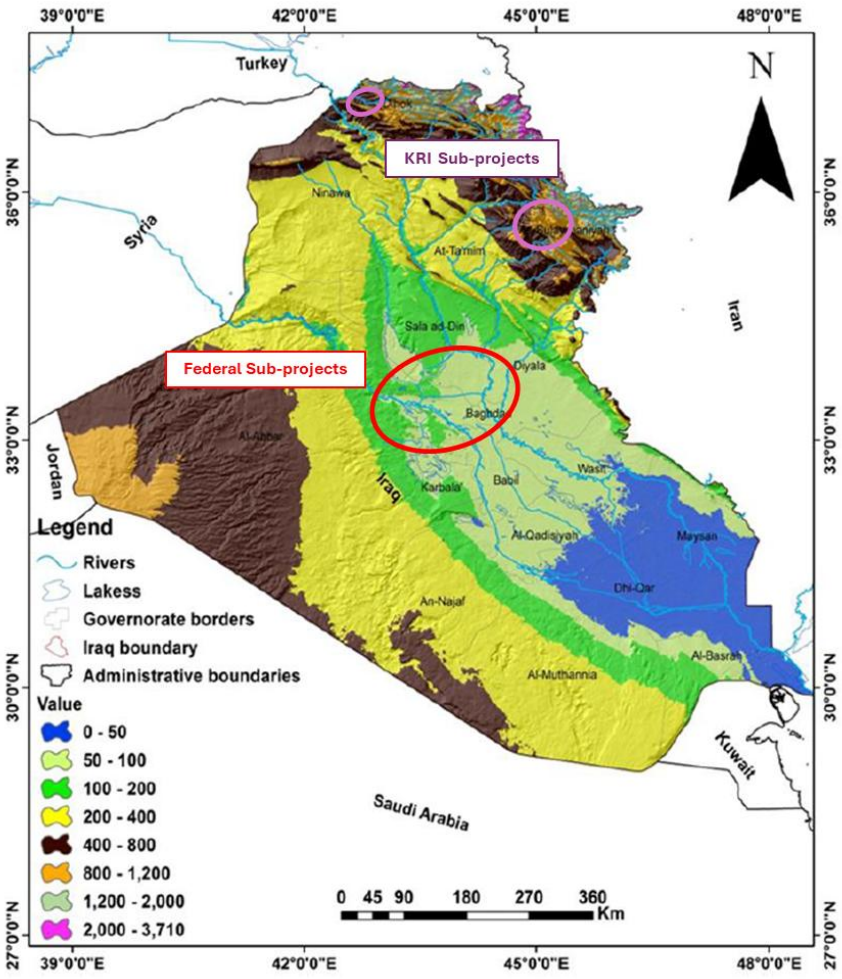
Soils are moist during winter and early spring, then dry rapidly from May onward, remaining extremely dry throughout June to September.

Girsheen–Suhaila Road Upgrade and Girsheen Interchange (KRI)

Soils consist of alluvial brown fertile soils, including Calcic Xerosols (reddish-brown, strongly calcareous) and Gypsic Xerosols (containing a strong zone of gypsum accumulation at 20-80 cm depth). The area also contains beds of gravel, conglomerate, and sandstones.

4.2.6 Topography

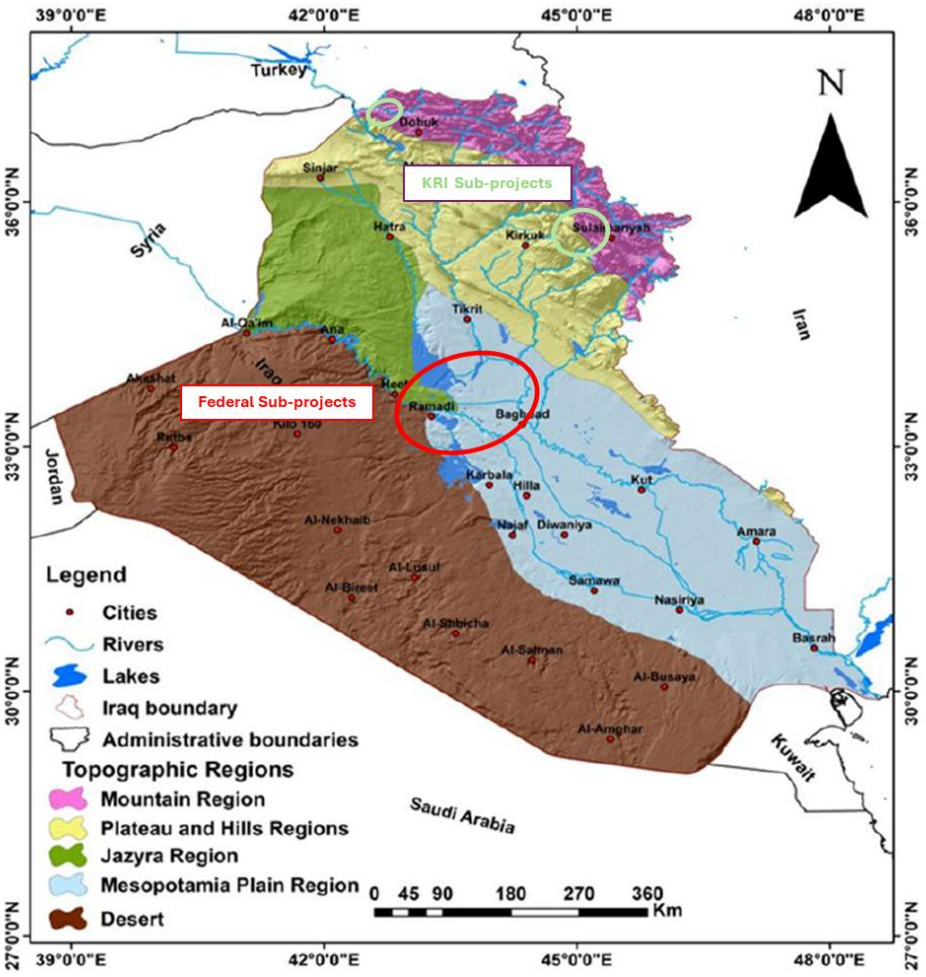
Topographically, Iraq can be described as a broad basin dominated by the Mesopotamian Plain, which is bounded by higher terrain to the north, northeast, and east, and by extensive desert landscapes to the west and south. Elevations rise from near sea level in the far south (Al-Faw) and increase northward and eastward toward the mountain ranges along the Iraqi–Iranian border, where the highest elevations exceed 3,000 m above sea level (Figure 4-30). As shown by the Project locations highlighted in Figure 4-30, the Federal sub-project corridors are situated predominantly within the low-lying central plain and adjacent low-elevation areas, with elevation bands generally within the 50–100 m class and locally transitioning into the 100–200 m class. In contrast, the KRI sub-project locations are situated within higher-elevation terrain, consistent with the northeastern uplands, where elevation bands increase substantially relative to the central plain.



الشكل (1-2): الخريطة الطبوغرافية للعراق.

Figure 4-30: Topography (elevation bands) of Iraq and location of Federal and KRI sub-projects (Ahmed Sardah Kazem Al-Zubaidi, 2024).

Iraq's topography can also be grouped into five main regions: Mountain Region, Plateau and Hills Region, Jazira Region, Desert Region, and the Mesopotamian Plain Region (Figure 4-31). The Project spans more than one topographic region. As shown in Figure 4-31, the Federal sub-project corridors are located predominantly within the Mesopotamian Plain Region, with some sections extending into or near Jazira and Desert settings depending on the corridor. The Mesopotamian Plain Region occupies central and southern Iraq and is associated with broad alluvial lowlands linked to the Tigris River–Euphrates River basin. This region is characterized by a very gentle regional slope from north to south and an extensive network of rivers and irrigation/drainage canals. Land use in this setting is therefore strongly influenced by irrigated agriculture and canal-fed cultivation systems drawing from the Tigris and Euphrates waters. In contrast, the KRI sub-project locations are situated within the Mountain Region and/or Plateau and Hills Regions, which are characterized by higher relief, steeper slopes, and more pronounced drainage networks than the central plain. This regional differentiation provides baseline context for expected differences in terrain, drainage behavior, and earthworks requirements across the Federal and KRI sub-projects.



الشكل (1-4): الخريطة الطبوغرافية للعراق (Al-Ansari, 2020).

Figure 4-31: Topographic regions of Iraq and location of Federal and KRI sub-projects (Nadhir Al-Ansari, 2020).

4.2.7 Groundwater Hydrology

Iraq's hydrogeological setting includes multiple aquifer groups that reflect differences in geological age, structure, and lithology. Krasny et al. (2006) classify Iraq's aquifers into 14 groups based on the geological age, structures, and lithology of groundwater-bearing formations (Figure 4-32). As shown in Figure 4-32, the Baghdad–Samarra section of Expressway No. 2 is located within Aquifer Group 11 (Alluvial Fan Gravel). The R9B segment spans more than one hydrogeological unit, intersecting Aquifer Group 10 (Mesopotamian Plain) and Aquifer Group 4 (Miocene Carbonate). Within the KRI sub-projects, the Sulaymaniyah–Chamchamal–Kirkuk Road is mapped predominantly within Aquifer Group 14 (Fractured Karstified Carbonate), with a smaller portion extending into Aquifer Group 12 (Pliocene Conglomerate). The Girsheen–Suhaila Road Upgrade and Girsheen Interchange is also mapped predominantly within Aquifer Group 14 (Fractured Karstified Carbonate), with a smaller portion extending into Aquifer Group 13 (Mio–Pliocene Sandstone).

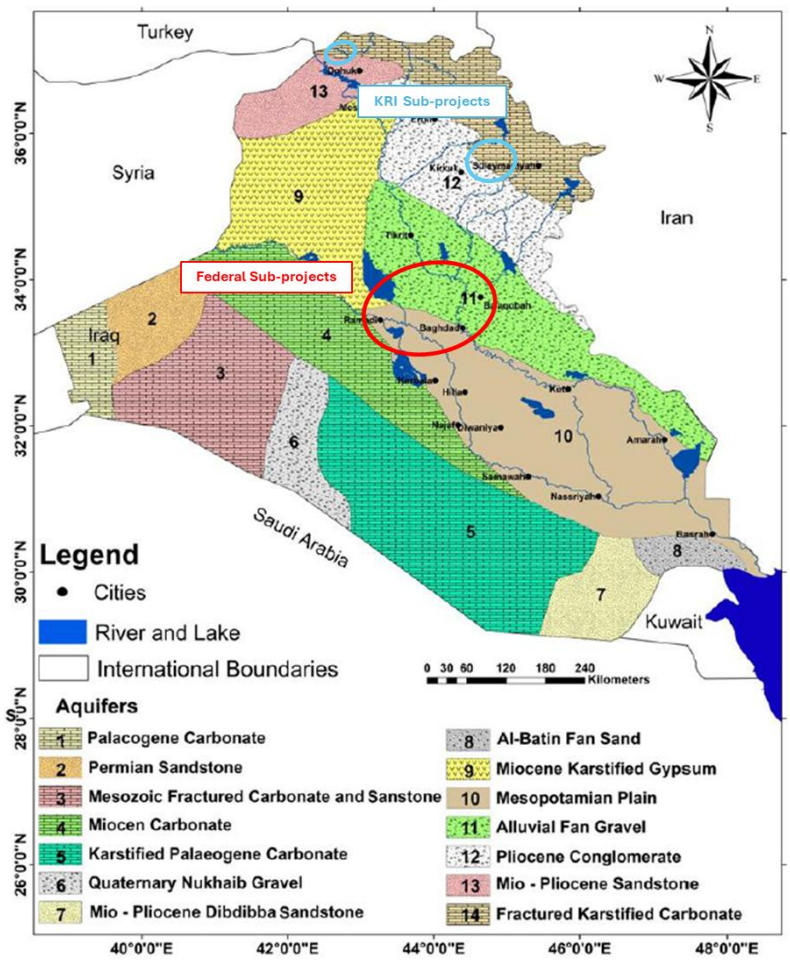


Figure 4-32: Groups of underground water aquifers in Iraq (after Alsam et al., 1990 in Jassim and Goff, 2006)

Al-Jiburi and Al-Basrawi (2015) further divide Iraq into seven hydrogeological zones based on physiographic, structural, geological, and hydrogeological characteristics (Figure 4-33). As shown in Figure 4-33, the Baghdad–Samarra section of Expressway No. 2 is located within the Mesopotamia Zone, where the Quaternary Aquifer System is identified as the principal aquifer system. The R9B segment spans two hydrogeological zones: the eastern portion lies within the Mesopotamia Zone, while the western portion extends into the Al-Jazira Zone (Figure 4-33). In this baseline context, the Quaternary Aquifer System remains the dominant aquifer system across the Mesopotamia setting, while the transition westward toward Al-Jazira reflects differing regional hydrogeological conditions. Within the KRI sub-projects, the Sulaymaniyah–Chamchamal–Kirkuk Road and the Girsheen–Suhaila Road Upgrade and Girsheen Interchange are located within the folded zone belt, falling between the Low Folded Zone and the High Folded Zone, consistent with the more structurally controlled hydrogeological setting of northern and northeastern Iraq (Figure 4-33).

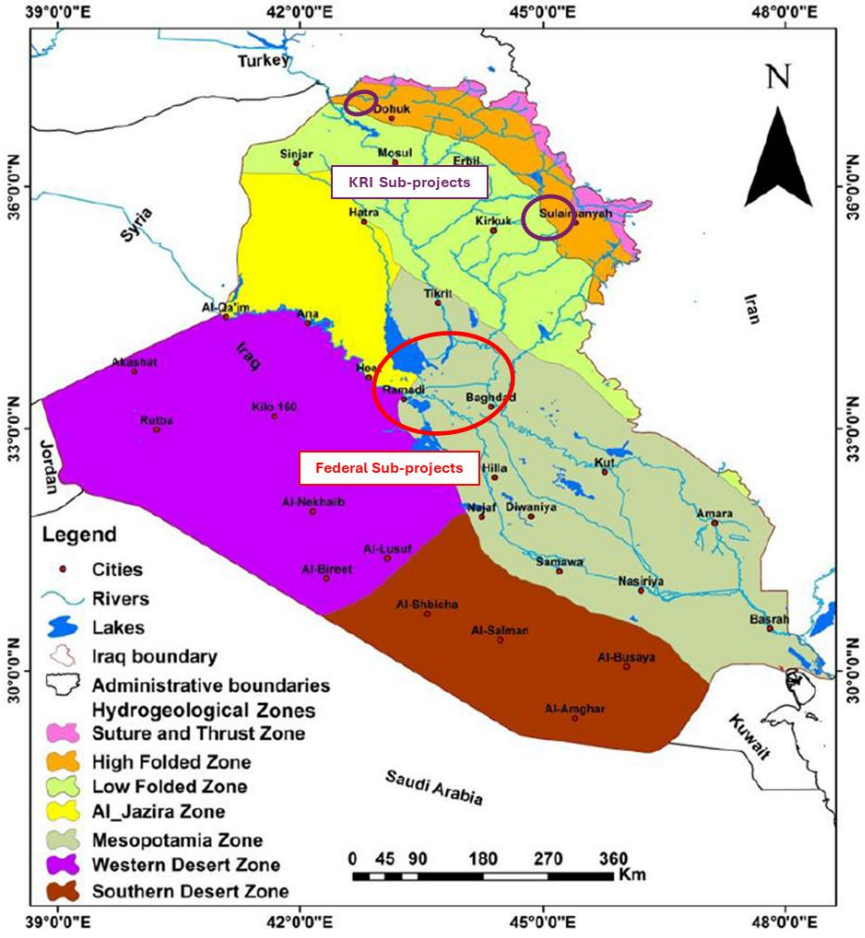


Figure 4-33: Hydrogeological Zones in Irag. (Al-Jiburi and Al Basrawi, 2015)

Based on the groundwater-depth map (Figure 4-34), groundwater depth varies across the Federal and KRI sub-project areas. The Baghdad–Samarra section of Expressway No. 2 is located predominantly within the 10–20 meters below ground surface class. The R9B segment spans two groundwater-depth classes, with areas falling within 10–20 meters below ground surface and 20–30 meters below ground surface. In contrast, the KRI sub-projects (i.e., the Sulaymaniyah–Chamchamal–Kirkuk Road and the Girsheen–Suhaila Road Upgrade and Girsheen Interchange) fall within comparatively deeper groundwater-depth classes, predominantly 30–40 meters below ground surface and 40–50 meters below ground surface (Figure 4-34).

Figure 4-34: Groundwater Depth and ITREC Sub-projects

4.2.7.1 Federal Sub-projects

Expressway No. 2 (Baghdad – Samarra)

Baghdad Region

Ismail et al. (2019) assessed groundwater hydrochemistry and quality in the urban area of Baghdad based on 66 samples collected from shallow tube wells and analyzed for pH, TDS, EC, Ca, Mg, Na, K, Cl, HCO_3, CO_3, SO_4, and NO_3 (Figure 4-35).

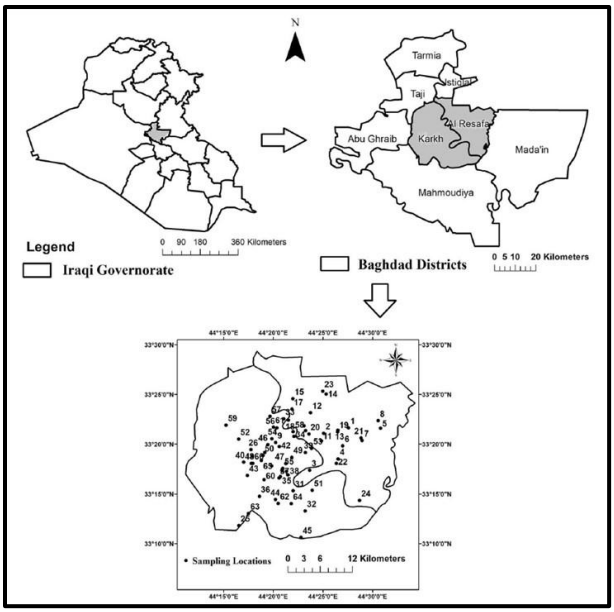


Figure 4-35: Study area and location of collected groundwater samples in Baghdad. (Ismail et al, 2019)

The authors report that groundwater in Baghdad is alkaline and strongly influenced by anthropogenic sources, and that several measured water-quality parameters exceed prescribed drinking-water limits, indicating that untreated groundwater may pose health risks if used for potable supply.

With respect to irrigation suitability, Ismail et al. (2019) report SAR < 10 (generally indicating low sodium hazard) and RSC < 1.5 (generally indicating water that is acceptable/safe with respect to carbonate hazard). However, when salinity and combined hazards are considered using irrigation classification approaches, the results indicate poor overall suitability: the US salinity diagram classifies 90% of the samples as very poor for irrigation (requiring special soil/water management such as improved drainage and leaching), the Wilcox diagram indicates 75% of samples are unsuitable, and the Magnesium Hazard (MH) suggests 85% of samples exceed the commonly used threshold (MH > 50), implying unsuitability. Overall, the study attributes the limited irrigation suitability primarily to high salinity and elevated sodium and magnesium concentrations, and notes that additional parameters (e.g., fluoride) and integrated assessment tools may be needed to better predict and manage groundwater quality in water-scarce, semi-arid settings.

Samarra Region

Shimal and Shaban (2019) investigated pollutant-element levels in groundwater in Samarra (Salah Al-Din Province) using 29 wells, evaluating concentrations of key dissolved constituents (K, Na, Mg, Cl, Ca) and major compounds (SO_4, HCO_3) across the study area (Figure 4-36).

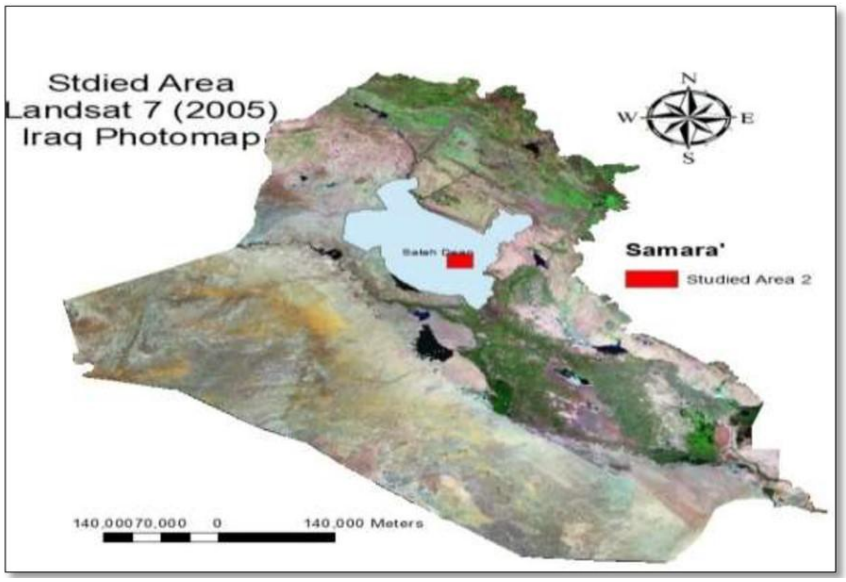


Figure 4-36: Study area in Samarra. (Shimal and Shaban 2019)

Shimal and Shaban (2019) report elevated concentrations of multiple groundwater quality parameters in the Samarra area, with several constituents exceeding applicable permissible limits. Increased TDS was identified as a factor affecting palatability. Chloride and sodium were reported above international guideline values, and the authors note potential human health implications associated with elevated sodium. Magnesium and calcium were also reported to exceed WHO guideline values, and sulfate concentrations exceeded the permissible limit. Overall, the authors conclude that all sampled wells exceeded WHO guideline values for one or more parameters, while potassium and bicarbonate remained within permissible limits.

The study notes a potential local contamination contributor associated with industrial activity, including a pharmaceutical facility in Samarra. Based on the reported exceedances, groundwater was characterized as unsuitable for human use; however, the authors indicate it may remain usable for irrigation and other non-potable purposes, subject to salinity and major-ion constraints.

R9B Segment under Expressway No. 1

Ramadi Region

Abbas et al. (2025) evaluated groundwater quality in Ramadi City, within the western part of the R9B segment. The locations of the sampled wells are shown in Figure 4-37.

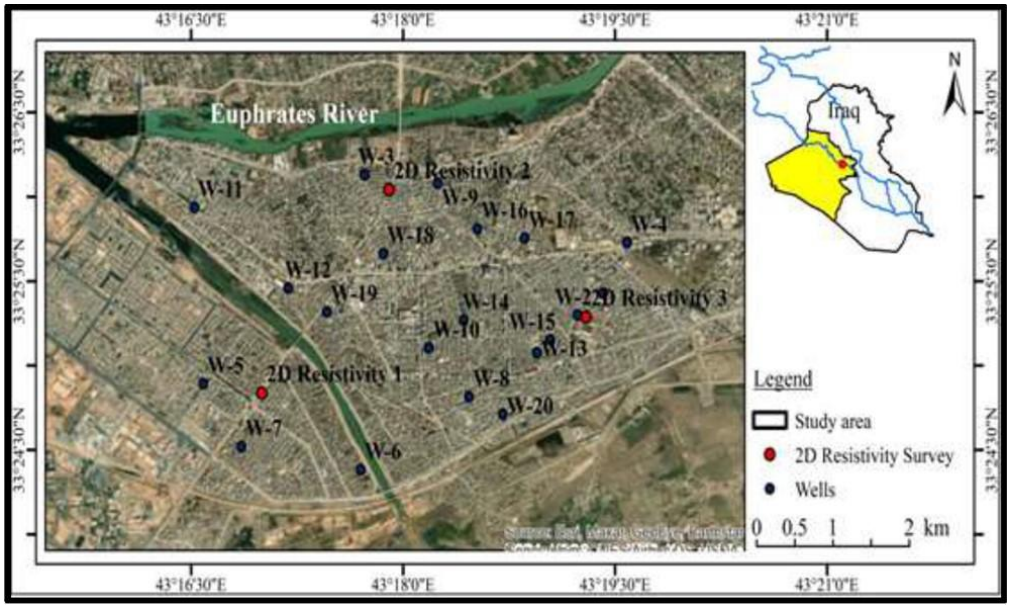


Figure 4-37: Location of groundwater wells in Ramadi City (Abbas et al., 2025)

Groundwater samples were collected from 20 wells distributed across Ramadi and analyzed for key physicochemical parameters, including pH, TDS, EC, TH, Na^+, Ca^{2+}, Mg^{2+}, SO_4^{2-}, HCO_3^-, Cl^-, and NO_3^-. The coordinates, well depths, and water-quality class assigned to each well are summarized in Table 4-9.

Table 4-9: Coordinates and depths of wells in the study area. (Abbas et al., 2025)

Wells	Longitude	Latitude	Well depth (m)	Water quality
W-1	43° 19' 25.0000" E	33° 25' 25.7000" N	48	Unfit
W-2	43° 19' 14.1000" E	33° 25' 17.9000" N	48	Unfit
W-3	43° 17' 43.6000" E	33° 26' 07.8000" N	36	Very poor
W-4	43° 19' 35.1000" E	33° 25' 43.7000" N	42	Very poor
W-5	43° 16' 35.2000" E	33° 24' 53.5000" N	38	Unfit
W-6	43° 17' 42.0000" E	33° 24' 23.0000" N	40	Unfit
W-7	43° 16' 51.4000" E	33° 24' 31.2000" N	32	Very poor
W-8	43° 18' 28.0000" E	33° 24' 48.8000" N	45	Very poor
W-9	43° 18' 14.7000" E	33° 26' 04.7000" N	43	Unfit
W-10	43° 18' 11.0000" E	33° 25' 06.3000" N	32	Very poor
W-11	43° 16' 31.4000" E	33° 25' 56.2000" N	29	Very poor
W-12	43° 17' 11.2000" E	33° 25' 27.5000" N	43	Very poor
W-13	43° 18' 56.8000" E	33° 25' 04.5000" N	30	Very poor
W-14	43° 18' 25.8000" E	33° 25' 16.1000" N	25	Very poor
W-15	43° 19' 02.5000" E	33° 25' 09.1000" N	36	Poor
W-16	43° 18' 31.5000" E	33° 25' 48.6000" N	38	Very poor
W-17	43° 18' 51.5000" E	33° 25' 45.3000" N	41	Very poor
W-18	43° 17' 51.6000" E	33° 25' 39.8000" N	43	Very poor
W-19	43° 17' 27.6000" E	33° 25' 19.1000" N	34	Unfit

W-20	43° 18' 42.3000" E	33° 24' 42.7000" N	46	Poor

Measured groundwater levels across Ramadi vary from approximately 2 to 7 m, as indicated in Figure 4-38. Abbas et al. (2025) attribute this spatial variability to the occurrence of sandy–silt lenses within Quaternary sediments that can form localized perched groundwater conditions, potentially influenced by infiltration from rainfall and leakage from sewage systems.

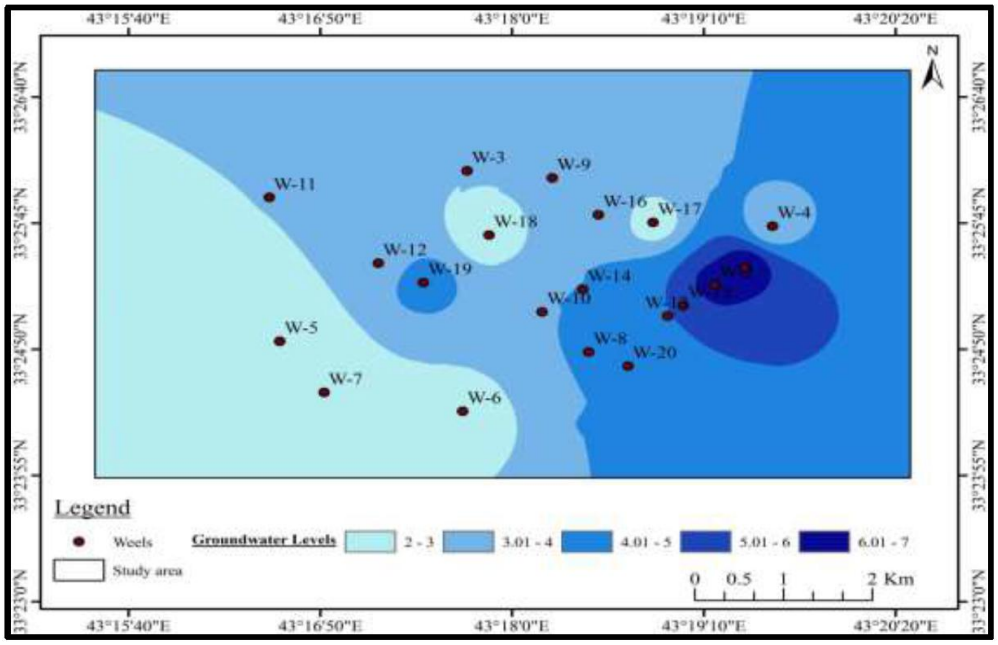


Figure 4-38: Groundwater levels in Ramadi City. (Abbas et al., 2025)

Overall, Abbas et al. (2025) characterize groundwater quality in Ramadi City (R9B segment context) as follows:

- The groundwater exhibits a neutral to slightly alkaline pH, is slightly brackish based on TDS, and shows high mineralization based on EC. In terms of total hardness (TH), the groundwater is classified as very hard. The dominant cations are ordered as $Na^{+} > Ca^{2+} > Mg^{2+}$, while the dominant anions are $Cl^{-} > SO_4^{2-} > HCO_3^{-}$.
- Based on the WQI classification applied in the study, groundwater samples range from poor to unfit, indicating that the sampled groundwater is not suitable for drinking without treatment.
- Elevated concentrations of major ions are interpreted as indicating contamination primarily associated with sewage network leakage and local human activities.
- The study notes the need for measures to improve groundwater quality, including strengthening sewage management practices and upgrading and maintaining water and sanitation infrastructure.

Saqlawiya Region

Al-Kubaisi et al. (2025) evaluated groundwater quality in Saqlawiya City, at the eastern end of the R9B segment. The locations of the sampled wells are shown in Figure 4-39.

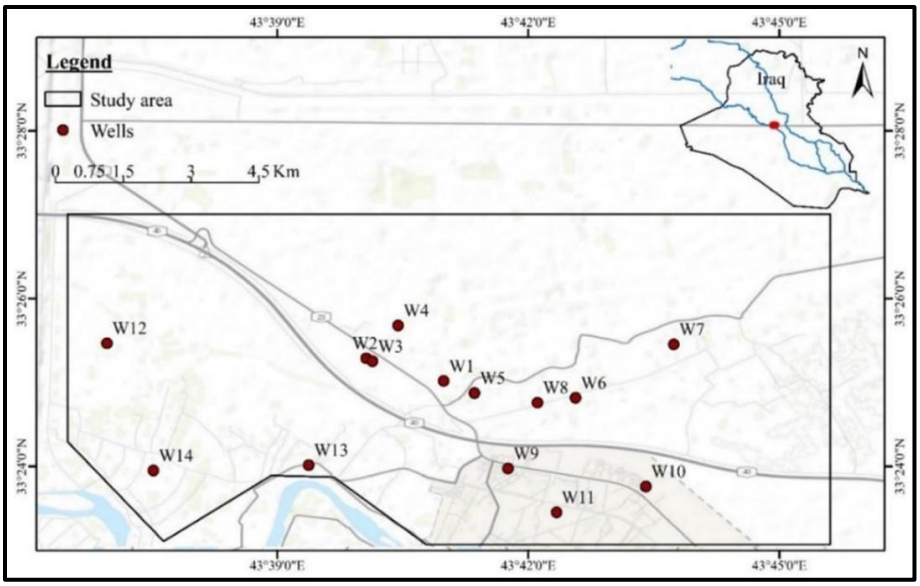


Figure 4-39: The study area in Saqlawiya City and the sites of the studied wells. (Al-Kubaisi et al., 2025)

The wells are shallow and are used primarily for agricultural and irrigation purposes. Groundwater samples were analyzed for key physicochemical parameters (pH, EC, TDS, total hardness, turbidity, Ca^{2+}, Mg^{2+}, Na^{+}, K^{+}, Cl^{-}, SO_4^{2-}, HCO_3^{-}, CO_3^{2-}, and NO_3^{-}), as well as selected heavy metals (Pb, Cd, Ni, Cu, Co, and Zn), following standard methods (APHA, 2012). Measured groundwater depth ranges from approximately 7 to 20 m below ground surface, and the mapped groundwater level ranges between 21 and 37 m above sea level, as shown in Figure 4-40.

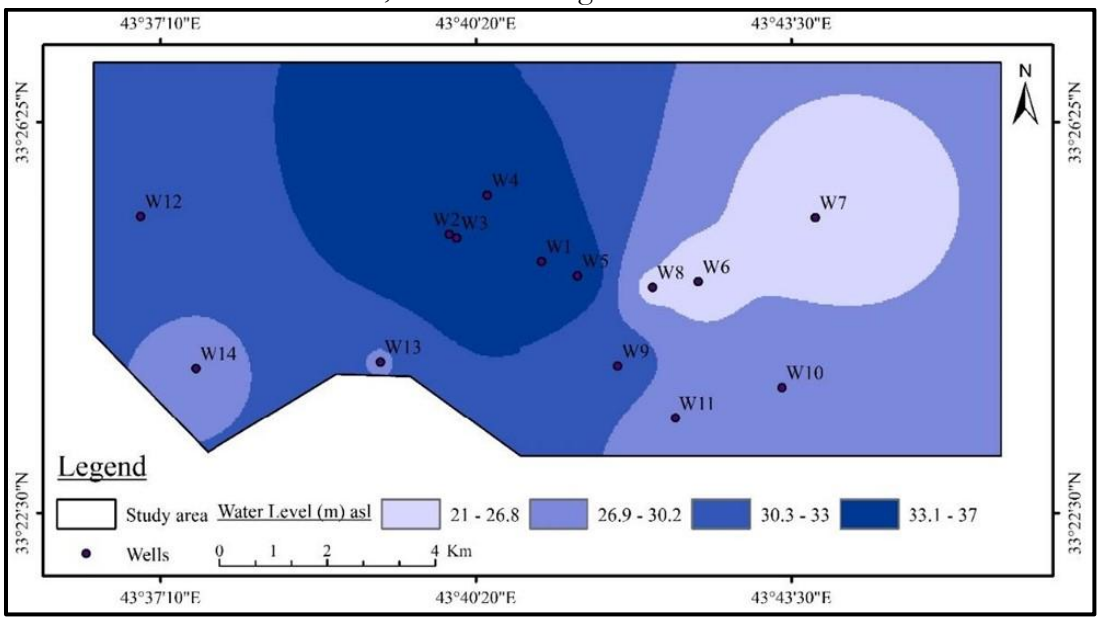


Figure 4-40: Groundwater level in Saqlawiya city. (Al-Kubaisi et al., 2025)

Overall, Al-Kubaisi et al. (2025) report that groundwater in the assessed wells is generally polluted and is not suitable for irrigation or human consumption without appropriate evaluation and/or treatment.

The study indicates that evaporation and related mineral crystallization processes are key controls on groundwater chemistry in the area.

4.2.7.2 KRI Sub-projects

Sulaymaniyah–Chamchamal–Kirkuk Road (KRI)

Groundwater in the project area is accessed through deep wells used by nearby communities, agricultural lands, and factories as a supplementary source in addition to the main piped supply. Approximately 20 wells are located near or within the wider right-of-way of the corridor, many of which are concentrated around the Kani Shaitan area. These wells are generally protected and are outside the expected construction footprint and are not anticipated to be affected by the works.

Two wells are located within the median, used exclusively for irrigating the planted trees and not for potable purposes. These median wells are the groundwater structures requiring attention during construction due to their location

Figure 4-41: Groundwater well in the median

Figure 4-42: Protected groundwater well nearby the road

Several wells in the wider area have experienced reduced yield or seasonal drying during recent dry years, reflecting the region's reliance on winter and early spring rainfall for groundwater recharge. No shallow groundwater or seepage conditions were observed along the road's alignment.

Girsheen–Suhaila Road Upgrade and Girsheen Interchange (KRI)

According to the Directorate of Water, groundwater resources in the project area are associated with the Zakho Basin, which contains a shallow and productive aquifer system extending across the Iraq–Turkey border. The aquifer is primarily recharged through rainfall infiltration and supports groundwater abstraction for domestic and agricultural uses within the basin.

No groundwater wells are recorded within the project Right of Way or in the immediate vicinity of the overpass location.

4.2.8 Surface Water Hydrology

Iraq's surface water resources are dominated by the Tigris and Euphrates rivers, which together represent the primary renewable surface water resources in the country (Figure 4-43). FAO (1994) indicates that the Tigris and Euphrates account for approximately 98% of Iraq's water resources. At the national scale, Frenken (2009) reports basin areas of approximately 126,900 km² for the Tigris and 177,600 km² for the Euphrates (excluding tributaries).

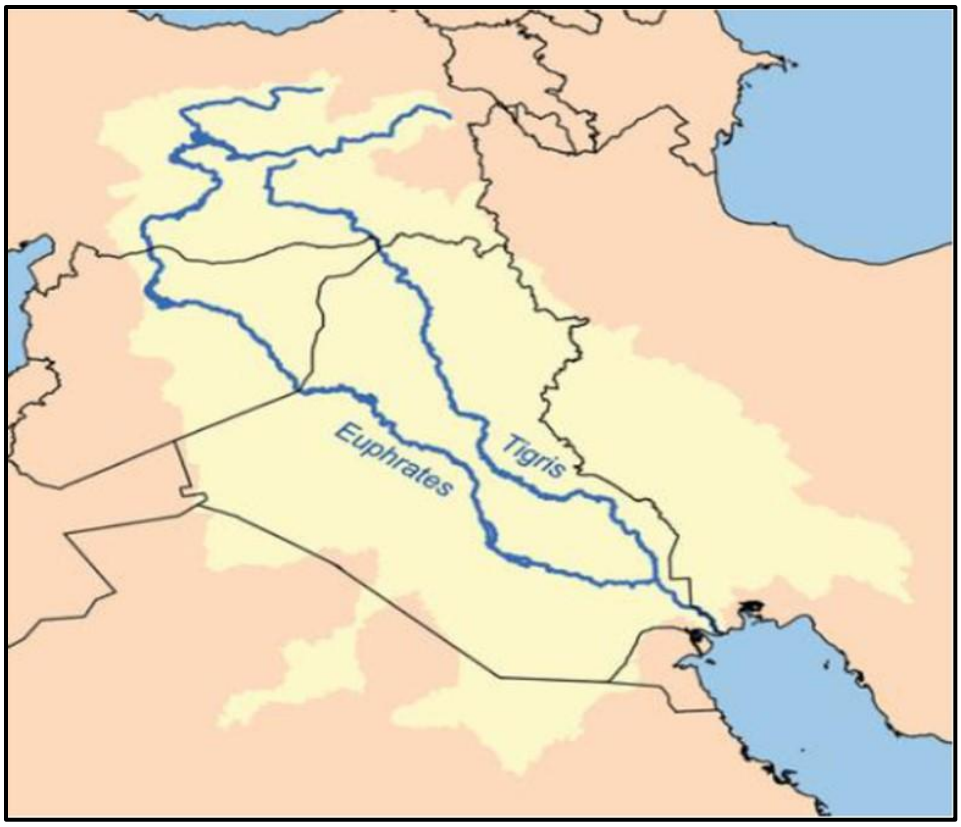


Figure 4-43: Tigris and Euphrates Rivers in Iraq

4.2.8.1 Federal Sub-projects

Expressway No. 2 (Baghdad – Samarra)

Expressway No. 2 traverses a predominantly agricultural landscape with interspersed settlements and localized low-lying areas. Agricultural land uses along the corridor are associated with irrigation supply and return-flow drainage, and wetlands are locally present, commonly reflecting ponding in agricultural drainage areas. Within the broader hydrologic context (50 km on either side of the corridor), major surface-water systems include the Tigris and tributary systems to the east (including the Al Uzaym and Sirwan rivers) and the Tharthar Canal to the west (Figure 4-44).

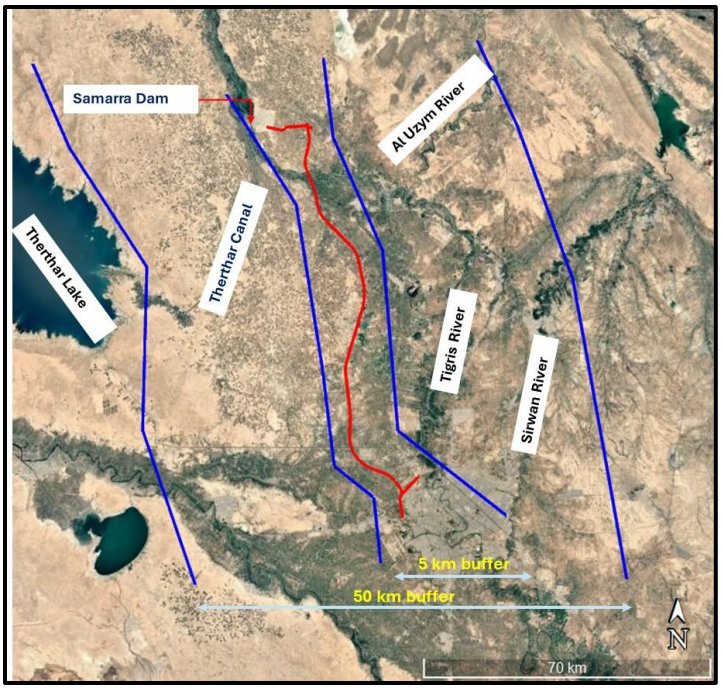


Figure 4-44: Location Map Of Baghdad–Samarra New Highway Road and Surface Water Bodies

Chabuk et al. (2020) provides project-relevant baseline context for the principal receiving waterbody within the broader Baghdad–Samarra hydrologic setting, given the corridor's proximity to the Tigris system and the presence of irrigation/drainage features that ultimately connect to major river channels. Using a Water Quality Index (WQI), the study mapped spatial patterns along the Tigris for wet and dry seasons (2016) (Figure). For the reach corresponding to the Baghdad–Samarra geographic context, the reported wet-season WQI classes at Samarra (Station 5) and at Baghdad-area stations (e.g., Muthanna Bridge (6) and Shuhada Bridge (7)) are classified as Good, while downstream stations are classified as Poor, indicating a deterioration in WQI class moving downstream from the Baghdad–Samarra reach.

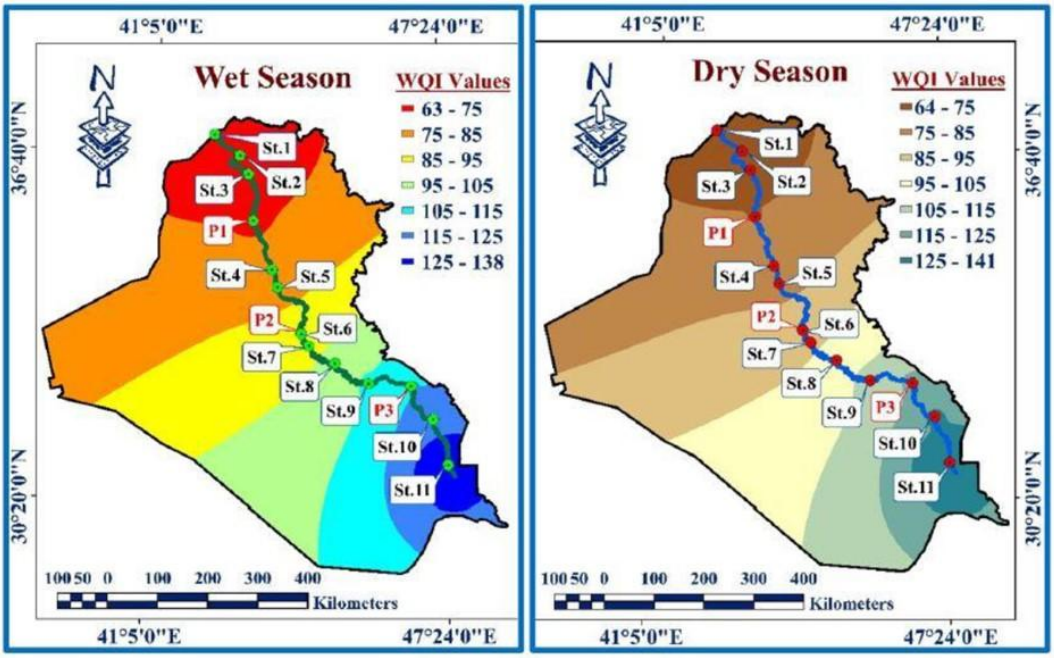


Figure 4-45: Distribution maps of the Water Quality Index WQI values along Tigris. River in 2016 during a wet season and a dry season. (Chabuk et al., 2020)

R9B Segment under Expressway No. 1

The R9B segment traverses a densely used landscape with multiple activities, dominated by agricultural land and several cities and population centers on both sides of the Euphrates River. Agricultural areas along the corridor are interspersed with irrigation and drainage channels and localized wetlands, which are often formed by agricultural drainage. Within a 50 km buffer zone on both sides of the R9B segment, the principal surface-water features include the Euphrates River and the Tharthar Canal, in addition to freshwater lakes including Lake Tharthar and Lake Habbaniyah (Figure 4-46).

Figure 4-46: Hydrological Setting of R9B Segment

Euphrates River water quality (R9B segment)

Euphrates River water quality within Al-Anbar Governorate was assessed by Al-Kubaisi et al. (2023). The study collected 144 samples from the Euphrates River sector running through Al-Anbar (Figure 4-47).

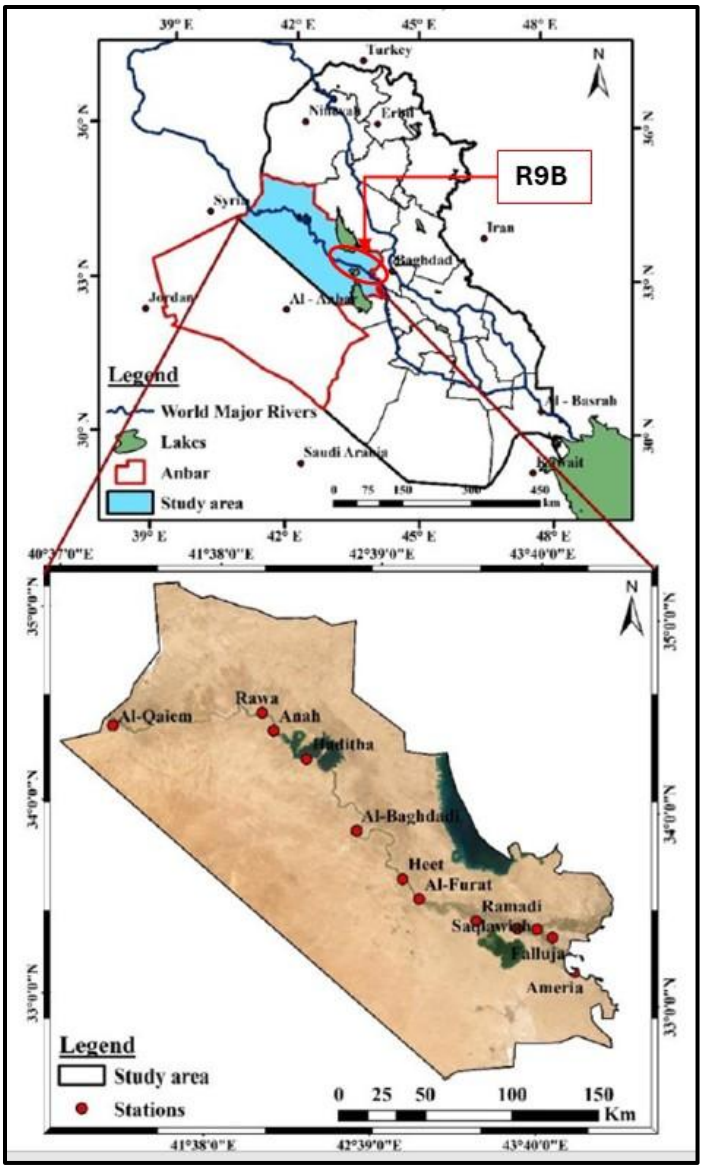


Figure 4-47: Samples Collected and Location of R9B (Modified after Al-Kubaisi et al., 2023)

The physico-chemical characteristics of the sampled water are presented as statistical minimum, maximum, and average values (Table 4-10). The study also presents the average ionic composition of Euphrates River water (Figure 4-48), reporting average cation contributions of Ca^{2+} (20%), Mg^{2+} (12%), Na^{+} (19%), and K^{+} (1%), and average anion contributions of Cl^{-} (15%), SO_4^{2-} (26%), and HCO_3^{-} (7%).

Table 4-10: Physico-chemical data for water samples taken from the Euphrates River during one water year (October 2021- October 2022). After Al-Kubaisi etal., 2023

Physico-chemical data	Min.	Max.	Average
T (°C)	20.75	24.92	23.61
pH	7.60	7.99	7.81
EC (µS/cm)	895.08	1268.58	1142.09

TDS (mg/l)	626.56	888.01	799.46
T.H (mg/l)	359.25	477.08	422.67
Turb. (NTU)	1.93	15.68	7.01
Alkalinity (as $CaCO_3$)	108.25	118.58	112.29
T.S.S	12.83	41.83	25.96
Ca^{2+}	78.25	116.08	99.47
Mg^{2+}	27.25	37.33	34.08
Na^{+}	82.33	116.17	106.22
K^{+}	3.79	6.28	5.42
Cl^{-}	107.92	138.00	129.53
$SO4^{2-}$	224.00	366.92	305.56
$HCO3^{-}$	80.83	108.33	103.13
$NO3^{-}$	4.29	5.14	4.63

The results indicate that calcium and sodium are the dominant cations across months and sampling stations, while sulfate is the dominant anion across months and stations within Al-Anbar Governorate. Overall, Al-Kubaisi et al. (2023) characterize Euphrates River water in this setting as clear to cloudy, low alkaline, fresh to highly mineralized (and locally excessively mineralized), very hard, and normal sulfate to oligo-sulfate water.

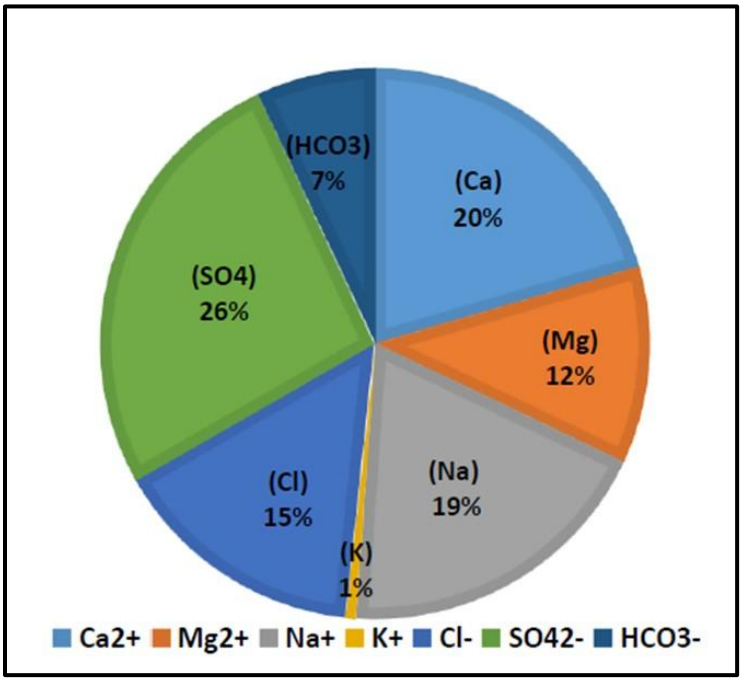


Figure 4-48: Pie chart illustrating the Euphrates River's average ionic composition (after Al-Kubaisi et al., 2023).

Overall, the Euphrates River water quality in this sector can be described as fresh to moderately mineralized and slightly alkaline, but it is very hard and shows moderate levels of suspended material at times. Accordingly, the baseline indicates moderate water quality with constraints, and suitability

for specific uses (particularly potable supply) would depend on treatment requirements and the applicable national standards.

Lakes Therthar and Habbaniyah water quality (R9B segment)

Sayel et al. (2026) assessed seasonal variability in surface water quality for lakes located in proximity to the R9B segment within Al-Anbar Governorate. The investigated lakes include Lake Tharthar and Lake Habbaniyah, which are located to the east of the corridor, while Lake Haditha is located farther to the west (Figure 4-49).

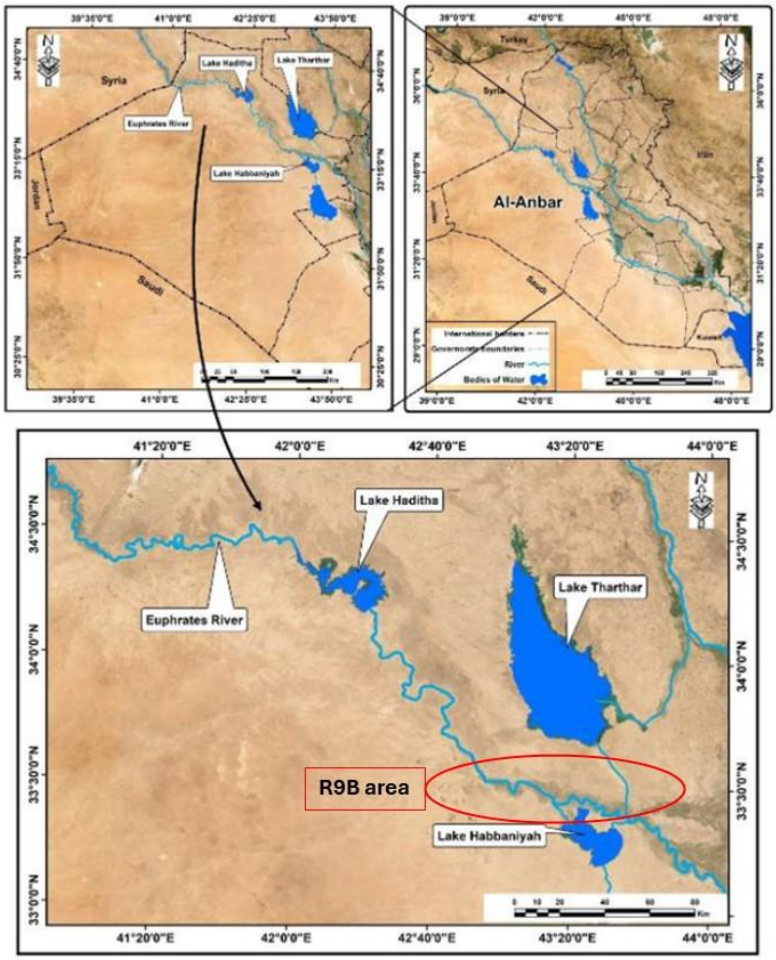


Figure 4-49: Study area map indicating the Euphrates River, Lake Habbaniyah, and Lake Tharthar in Al-Anbar Governorate (Source: Authors' own elaboration). (Modified after Sayel et al., 2026)

Lake Tharthar water quality

Lake Tharthar, the largest artificial reservoir in Iraq, plays an important role in regulating water transfers between the Tigris and Euphrates systems. Sayel et al. (2026) focus on the southern portion of the lake within Al-Anbar Governorate, which is characterized by controlled water exchange and moderate evaporative stress compared with Lake Habbaniyah. Seasonal water quality parameters are summarized in Table 4-11. Water temperature ranged from 17.8 °C (January) to 33.5 °C (July), indicating notable seasonal variability. Electrical conductivity reached 1.9 dS/m in summer, while total

dissolved solids remained relatively stable at 760–785 mg/L. Total hardness was high (annual average 644.4 mg/L), associated with elevated calcium and magnesium concentrations. Sodium and chloride were also elevated, with chloride peaking at 271 mg/L, which the study attributes to evaporative concentration and geochemical inputs from surrounding formations. Total suspended solids varied seasonally, which is interpreted as reflecting wind mixing and resuspension of bottom sediments. Overall, Sayel et al. (2026) characterize Lake Tharthar's water quality as intermediate, noting that elevated hardness and sodium may pose longer-term constraints for irrigation without careful management, which may include dilution with higher-quality water.

Table 4-11: Water quality parameters of Lake Tharthar (2024). (Modified after Sayel et al., 2026)

Parameter	Dec	Jan	Jul	Aug	Annual avg
Temperature (°C)	20.9	17.8	33.5	31.9	26.0
pH	7.8	7.6	8.1	8.0	7.875
EC (dS/m)	1.5	1.6	1.9	1.8	1.7
TSS (mg/L)	522	523	644	648	584.2
TH (mg/L)	610	640.3	665	662.4	644.4
TDS (mg/L)	760	776	785	783	776.0
Sodium (mg/L)	242	248	262	271	255.7
Potassium (mg/L)	8.8	9.0	10.2	12.0	10.0
Calcium (mg/L)	188.4	200.1	224.3	219	208.0
Chloride (mg/L)	127.6	141.0	149.1	144.2	140.5
Magnesium (mg/L)	40	45	48	46	44.8
Sulfates (mg/L)	510	519	484.2	460	493.3

Lake Habbaniyah water quality

Lake Habbaniyah is a shallow lake located southeast of Ramadi and serves as a secondary reservoir for excess Euphrates River water via the Warrar Canal. Due to its stagnant hydrology and broad surface area, the lake is susceptible to evaporative concentration of dissolved solutes during the dry season. Seasonal water quality parameters are summarized in Table 4-12. Water temperature ranged from 14.0 °C (December) to 37.6 °C (July), reflecting strong seasonal thermal variability. Electrical conductivity increased during summer, reaching 1.9 dS/m, while total dissolved solids exceeded 1,000 mg/L, peaking at 1,150 mg/L (August). Total hardness reached very high levels, particularly in July (783.8 mg/L), consistent with elevated calcium and magnesium concentrations. Total suspended solids remained high throughout the year, peaking at 977 mg/L, which indicates persistent turbidity and potential sediment resuspension under limited circulation conditions. Major ions show a similar seasonal pattern, with increases in sodium (up to 249 mg/L), chloride (up to 338.4 mg/L), and sulfate (up to 680 mg/L). Overall, Lake Habbaniyah exhibits elevated salinity, hardness, and turbidity, particularly during the summer months, and Sayel et al. (2026) conclude that its suitability for sustained agricultural use may be constrained without measures such as dilution or pretreatment, particularly for fine-textured or poorly drained soils.

Table 4-12: Water quality parameters of Lake Habbaniyah (2024). (Modified after Sayel et al., 2026)

Parameter	Dec	Jan	Jul	Aug	Annual avg
Temperature (°C)	14.0	17.8	37.6	31.7	25.3
pH	7.9	7.7	8.1	8.2	7.975
EC (dS/m)	1.5	1.3	1.9	1.8	1.625
TSS (mg/L)	818	843	960	977	899.5
TH (mg/L)	551.4	501.0	783.8	581.7	604.5
TDS (mg/L)	895	908	1058	1150	1003
Sodium (mg/L)	203	209	237	249	224.5
Potassium (mg/L)	7.1	7.2	9.3	10.5	8.525
Calcium (mg/L)	120.3	122.1	191.3	125.5	139.8
Chloride (mg/L)	224.5	216.2	338.4	290.8	267.475
Magnesium (mg/L)	56	64	80	60	65
Sulfates (mg/L)	490	500	510	680	545

4.2.8.2 KRI Sub-projects

Surface water resources within the KRI sub-project areas are dominated by seasonal runoff and ephemeral drainage features that convey stormwater during rainfall events and remain dry for most of the year. These drainage systems form part of the broader catchments draining toward the Tigris River basin.

Sulaymaniyah–Chamchamal–Kirkuk Road (KRI)

The Sulaymaniyah–Chamchamal–Kirkuk Road crosses three main seasonal streams that remain dry for most of the year but convey intermittent runoff during winter and spring rainfall. Two crossings are served by bridge structures, while the third is served by a three-culvert system. These structures function mainly during short periods of intense rainfall and remain dry throughout summer and early autumn. Outside these main crossings, the corridor is serviced by numerous small- to medium-diameter culverts that convey stormwater runoff from surrounding slopes and roadside catchments. No perennial water bodies are present within the right-of-way.

Girsheen–Suhaila Road Upgrade and Girsheen Interchange (KRI)

Based on available information and field observations, surface water resources within the Girsheen corridor consist primarily of seasonal runoff pathways that activate during rainfall events and remain dry for most of the year. The corridor is not located within a flood-prone area, and no significant flood risk has been identified along the alignment. Drainage structures have been designed to accommodate seasonal runoff and to maintain natural surface-water flow paths.

4.2.9 Natural Hazards

4.2.9.1 Temperature Extremes and Heatwaves

Extreme temperature refers to conditions in which temperatures exceed typical maximums or fall below typical minimums for a given period. These conditions are commonly discussed in terms of heat waves and cold waves. There is no single global definition of a heat wave; thresholds and metrics vary by region and climate context (Perkins-Kirkpatrick and Lewis, 2020). Iraq is characterized as

highly vulnerable to climate change in regional and global assessments (ESCWA, 2015; Osman-Elasha, 2010; Al-Dabbas et al., 2015; National Intelligence Estimate, 2021). Recent observations indicate the occurrence of severe extreme heat events; for example, maximum temperature in Basra reportedly reached 53.9 °C on June 22, 2016 (WMO, 2016).

Trend analyses report statistically significant warming across Iraq, with stronger increases during summer months than winter months and more pronounced warming in southern Iraq relative to central and northern areas (Muslih and Błażejczyk, 2017; Salman et al., 2017). Binder et al. (2022) present national-scale temperature projections under different emissions scenarios (Figure 4-50) and report that temperatures in Iraq are estimated to increase by 1.6–2.4 °C by 2030, 1.9–3.2 °C by 2050, and 1.8–4.8 °C by 2080 relative to pre-industrial levels (Binder et al., 2022).

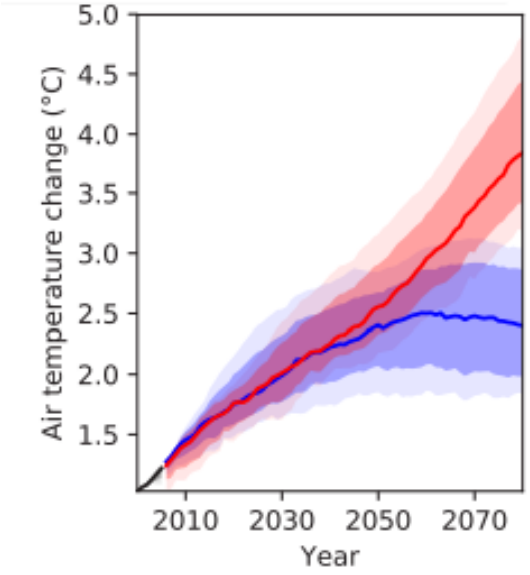


Figure 4-50: Air Temperature Projections For Iraq Under Different Greenhouse Gas Emissions Scenarios (Binder et al., 2022).

In addition to mean temperature change, Binder et al. (2022) present heat-extremes indicators, including projected changes in the annual number of very hot days (daily maximum temperature above 35 °C) (Figure 4-51). The projections indicate a substantial increase in the frequency of very hot days across Iraq by mid-century and late-century, with larger increases under higher-emissions scenarios, consistent with an intensification of extreme heat conditions.

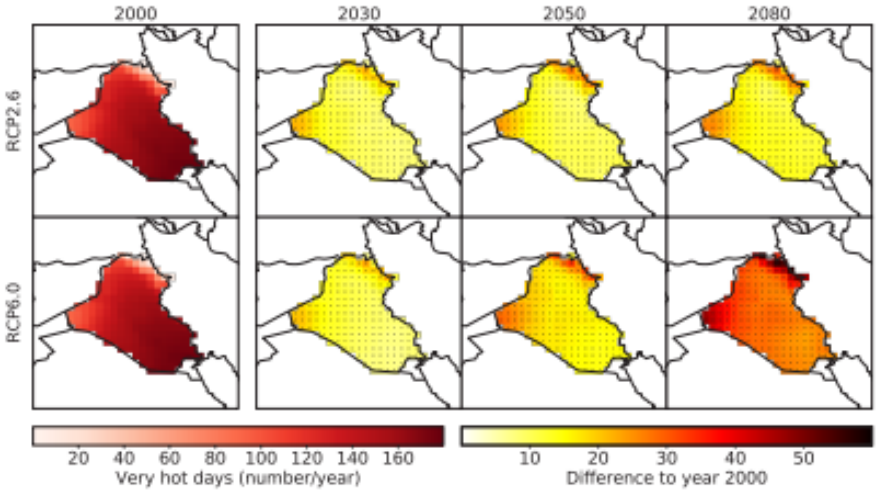


Figure 4-51: Projections Of The Annual Number Of Very Hot Days (Daily Maximum Temperature Above 35 °C) (Binder et al., 2022).

Binder et al. (2022) present national-scale projections for Iraq of (a) the share of the population exposed to heatwaves at least once per year and (b) heat-related mortality (deaths per 100,000 people per year) under different GHG emissions scenarios, assuming no adaptation (Figure 4-52 a–b). In Figure 4-52a, the central estimates indicate an increase in annual heatwave exposure from approximately 5% (around 2010) to 18–20% (around 2030), with scenario divergence by late century reaching approximately 24–26% under a lower-emissions pathway versus 43–46% under a higher-emissions pathway by 2070. In Figure 4-52b, the central estimates indicate heat-related mortality increasing from approximately 2 deaths/100,000/year (around 2010) to 3 deaths/100,000/year (around 2030), diverging to approximately 4 deaths/100,000/year (lower-emissions) versus 7 deaths/100,000/year (higher-emissions) by 2070.

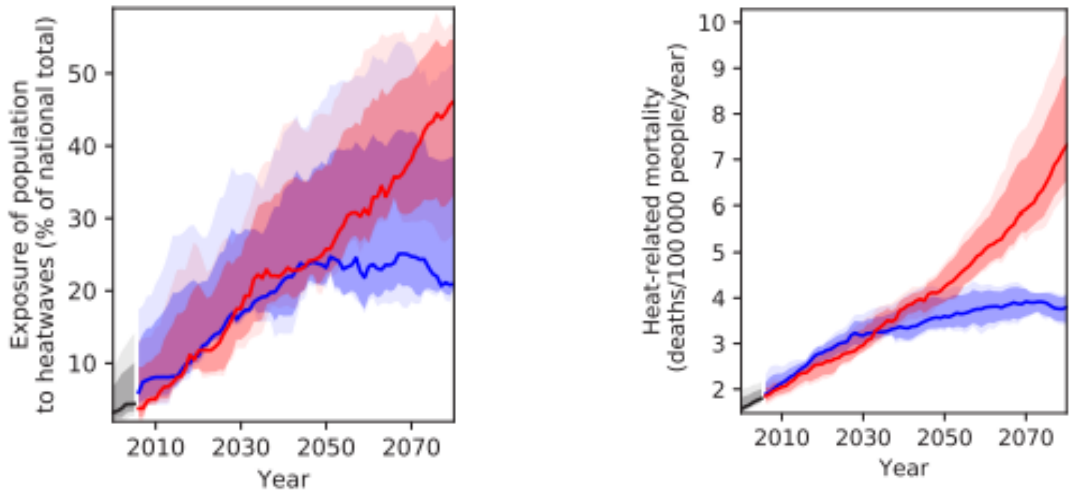


Figure 4-52: (a) Projections Of Population Exposure To Heatwaves At Least Once A Year For Iraq Under Different Greenhouse Gas Emissions Scenarios; and (b) Projections Of Heat-Related Mortality For Iraq Under Different Greenhouse Gas Emissions Scenarios Assuming No Adaptation To Increased Heat (Binder et al., 2022).

These indicators provide national-scale context for increasing heatwave exposure and heat-related health risks that are relevant to ITREC Project as a transport and construction environment. Increasing heat extremes are associated with adverse impacts on human health and reduced labor capacity during hot conditions, with potential implications for

4.2.9.2 Sand And Dust Storms

Sand and dust storms (SDS) are a recurrent meteorological hazard in Iraq and are widely identified as a dominant climate-related hazard affecting the country and the broader Middle East region. National and regional assessments link SDS occurrence to aridity, drought conditions, and land degradation processes that increase the susceptibility of exposed soils to wind erosion and dust emission. UNEP reporting notes that Iraqi government records included 122 dust storms and 283 dusty days in a single year, and indicates that Iraq could experience substantially higher dust-event frequency over the following decade.

Hamidi et al. (2014) classify SDS affecting Iraq into two principal event types with distinct seasonal peaks: Summer Shamal SDS (highest frequency in June–July) and frontal dust storms (highest frequency in March–April). Mapped trajectories and potential source regions for these storm types and their transport pathways across Iraq are presented in Figure 4-53.

Consistent with the above, a UNEP-supported climate risk assessment for Iraq (UNEP,2022) states that SDS have increased in frequency of occurrence and characterizes Iraq as a very high potential zone for dust storms (except the extreme northeast), linking SDS development to climatic changes (including decreased annual rainfall in western Iraq) and environmental changes such as marsh drying, land degradation, and desertification.

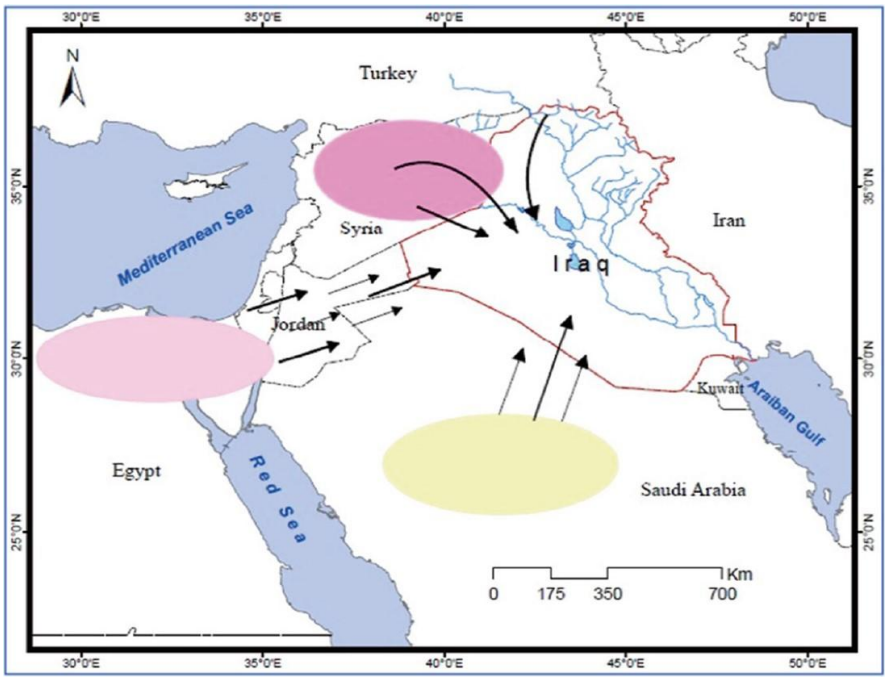


Figure 4-53: Trajectories And Potential Sources Of SDS In Iraq (Drawings Based On Hamidi et al., 2014; Cao et al., 2015; Modified After Muslih and Abbas, 2024).

4.2.9.3 Floods[6]

Flash floods are rapid-onset inundation events that can develop over short timeframes (minutes to hours) in response to localized, high-intensity rainfall (e.g., convective storms), particularly where surface drainage is limited and runoff concentrates in low-lying terrain. For baseline characterization of extreme rainfall conditions relevant to flash flooding, very heavy rainfall is defined as a cumulative total of ≥20 mm in 24 hours, consistent with the WMO extreme precipitation indicator (WMO, 2016) (after Klein et al., 2009), and this threshold is used to evaluate the frequency of extreme rainfall days at representative Iraqi climatic stations over 1997–2019 (Table 4-13).

Table 4-13: Frequency Of Very Heavy Rainfall Days In Iraq (≥20 mm/24 h), 1997–2019 (After Muslih and Abbas, 2024; WMO Indicator After WMO, 2016)

Class (mm/24 h)	Mosul	Baghdad	Rutba	Basra
20–40	48	19	11	23
40–60	11	3	2	1
60–80	4	1	0	0
>80	0	1	0	0
Total	63	24	13	25

Table 4-13 indicates that the 20–40 mm/24 h class is the most common extreme-rainfall category across all stations. The 40–60 mm/24 h class (extremely heavy rainfall days under the applied WMO indicator) occurs less frequently, and higher-intensity classes are rare. Rainfall >80 mm/24 h is reported as a single occurrence at Baghdad station (November 19, 2013; ~89.1 mm/24 h). Muslih and

[6] https://documents1.worldbank.org/curated/en/099091824082519913/pdf/P17116513c9c030919c1c13739ad9e56bc.pdf

Abbas (2024) describe this event as producing flash flooding and widespread damage in Baghdad, noting the intensity relative to typical seasonal rainfall totals and the sensitivity of urban areas with limited drainage capacity. The authors also report that most extremely heavy rainfall days (>40 mm/24 h) occurred during 2010–2019.

Across the four stations, the total number of ≥20 mm/24 h days over 1997–2019 shows substantial spatial variability, with Mosul recording the highest total (63 days), followed by Basra (25 days), Baghdad (24 days), and Rutba (13 days). In the ITREC context, this pattern is relevant because the KRI sub-project setting is more comparable to northern stations (e.g., Mosul) with higher frequencies of extreme rainfall days, whereas the Federal sub-project corridors (including the Baghdad area corridors and R9B in the western/central setting) are more comparable to the Baghdad–Rutba range, with lower overall frequencies than the north but still with occasional high-intensity events capable of producing localized flash flooding.

At the national scale, the World Bank flood hazard mapping presents 100-year return period modeled flood depth classes for both fluvial (riverine) flooding and pluvial (rainfall-driven) flooding (Figure 4-54) (World Bank, 2023). The mapping indicates that fluvial flood hazard is spatially concentrated along major river channels and connected low-lying floodplain areas, while pluvial flood hazard is more spatially diffuse, reflecting rainfall-runoff processes and localized drainage limitations.

For the Federal sub-project corridors, including Expressway No. 2 (Baghdad–Samarra) and R9B, the mapped fluvial flood hazard is generally limited to areas immediately adjacent to major watercourses, with the Federal corridor setting overall dominated by lower depth classes away from rivers. In contrast, localized higher-depth classes may occur near river crossings and floodplain zones. For pluvial flooding, the Federal corridor setting is mapped broadly within the lower depth classes over large areas, indicating that rainfall-driven ponding and short-duration inundation remain plausible, particularly where drainage infrastructure is constrained, where runoff concentrates at low points, or where culverts and channels are undersized or clogged.

For the KRI sub-project corridors (including the Sulaymaniyah–Chamchamal–Kirkuk Road and the Dohuk-area corridor), the mapping indicates a comparatively greater association with upland catchments and denser drainage networks, where fluvial hazard remains concentrated along channels/valleys and pluvial hazard is more evident across the northern setting than in parts of central/western Iraq. While the national-scale mapping continues to show predominantly lower depth classes over broad areas, the KRI setting is more sensitive to short-duration high-intensity rainfall and rapid runoff concentration, reinforcing the importance of drainage capacity, protection of natural flow paths, and maintaining culvert conveyance along the corridors.

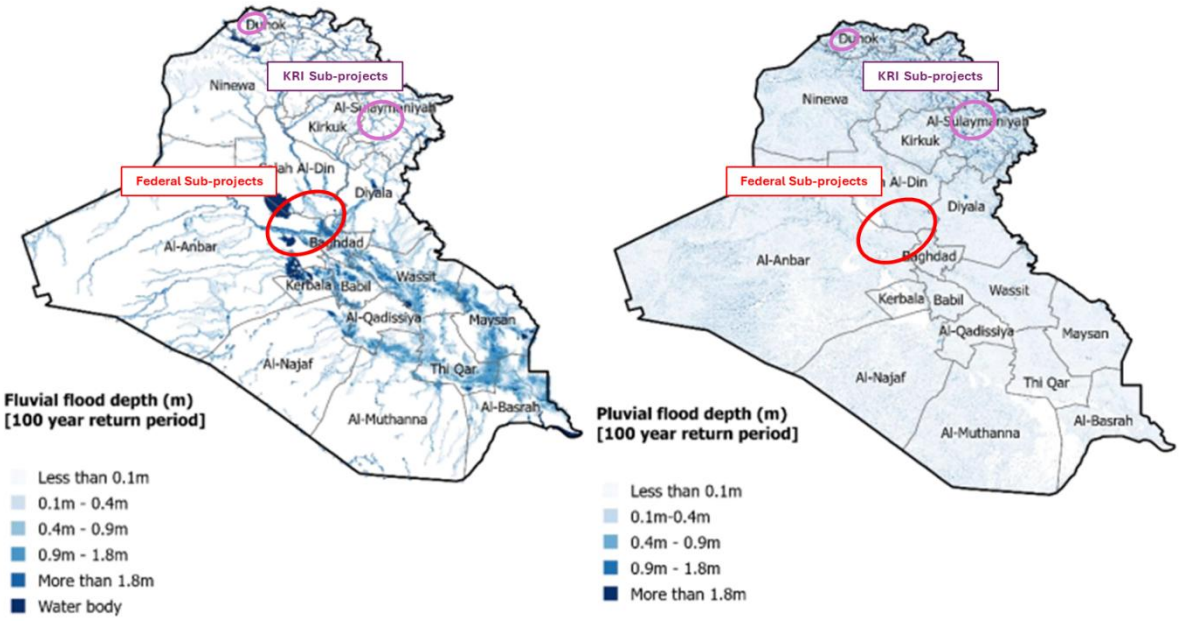


Figure 4-54: Iraq Fluvial Flood Hazard (Left) and Pluvial Flood Hazard (Right), 100-Year Return Period (Federal and KRI Sub-project Areas Highlighted) (World Bank, 2023).

4.2.9.4 Earthquakes

Based on the seismic isointensity (damage zoning) map presented by Said (2010), Iraq is divided into four seismic zones (Zones 1–4) defined by expected damage levels using Modified Mercalli (MM) intensity. In this classification, Zone 1 (blue/white in Figure 4-55) corresponds to MM ≤ III ("no damage" zone), while Zones 2–4 represent progressively higher expected damage (minor to major). The Federal sub-project corridors highlighted in Figure 4-55 (including the Baghdad–Samarra section of Expressway No. 2 and the R9B segment) fall predominantly within Zone 1, indicating a generally low baseline seismic-intensity setting relative to other parts of the country. In contrast, the KRI sub-project locations highlighted in Figure 4-55 are situated closer to mapped transitions into higher seismic zones (Zones 2–3), consistent with the broader northeast/eastern part of Iraq where expected damage levels increase.

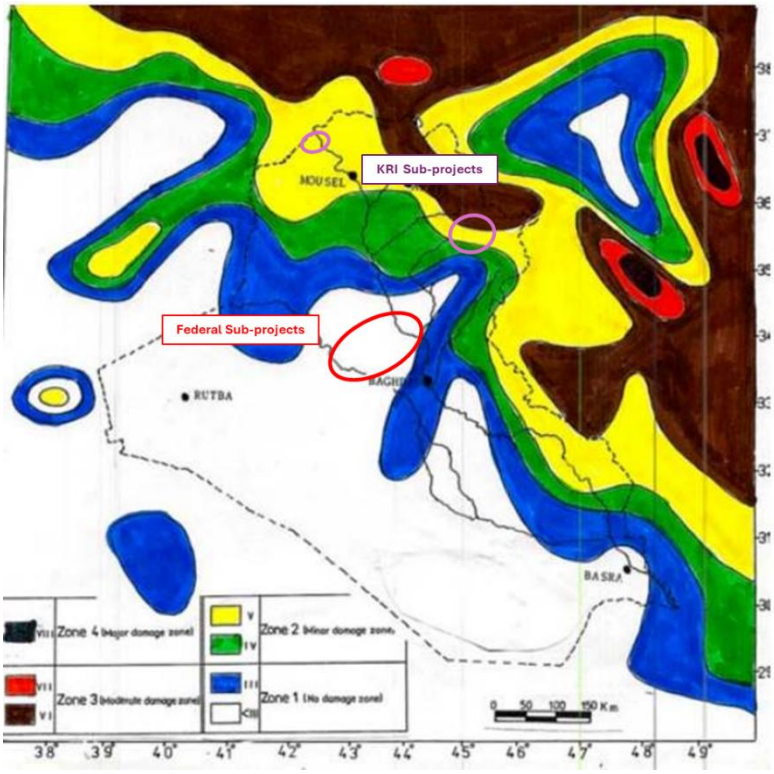


Figure 4-55: Seismic Zones in Iraq and location of ITREC Sub-projects

4.3 Biological Environment

4.3.1.1 Federal Sub-projects

4.3.1.1.1 Desktop Review

This chapter presents a rapid desktop biodiversity risk screening conducted for the planned development of the new Expressway No. 2 and the R9B segment of Expressway No. 1. The objective of this assessment is to identify potential biodiversity features of conservation concern, and any biodiversity red flags, to support early risk screening and alignment of the Project with the World Bank applicable biodiversity risk management requirements (ESS6).

4.3.1.1.1.1 Methodology

The review is based on a combination of:

- Data review, using publicly available information and relevant literature
- Consultation with the local team in charge of E&S topics
- Consultation with renowned Iraqi biodiversity expert Dr Omar Al-Sheikhly[7]

No consultations with authorities nor fieldwork were conducted for this assessment. However, a meeting was conducted with the Ministry of Environment on December 2nd.

[7] Dr Al Sheikhly co-edited the recent UNDP (2025), Participatory Ecosystem Assessment of Mesopotamian Marshlands of Southern Iraq (link)

4.3.1.1.1.2 Applicable Standard

This screening is conducted against World Bank's ESF on Biodiversity Conservation and Sustainable Management of Living Natural Resources (ESS6) and its Guidance Note[8] which requires projects to identify project's potential impacts on priority biodiversity features, such as Critical Habitats (CH), Natural Habitats (NH), protected areas (PA) and internationally recognized areas (IRA), and to manage them according to the mitigation hierarchy framework in close coordination with stakeholders.

4.3.1.1.1.3 Ecological Context

4.3.1.1.1.3.1 Biodiversity in Iraq

Iraq is renowned for its distinctive landscapes, from the western deserts to the rugged northern highlands, to the extensive plains and marshlands of the Tigris and Euphrates river basins. These diverse landscapes are home to a rich biodiversity, including nine of the most important ecological ecoregions in the Middle East, including 4,500 plant species, over 400 birds (many of which are wintering migrants), over 100 fishes, and numerous reptiles, mammals and amphibians, many of which are of conservation concern and (near) endemic.

Yet, the country's biodiversity is increasingly under threat due to illegal or unsustainable fishing and hunting practices, conversion of ecosystems such as wetland drainage for agriculture, pollution from municipal and industrial sources (including oil spills), impacts of agricultural chemicals, overgrazing, poor management of water resources, salinization, but also infrastructure development, such as road construction, leading to an increasing degradation of the Mesopotamian marshlands. Lack of environmental awareness is also a key challenge to sustainable management and conservation of natural resources.

4.3.1.1.1.3.2 Central Iraq Riverine and Wetland Systems

The Expressway No. 2 and R9B corridors are located in Central Iraq, within a landscape influenced by the Tigris–Euphrates river system and associated riverine and wetland features (e.g., riparian corridors, seasonal depressions, irrigated canals/drainage networks, and localized reedbeds and wet areas). These habitats can provide suitable conditions for biodiversity, including migratory and wintering waterbirds and other wetland-associated fauna, particularly where hydrological connectivity and aquatic vegetation are present.

From a biodiversity risk-screening perspective, the key sensitivities in Central Iraq are typically associated with: (i) wetland and riparian habitats (including reedbeds where present), (ii) open steppe/agricultural mosaics used by migratory and resident birds, and (iii) aquatic habitats that may support species of conservation concern. Examples of bird species of conservation concern that may be relevant at a national scale and could occur within suitable habitats in Central Iraq (subject to field verification) include Sociable Lapwing, Asian Houbara, Saker Falcon, and Egyptian Vulture, among others. The likelihood of occurrence and the sensitivity of receptors is expected to vary spatially along the corridors depending on proximity to wetlands, watercourses, and irrigated/agricultural areas.

The broader river system has also been influenced by long-term anthropogenic modification, including hydrological regulation and infrastructure. Examples include barrages/regulators (Samarra, Ramadi,

[8] https://documents1.worldbank.org/curated/en/924371530217086973/ESF-Guidance-Note-6-Biodiversity-Conservation-English.pdf

Fallujah) and upstream dams that influence basin hydrology, in addition to irrigation withdrawals and water quality pressures. These factors should be considered when interpreting baseline sensitivity and defining mitigation measures, particularly where works may interact with drainage paths, wetlands, or riverine features.

4.3.1.1.1.3.3 National Policies and Strategies

A comprehensive national-level reference that supports biodiversity prioritization in Iraq is the Key Biodiversity Areas of Iraq assessment published in 2017 by Nature Iraq, with support from the Iraqi Ministry of Health and Environment (IMoHE). This multi-year assessment identified 39 non-avian Key Biodiversity Areas (KBAs), 67 Important Bird and Biodiversity Areas (IBAs), and 73 Important Plant Areas (IPAs) across the country, and calls for stronger national environmental policies and strategic actions to protect Iraq's biodiversity.

Iraq's national policy framework has also evolved through the National Environmental Strategy and Action Plan (NESAP), including the most recent NESAP cycle, which sets strategic objectives and actions relevant to biodiversity conservation and sustainable use. In parallel, Iraq has advanced work under the Convention on Biological Diversity (CBD), including identification of candidate protected areas to support development of a national protected area network. Notwithstanding these steps, continued strengthening of biodiversity planning, coordination, and implementation remains relevant at the national level.

For the purposes of this desktop screening, national-level prioritization outputs (including KBAs/IBAs/IPAs) are used to inform early identification of potential biodiversity sensitivities and "red flags" relevant to the Expressway No. 2 and R9B corridors. These desktop findings require verification through stakeholder consultation and targeted field assessment along the project alignments, particularly in proximity to wetland and riverine features.

4.3.1.1.1.4 Risk of Projects' Interference with PA/IRA

Expressway No. 2 (Baghdad – Samarra)

Expressway No. 2 does not overlap with any legally recognized protected area or internationally recognized area. However, the northern end of the Baghdad–Samarra section is located south of the Samarra Wetlands (KBA IQ052 / IBA008) as shown in Figure 4-57, a wetland system associated with the Tigris River regulation (Figure 4-56) infrastructure and characterized by reed beds and submerged aquatic vegetation . Samarra Wetland is an environmentally rich wetland attracting a significant number of migratory waterfowl and raptors, created by a dam built in 1955 to regulate water flow to Tharthar Lake through a canal. Based on the current screening-level review, no direct overlap is expected; nevertheless, field verification is required to confirm the separation distance to the KBA boundary and to confirm whether any indirect pathways (e.g., drainage connectivity, changes in surface runoff, dust dispersion, noise disturbance, lighting, and induced access) could affect wetland receptors.

Figure 4-56: Samarra Wetlands KBA

Other protected areas and KBA are located at higher distances, and no interference is expected from the Expressway No. 2 project (Tharthar Lake & Dhebaeji Field Nature Reserve and KBA c.45 km west, Attariya plains KBA c.30 km east, Baquba wetlands KBA c. 40 km east. No Ramsar Sites are located near Expressway No. 2 - the closest one is Sawa Lake located c. 200 km to the south-east.

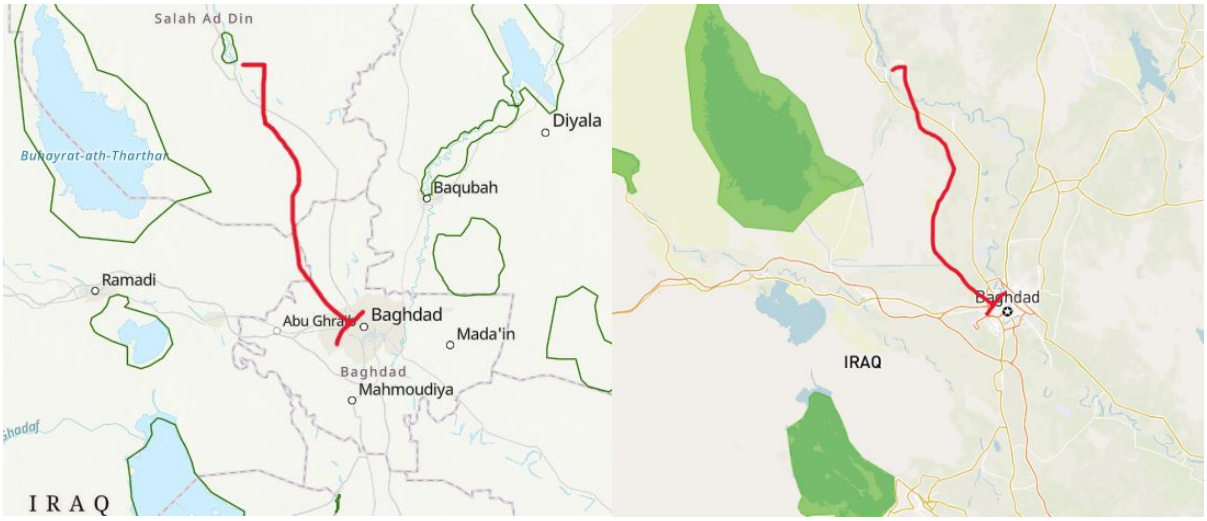


Figure 4-57: Presence of KBAs (left map) and protected areas (right map) against Expressway n°2 (in red). Note that the route of Expressway No..2 has been hand-drawn and therefore is not accurate.

R9B Segment under Expressway No. 1

The R9B rehabilitation project is not expected to overlap with any legally recognized protected areas or internationally recognized areas (PA/IRA), based on the currently available corridor information.

As shown in Figure 4-58 , Lake Habbaniyah KBA is located approximately 10 km south of the R9B corridor. Lake Habbaniyah is a human-made storage reservoir used for flood control on the Euphrates, with annual water-level fluctuations of approximately 6 m. Available sources indicate that the site may no longer meet global KBA criteria, and that recent water management patterns have contributed to increased salinity and stagnation in parts of the lake, with localized reductions in water quality.

Other biodiversity-designated areas in the wider region include Tharthar Lake & Dhebaeji Field Nature Reserve and KBA, located approximately 20 km north of the R9B corridor, and the Razzaza Lake Nature Reserve and KBA, located approximately 70 km south of the corridor.

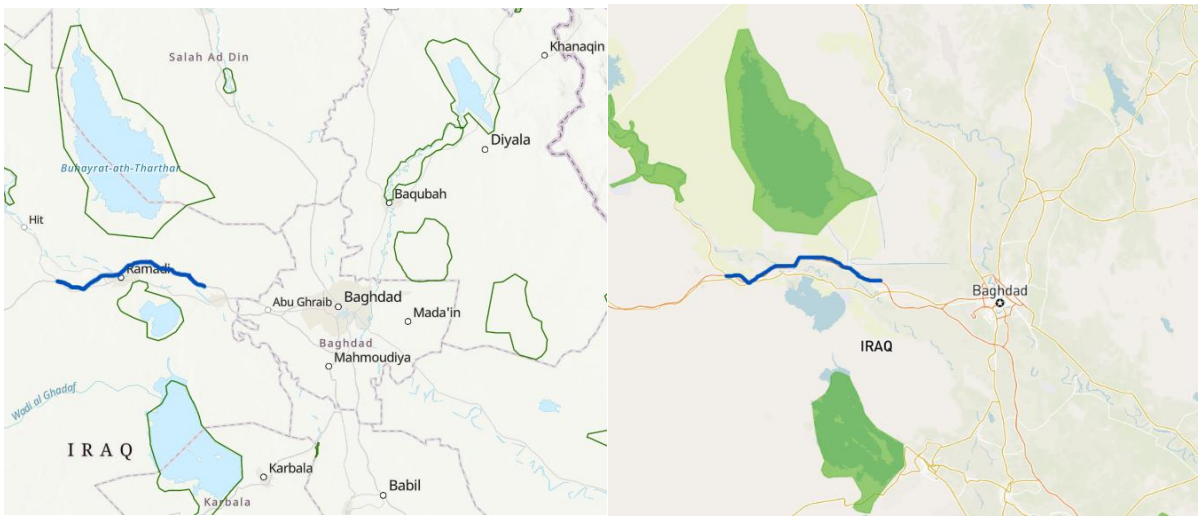


Figure 4-58: Presence of KBAs (left map) and protected areas (right map) against R9B rehabilitation project (in blue). Note that the route of R9B has been hand-drawn and therefore is not accurate.

4.3.1.1.1.5 Risk of Presence of Critical Habitats

The identification of potential Critical Habitat the Sub-projects requires a dedicated Critical Habitat Assessment (CHA) supported by project-specific field surveys within the project's area of influence and engagement of relevant experts and stakeholders. This is particularly important in central Iraq where species occurrence, distribution, and seasonal use of habitats can vary materially between years and seasons.

Based on available desktop information, the biodiversity features most likely to trigger Critical Habitat considerations, if present in sufficient numbers and/or in locations meeting the World Bank thresholds, include the following priority taxa and habitats.

- Some of the **bird species**, especially wintering migrants, found in the wetland areas mentioned above if found in sufficient numbers to meet CH thresholds for Criteria 1, 2 or 3, such as **water birds** (e.g., Common Pochard *Aythya ferina*, VU[9] ; Marbled Teal *Marmaronetta*

[9] https://www.iucnredlist.org/species/22680358/205288455

angustirostris, NT[10] ; Ferruginous Duck *Aythya nyroca*, NT[11] ; or the Iraqi subspecies of the Little Grebe *Tachybaptus ruficollis iraquensis*[12]), **raptors** (e.g., Saker Falcon *Falco cherrug*, EN[13] ; Egyptian Vulture *Neophron percnopterus*, EN[14] and highly threatened by poaching[15], Asian Houbara *Chlamydotis macqueenii*, VU[16] ; Eastern Imperial Eagle *Aquila heliaca*, VU[17] ; Pallid Harrier *Circus macrourus*, NT[18]) or **other birds** (e.g., Basra Reed Warbler *Acrocephalus griseldis*, EN[19], Black-tailed Godwit *Limosa limosa*, NT[20] or the endemic Mesopotamian subspecies of the Hooded Crow *Corvus cornix capellanus*[21]).

- **Mammals** like the endemic Mesopotamian Gerbil (*Gerbillus mesopotamiae*, LC[22]).
- **Reptiles** like the Endangered (EN) Euphrates Softshell Turtle (*Rafetus euphraticus*[23]) or the endemic and Vulnerable (VU) Egyptian Spiny-tailed Lizard *Uromastyx aegyptia*[24]
- **Fish** occurring in the river and lakes of central Iraq, in particular endemic and threatened cyprinid species (e.g., *Mesopotamichthys sharpeyi* or 'Binni', VU[25] ; *Arabibarbus grypus* or 'Shabout', VU[26]).

4.3.1.1.1.6 Risk of impacts on potential Critical Habitats and on other species of concern

Shall any of the above-mentioned species be recorded onsite, the risk of impacts would need to be assessed considering the nature of the projects:

- Water-dependent species (water birds, fishes, freshwater turtles, otters): the risk of generating significant impact depends on whether the projects interfere with the water bodies (rivers, lakes, wetlands), especially at the junctions between the roads and the rivers (Euphrates for R9B and Tigris for Expressway No.2). This risk is considered possible for both R9B and Expressway No. 2 projects.
- Raptors and other birds: the risk of generating significant impact depends on whether the projects will destroy suitable breeding and foraging grounds for these species especially during construction works (to be assessed with relevant ornithologists). This risk is considered unlikely for R9B (given the road already exists) and possible for Expressway No. 2 (given it is a new development).

[10] https://www.iucnredlist.org/species/22680339/205917761
[11] https://www.iucnredlist.org/species/22680373/152620862
[12] https://avibase.bsc-eoc.org/species.jsp?avibaseid=82135992B9081113
[13] https://www.iucnredlist.org/species/22696495/204182473
[14] https://www.iucnredlist.org/species/22695180/205187871
[15] http://www.natureiraq.org/news/egyptian-vulture-conservation-project-in-iraq#/
[16] https://www.iucnredlist.org/species/22733562/205364424
[17] https://www.iucnredlist.org/species/22696048/203686356
[18] https://www.iucnredlist.org/species/22695396/201209093
[19] https://www.iucnredlist.org/species/22714757/216850934
[20] https://www.iucnredlist.org/species/22693150/154733209
[21] https://www.aviandiscovery.com/bird-identification/mesopotamian-crow-corvus-cornix-capellanus/
[22] https://www.iucnredlist.org/species/9135/115091132
[23] https://www.iucnredlist.org/species/19070/1956551
[24] https://www.iucnredlist.org/species/164729/115304711
[25] https://www.iucnredlist.org/species/19383657/19849450
[26] https://www.iucnredlist.org/species/19171241/134236379

- Terrestrial mammals: the risk of generating significant impacts on mammals is associated with collisions with vehicles and with habitat fragmentation impeding free movement of wildlife and livestock. This risk is considered possible for both R9B and Expressway No. 2 projects.

4.3.1.1.2 Rapid Field Survey Assessment

4.3.1.1.2.1 Introduction

The rapid field survey was undertaken to collect up-to-date information on the current biodiversity conditions within the Project right-of-way (RoW) in the Ishaqi area of central Iraq. This rapid field survey was conducted specifically for Expressway No. 2 (Baghdad–Samarra) because it is a greenfield section and is therefore expected to present the highest potential for biodiversity impacts relative to the other ITREC sub-projects. Accordingly, the survey was not undertaken for the R9B segment or the KRI sub-projects, where works are primarily rehabilitation/upgrade in nature and where baseline characterization relies on desktop review and available secondary information.

Although rapid in nature, the survey provides an improved understanding of the current status of key native flora and fauna of ecological value in a context where site-specific biodiversity information remains limited. The findings of this rapid survey will be incorporated into, and used to complement, the results presented in the Draft ESIA, which characterizes the broader baseline context through desktop review and available literature sources. In particular, the field observations support validation of the biodiversity receptors and screening conclusions identified through the Draft ESIA baseline work and help confirm which ecological values remain relevant under current conditions within the Ishaqi area.

Together, the desktop review and the Expressway No. 2 rapid field survey provide a consolidated baseline that: (i) identifies and analyzes information gaps in the biodiversity profile of the area; (ii) strengthens the evidence base for screening and scoping of any further biodiversity surveys that may be required; and (iii) informs practical recommendations to the Government of Iraq on biodiversity management measures where Project activities may affect native biodiversity and where additional conservation actions may be warranted.

4.3.1.1.2.2 Survey Objectives

The objective of the biodiversity field assessment is to: (i) conduct a preliminary, rapid in-situ survey to provide a snapshot of current biodiversity conditions in the Ishaqi area, with limited ad hoc extension to the nearest eastern surrounding outstretches (northwestern Balad District); and (ii) verify desktop biodiversity screening findings, characterize terrestrial, riparian, and aquatic habitats at ecologically important areas/localities crossed by the Expressway No. 2 corridor, and determine whether additional biodiversity assessment and/or management measures are required in accordance with World Bank ESS6.The survey is intended to:

- confirm habitat condition and species presence/likelihood;
- inform the Draft ESIA biodiversity impact assessment; and
- inform the development of proportionate, site-specific mitigation measures under the ESMP and/or a BMP.

4.3.1.1.2.3 Scope of the Survey

A rapid ground-truthing survey was undertaken to verify key biodiversity features along a defined portion of Expressway No. 2 in the Ishaqi area (hereafter, the *survey site*). The survey covered approximately 8.42 km of the northern section of the corridor, extending from the Start Survey Point (34°00'38.86"N, 44°02'15.73"E) to the End Survey Point (34°04'59.76"N, 44°00'38.29"E). The rapid field survey focused on the following environmentally sensitive areas (see also Figure 4-59):

Tigris River crossing, including:

- the active river channel
- riparian vegetation zones on both banks
- adjacent floodplain habitats located within and immediately outside the utility right-of-way (ROW)

Ishaqi area (also referred to as Al-Ishaqi):

- agricultural–semi-natural habitat interfaces
- irrigation and drainage canals connected to the Tigris system
- remaining semi-natural terrestrial habitats and potential movement corridors

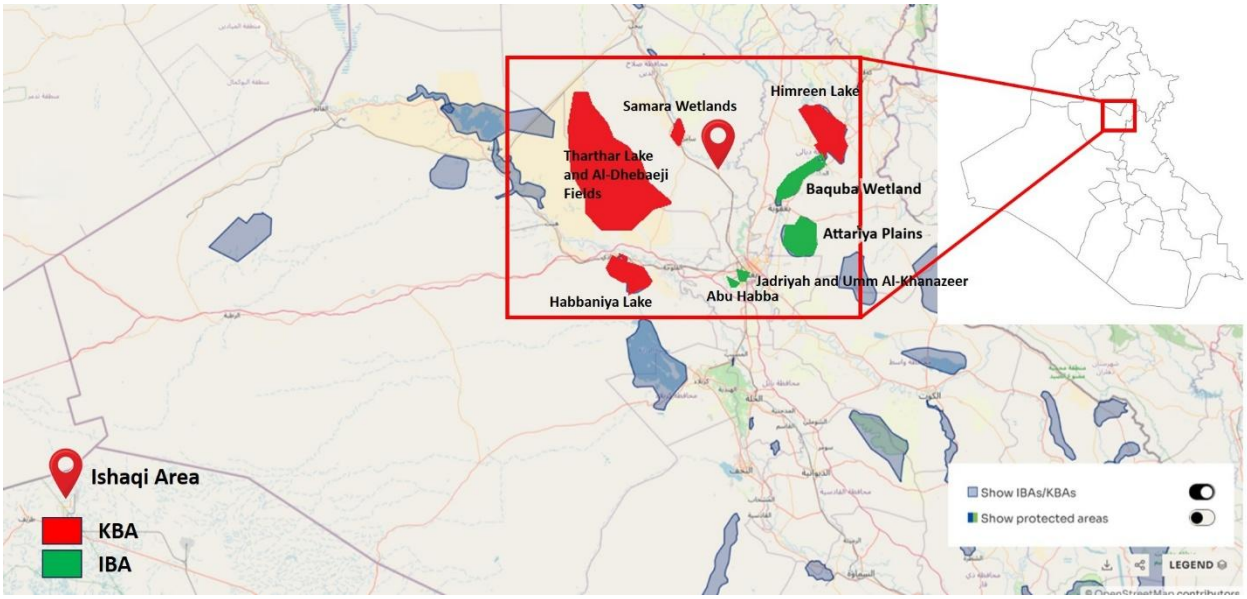


Figure 4-59: The survey area (Ishaqi) surrounded by sites of global conservation concern including Important Bird Areas and Key Biodiversity Areas. Source: Birdlife Internation-Data Zone-Iraq Factsheet

4.3.1.1.2.4 Literature Review

Biodiversity in central Iraq is diverse; however, the current status and distribution of many flora and fauna species remain poorly understood due to limited field surveys and long-standing access constraints in parts of the region following the post-2014 ISIL conflict.

The Ishaqi area (approx. 34°02'N, 44°02'E) is located on the western bank of the Tigris River, approximately 100 km north of Baghdad. The area is bordered to the north by Samarra District (approx. 34°11'44.70"N, 43°53'51.35"E), and lies approximately 10 km from Balad District to the southeast (approx. 34°00'39.19"N, 44°08'43.26"E). To the west, it extends toward the Tharthar plains and Tharthar Lake within Saladin Governorate. Ishaqi is located east of the major highway linking Baghdad–Tikrit–Mosul and covers an area of approximately 410 km² (about 41,000 hectares).

The central Iraq landscape is ecologically significant for both native and migratory fauna. Its geomorphology—dominated by desert and semi-desert habitats interspersed with wetlands and arid plains—supports biodiversity of regional and international importance. The terrestrial ecoregions of the Middle Eastern Steppes, Mesopotamian Shrub Desert, and the East Sahero-Arabian Xeric Scrublands (Arabian Desert), together with a substantial portion of the Lower Tigris–Euphrates River Basin freshwater ecoregion, largely shape the geographic context of central Iraq (Olson et al., 2001). The Lower Tigris–Euphrates basin in central Iraq supports multiple faunal groups, particularly avifauna, including species of global conservation concern. The region also provides suitable stopover and/or congregation sites for migratory birds, as indicated by ornithological counts and records (Al-Dabbagh, 1998; Sheikhly, 2021).

The Ishaqi area lies within the Mesopotamian Shrub Desert (PA1320) ecoregion, which forms a transitional landscape between the deserts of southern and southwestern Iraq and the steppes of the north, including the Syrian Desert (Nature Iraq, 2017). This ecoregion provides important habitat for passage migrants, wintering birds, and resident bird species, with large wetlands embedded within an otherwise arid setting, including systems associated with Tharthar Lake and Samarra-area lakes (Nature Iraq, 2017).

Nature Iraq (2017) prioritized 10 Key Biodiversity Areas (KBAs) in central Iraq, consisting largely of major waterbodies (lakes, reservoirs, and riverine systems and their tributaries). Five freshwater lakes and dams—Qadissiya, Tharthar, Himreen, Habbaniyah, and Razazah—were identified as key sites for migratory, wintering, and breeding bird populations (Nature Iraq, 2017). Within this broader setting, the Ishaqi area is located within a wider landscape that includes multiple sites recognized for biodiversity and bird conservation importance, including several Important Bird Areas (IBAs) and KBAs distributed across surrounding governorates (Evans, 1991; Fazaa et al., 2022; Jasim et al., 2025) (Table 4-14).

Table 4-14: Conservation-relevant sites in the wider Ishaqi, including nearby IBAs and KBAs.

Location	IBAs (proximity to the site)	KBAs (proximity to the site)
Ishaqi area	Attariya Plains (IBA013) – Diyala (**140 km**)	Samarra Wetlands (KBA IQ052) – Saladin (**19 km**)
	Baquba Wetland (IBA011) – Diyala (**65 km**)	Himreen Lake (KBA IQ053) – Diyala (**87 km**)
	Jadriyah and Umm Al-Khanazeer (IBA015) – Baghdad (**90 km**)	Tharthar Lake and Al-Dhebaeji Fields (KBA IQ051) – Anbar/Saladin (**55 km**)

	Abu Habba (IBA014) – Baghdad (**97 km**)	Habbaniyah Lake (IQ056) – Anbar (**90 km**)

1. Fauna

a) Avifauna

Central Iraq is considered an important landscape for migratory bird species, particularly those migrating from the Siberian platform and wintering in Iraq and the Arabian Peninsula along the West Asia–East Africa and Central Asia flyways (Al-Sheikhly, 2022). The region's geomorphology—including large wetlands situated along migration routes—provides foraging, stopover, and staging habitats supported by high prey availability. As a result, central Iraq regularly supports large seasonal concentrations of migratory birds.

Within this wider context, the Ishaqi area and its surrounding habitats may also support a diverse avifauna, including waterfowl and raptors that pass through or temporarily refuel in the area. Previous ecological surveys for the immediate Ishaqi landscape remain limited; however, the importance of nearby wetland systems is well documented through historical counts and published records. For example, 37 individuals of the Lesser White-fronted Goose (Anser erythropus, Vulnerable) were reported at Himreen Lake in 2011. Records from Tharthar Lake (between the Tigris and Euphrates basins) documented approximately 4,000 waterfowl in December 1972, including around 900 ducks (seven species), more than 2,000 Eurasian Coot (Fulica atra), and 23 Common Crane (Grus grus) (Koning and Dijksen, 1973). Further large waterfowl numbers were recorded at Tharthar Lake during 1988–1989, including up to 10,000 Mallard (Anas platyrhynchos), 10,000 Common Pochard (Aythya ferina, Vulnerable), and 10,000 Eurasian Coot.

Samarra Lake on the Tigris River also supported substantial wintering waterfowl counts, with over 20,000 wintering waterfowl recorded, including up to 200 Gadwall (Mareca strepera), 5,000 Mallard, 1,300 Northern Pintail (Anas acuta), 300 Northern Shoveler (Spatula clypeata), 10,000 Common Pochard, 250 Tufted Duck (Aythya fuligula), and 15,000 Eurasian Coot. Baquba Wetlands in the Tigris River valley were historically considered an important wintering area for dabbling ducks, with congregations of 24,000 ducks (10 species) and more than 39,000 waterfowl recorded in January 1967 and January 1968, respectively. High counts included 570 White Stork (Ciconia ciconia), 255 Glossy Ibis (Plegadis falcinellus), 5,000 Mallard, 14,000 Eurasian Teal (Anas crecca), 6,000 Gadwall, 5,000 Eurasian Wigeon (Mareca penelope), 5,000 Northern Pintail, 8,650 Northern Shoveler, 1,500 Common Pochard, and 11,000 Eurasian Coot. Notably, about 180 Marbled Teal (Marmaronetta angustirostris, Near Threatened) were recorded wintering in Baquba Wetlands in January 1968, representing one of the few winter records for this threatened species in Iraq (Al-Sheikhly, 2022).

Central Iraq also functions as a notable migration corridor for birds of prey, particularly raptors. The Greater Spotted Eagle (Clanga clanga, Vulnerable) and Steppe Eagle (Aquila nipalensis, Endangered) were among the wintering raptors reported from Baquba Wetlands and may also pass through the Ishaqi area en route to wintering grounds associated with major lakes such as Tharthar and Habbaniyah (Al-Sheikhly, 2012; Al-Sheikhly et al., 2017). However, Baquba Wetlands had reportedly lost much of their importance for waterfowl by 1972, with only 4,850 waterfowl (18 species) recorded in December 1972.

Other raptors of conservation concern have been reported from central Iraq. The Egyptian Vulture (Neophron percnopterus, Endangered) was recorded from Himreen on the western banks of the Tigris River in 2011 and may breed in the area, although breeding has not been confirmed (Al-Sheikhly, 2012). The Steppe Eagle was reported as frequent in the arid plains on the eastern edge of Tharthar Lake. The Greater Spotted Eagle and Eastern Imperial Eagle (Aquila heliaca, Vulnerable) were recorded from Jabal Himreen and Tharthar Lake. Endangered Saker Falcon populations have also been reported from semi-desert areas on the eastern bank of the Tigris River, including records from areas near eastern Samarra Lake where falconry activity has been documented. The Red-footed Falcon (Falco vespertinus, Vulnerable) was recorded for the first time in central Iraq (Al-Sheikhly, 2012; Nature Iraq, 2017).

Wetland survey coverage in central Iraq has historically been uneven. Baghdad and Attariya plains east of the Tigris River were the only sites surveyed in 1979, where large congregations were recorded including 412 Ruddy Shelduck (Tadorna ferruginea), 6,000 Eurasian Teal, 2,100 Eurasian Coot, and 2,500 Black-tailed Godwit (Limosa limosa). Lake Habbaniyah and the Ramadi Marshes on the south bank of the Euphrates River were formerly highly important staging and wintering areas, with records including 200 Eurasian Spoonbill (Platalea leucorodia) in winter, and additional records of Black-necked Grebe (Podiceps nigricollis), Greater Flamingo (Phoenicopterus roseus), and mixed duck flocks (Marchant and Macnab, 1963; Georg and Vielliard, 1970; Georg and Savage, 1970; Koning and Dijksen, 1973; Atkinson-Willes, 1976; Al-Dabbagh, 1998; Ctyroky, 1987; Scott and Carp, 1982; Scott, 1993).

The Sociable Lapwing (Vanellus gregarius, Critically Endangered) is known from several localities in Iraq. It was formerly considered a common passage migrant and winter visitor, but is now regarded as rare, reflecting global declines linked to illegal persecution and habitat degradation (Allouse, 1961; Salim et al., 2012; Donald et al., 2021). The open plains, steppes, and cultivated fields along the Lower Tigris and Euphrates basin—landscapes also characteristic of the Ishaqi area—are designated as key habitats for this species.

The Asian (MacQueen's) Houbara (Chlamydotis macqueenii, Vulnerable) historically bred in desert and semi-desert areas near Tharthar Lake in the 1980s and has been recorded at Himreen foothills, although no recent breeding records are available.

Freshwater lakes and river islets along the Tigris and Euphrates also support wintering and migrating waterbirds, including gull assemblages. Records include Common Black-headed Gull (Larus ridibundus) and Caspian Gull (Larus cachinnans) at Tharthar Lake, additional Black-headed Gull flocks at Baghdad and Attariya plains, Slender-billed Gull (Chroicocephalus genei) at Lake Habbaniyah, and more recent observations of Armenian Gull (Larus armenicus) and juvenile Caspian gulls near Baghdad (Ticehurst et al., 1921, 1926; Moore and Boswell, 1956–1957; Johnson, 1958; Allouse, 1961; Marchant and Macnab, 1963; Scott, 1993; Al-Dabbagh, 1998; Al-Sheikhly and Al-Barazangy, 2015; Nature Iraq, 2017).

The Ishaqi survey landscape is broadly consistent with the Tigris riparian system extending across central Iraq and the Middle Euphrates region. It is characterized by dense reed beds, reedmace and sedges, and mixed riparian/terrestrial vegetation including tamarisk thickets, poplar, and eucalyptus along riverbanks. North and west of the survey site, habitats transition to arid steppe with scattered xerophytic vegetation and localized cultivation (e.g., wheat, corn, and date palm orchards). Such

habitat mosaics can support restricted-range and biome-restricted species including Iraq Babbler (Turdoides altirostris), White-eared Bulbul (Pycnonotus leucotis), Dead Sea Sparrow (Passer moabiticus), and Hypocolius (Hypocolius ampelinus). In comparable landscapes (e.g., Jadriyah and Umm Al-Khanazeer), surveys recorded 144 bird species.

b) Wild Mammal Fauna

Information on wild mammals in central Iraq remains limited, particularly after 2014 when access constraints associated with ISIL conflict restricted field research. Consequently, the current status of many mammal species in central Iraq, including the Ishaqi area, remains insufficiently documented. Nevertheless, the central Iraq landscape provides foraging habitat, breeding areas, and shelter for a range of mammal species.

The Long-eared Hedgehog (*Hemiechinus auritus*) occurs in alluvial plains, grasslands, steppe, and desert habitats. Al-Sheikhly et al. (2015) reported 20 bat species (Chiroptera) from Iraq; in central Iraq settings, recorded bat species include Mehely's Horseshoe Bat (*Rhinolophus mehelyi*, Vulnerable), Botta's Serotine (*Eptesicus bottae*), Kuhl's Pipistrelle (*Pipistrellus kuhlii*), and Sind Serotine Bat (*Eptesicus nasutus*) in habitats comparable to those around the survey area. Rodent records include the Norway Rat (*Rattus norvegicus*) near settlements and Lesser Jerboa (*Jaculus jaculus*) in arid plains. The Indian Crested Porcupine (*Hystrix indica*) is described as common in riparian and cultivated landscapes and is reportedly hunted for consumption. Other rodents reported include Sundevall's Jird (*Meriones crassus*) and Libyan Jird (*Meriones libycus*). The Cape Hare (*Lepus capensis*) has been recorded in arid habitats in northern parts of Saladin Governorate.

Carnivore records from central Iraq include European Badger (*Meles meles*), Honey Badger (*Mellivora capensis*), Small Indian Mongoose (*Urva auropunctata*), Marbled Polecat (*Vormela peregusna*, Vulnerable), Jungle Cat (*Felis chaus*), Wildcat (*Felis silvestris*), Golden Jackal (*Canis aureus*), Red Fox (*Vulpes vulpes*; Turkmenistan subspecies *V. v. flavescens*), and Grey Wolf (*Canis lupus*; Iranian subspecies *C. l. pallipes*). Wild Boar (*Sus scrofa*) have been reported along reed beds and thickets on the Tigris, with frequent reports of crop raiding and retaliatory hunting.

An aquatic mustelid of note recorded in the Ishaqi area is the Eurasian Otter (*Lutra lutra*, Near Threatened). Al-Sheikhly et al. (2022) reported a captured albino individual from the Tigris River near Ishaqi. In comparable landscapes (Jadriyah and Umm Al-Khanazeer), recorded mammals included Small Indian Mongoose, Arabian Red Fox, Golden Jackal, Long-eared Hedgehog, and Norway Rat.

c) Herpetofauna

Amphibians
Reported amphibians from central Iraq include Green Toad (*Bufotes viridis*) and Marsh Frog (*Pelophylax ridibundus*), including records from muddy riverbanks of the Tigris (Al-Sheikhly, 2012; Auer et al., 2025). In comparable habitats at Jadriyah and Umm Al-Khanazeer, Marsh Frog and Green Toad were recorded.

Reptiles
The Euphrates Softshell Turtle (*Rafetus euphraticus*, Endangered) has been reported along the Tigris River in multiple KBAs surrounding the Ishaqi area and is considered a vulnerability criterion used in site designation. The heterogeneous landscape of riparian reed beds, thickets, orchards, and adjacent

arid areas likely supports a diverse reptile assemblage, although this remains poorly surveyed. Al-Sheikhly (2012) reported reptiles within the same ecoregion including Caspian Turtle (*Mauremys caspica*), multiple gecko species (e.g., Yellow-bellied Gecko *Hemidactylus flaviviridis*; Persian Leaf-toed Gecko *Hemidactylus persicus*; Werner's Leaf-toed Gecko *Asaccus elisae*; Rough Bent-toed Gecko *Cyrtopodion scabrum*), and lizards such as Egyptian Spiny-tailed Lizard (*Uromastyx aegyptia*, Vulnerable), Iraqi Mastigure (*Saara loricata*), Desert Monitor (*Varanus griseus*), and others (e.g., *Acanthodactylus* spp.; Snake-eyed Lizard *Ophisops elegans*; Golden Grass Mabuya *Heremites auratus*). Reported snakes include Dark-headed Dwarf Racer (*Eirenis persicus*), Collared Dwarf Snake (*Eirenis collaris*), Large Whip Snake (*Dolichophis jugularis*), Hardwicke's Rat Snake (*Platyceps ventromaculatus*), Crowned Leafnose Snake (*Lytorhynchus diadema*), Dice Snake (*Natrix tessellata*), and Javelin Sand Boa (*Eryx jaculus*). In recent surveys at Jadriyah and Umm Al-Khanazeer, several reptiles including Euphrates Softshell Turtle were also recorded.

d) Ichthyofauna

Fish surveys in central Iraq have largely focused on major watercourses and wetlands associated with the Tigris system, including Tharthar and Samarra lakes. In Tharthar Lake, winter 2009 fish data collected via fisheries frame survey methods recorded 10 species, including Yellowfin Barbell (*Luciobarbus xanthopterus*, Vulnerable; 31%) and Binni (*Mesopotamichthys sharpeyi*, Vulnerable; 3%) among the documented catch composition (Nature Iraq, 2017). In Samarra Lake, winter 2009 survey efforts were constrained by security; recorded species included *Carassius auratus*, *Cyprinus carpio*, Abu mullet (*Planiliza abu*), *M. sharpeyi* (Vulnerable), and *Silurus triostegus*, with fishermen also reporting Mangar (*Luciobarbus esocinus*, Vulnerable) and *L. xanthopterus* (Vulnerable) as present.

A fish community study in a similar aquatic habitat near Al-Khalis District (Diyala Governorate), approximately 40 km southeast of Ishaqi, recorded 26 fish species between December 2022 and March 2023, including notable proportions of *L. xanthopterus* (19.035%) (Hameed et al., 2025).

Two non-native species have been reported from the Tigris system: the Neotropical piranha (*Serrasalmus maculatus*) recorded near Al-Taji (Jawad and Qasim, 2019), and the African catfish (*Clarias gariepinus*) recorded in northern Baghdad in March 2023 (Inad, 2025). There is currently no confirmed evidence that *S. maculatus* occurs upstream near Ishaqi, and this warrants further investigation. Recent ichthyological observations in comparable habitats (Jadriyah and Umm Al-Khanazeer) recorded only three abundant species: Abu mullet, Tigris catfish, and Common carp.

e) Invertebrates

Due to limited field access and survey constraints since 2014, comprehensive information on invertebrate fauna in central Iraq is not currently available for the survey site.

2. Flora

No detailed, site-specific flora surveys were undertaken for the Ishaqi survey area. Available botanical information for central Iraq is largely derived from surveys conducted at surrounding KBAs (see Nature Iraq, 2017). In addition, Nature Iraq (2017) undertook an assessment relevant to IPA Criterion A (sites with threatened species) by compiling a national list of endemic and near-endemic plant species for Iraq (Appendix 7 in Nature Iraq, 2017), supported by geo-referencing and spatial analysis of historical records from the *Flora of Iraq* and *Flora Iranica*, and by examining relationships between these datasets and KBA survey outputs.

Many of the surrounding sites were assessed using the Important Plant Areas (IPAs) framework. Under IPA Criterion C (outstanding examples of globally or regionally threatened habitat types), sites were evaluated based on the presence of unique habitats of national and/or regional significance that are often under severe threat. The habitat classification applied in these assessments follows Abdulhasan (2009), Abdulhasan et al. (2009), and *Flora of Iraq* (Guest, 1960, Vol. 1). Plantlife International indicates that IPA identification is based on three broad criteria (Plantlife, 2008), and a site may qualify if it meets one or more of the following: (A) sites supporting significant populations of threatened species of global or regional concern; (B) sites of exceptional botanical richness in a regional context relative to the relevant biogeographic zone; and (C) sites representing threatened habitats that are outstanding examples of habitat types of global or regional importance.

The Ishaqi area lies within the Mesopotamian Shrub Desert ecoregion, which is classified under the Deserts and Xeric Shrublands biome (WWF, 2014). This ecoregion is described as having a Vulnerable conservation status and covers approximately 211,000 km² globally, of which around 129,995 km² (62%) occurs in Iraq. The ecoregion includes characteristic flora such as umbrella-thorn acacia (*Acacia tortilis*), shrubby rock-rose species (*Cistus* spp.), and various dwarf shrubs. Wetland and riparian settings support reed and rush communities, with *Populus euphratica* and *Tamarix* species commonly occurring along river channels (UNEP, 2006).

4.3.1.1.2.5 Methodology and Field Study

The rapid biodiversity field survey was conducted only for Expressway No. 2 (Baghdad–Samarra) within the Ishaqi area (hereafter, the "survey site"). The survey was prioritized for Expressway No. 2 because it is a greenfield corridor and is therefore expected to present the highest potential biodiversity risks and impacts among the ITREC road investments. The field work was implemented under constrained conditions, reflecting: (i) security limitations along the corridor (including the Ishaqi inland section and the Tigris River crossing toward the arid landscape of southern Samarra District), (ii) access permissions and escort requirements imposed by local authorities, (iii) limited time windows granted for site entry, and (iv) logistical and resource constraints. As a result, the field work comprised a one-day rapid "snapshot" survey, undertaken within the available security access period.

The survey was conducted on Wednesday, 14 January 2026, and covered an approximately 8.42 km pre-defined portion of the northern Expressway No. 2 alignment within the Ishaqi area. The survey limits were defined by the following coordinates: Start Survey Point 34° 0'38.86"N, 44° 2'15.73"E to End Survey Point 34° 4'59.76"N, 44° 0'38.29"E. Field survey activities were undertaken between 07:00 and 17:00 (Baghdad time), totaling approximately 10 hours of observation and recording.

Ornithological Survey

At the survey site (fixed start point 34° 0'38.86"N, 44° 2'15.73"E), an avian line transect method was applied (following Sutherland, 2006) and selected based on expert judgment as suitable for the open habitat context of the Ishaqi area. A total of six (6) transects were completed by the two observers (identifier and recorder) using a vehicle to maximize spatial coverage under the one-day security constraint. Transects were driven at 40–60 km/h to minimize double counting while enabling broad coverage given limited manpower and time.

Each transect followed a predetermined "ribbon route" of approximately 5 km length (range 4.99–5.76 km) with an observation zone of approximately 5 km width, with directions varied to reduce bias and minimize duplicate counts. Transect selection was constrained by road accessibility and security

escort instructions provided by the Iraqi Federal Police. Bird species observed visually or detected by calls were recorded, with photographic documentation collected using a Canon DSLR camera with a 300 mm telephoto zoom lens. Species identification followed Svensson et al. (2010). Transect details are presented in Table 4-15.

Table 4-15: Surveying transects conducted at the Expressway No. 2 identified portion at the site (Ishaqi) using Line transect field surveying methodology adopted from Sutherland (2006).

#	Name	Length (Km)	Start Point	End Point
Trans-1	Western side from Balad-Ishaqi highway towards Ishaqi river at Al-Misha'an Village الجهة الغربية من طريق بلد – اسحاقي نحو نهر الاسحاقي باتجاه قرية ال مشعان	5.31	34°0'38.42"N 44° 2'14.58"E	33°58'15.12"N 44° 3'19.50"E
Trans-٢	Al-Kuzariyah Checkpoint – joint security Checkpoint of Samara Operations Command Center and *Saraiya Al-Salam* towards Al-Farhatyah – Tofeashat السيطرة الكوزرية - السيطرة المشتركة بين قيادة عمليات سامراء وسرايا السلام باتجاه منطقة الفرحاتية - الطفيشات	5.49	34° 1'6.78"N 44° 2'31.63"E	34° 2'45.66"N 44° 4'11.09"E
Trans-3	Al-Ethayah on the western bank of Tigris River towards Al-Mutasim Concrete Bridge منطقة العذية بمحاذاة نهر دجلة باتجاه جسر المعتصم الكونكريتي	4.99	34°2'45.12"N 44° 4'21.67"E	34° 3'35.58"N 44° 4'13.20"E
Trans-٤	Al-Ethayah towards Al-Dheafat area and Al-Dheafat Water station and Al-Ghudhaeab "Ahal Ghidhab" area منطقة العذية باتجاه منطقة الضيفات ومحطة ماء الضيفات نحو منطقة ال غضيب	5.76	34°3'16.77"N ١٠,٨٢'٣ °٤٤"E	34° 4'15.81"N ١٠,٢٦'٠ °٤٤"E
Trans-٥	Albu-Daraj area towards the bridge facing Samara Thermal Electricity PowerStation on the opposite eastern bank of Tigris River منطقة البودراج باتجاه الجسر المقابل لمحطة كهرباء سامراء الحرارية	5.70	34°3'16.83"N ١٠,٥٣'٣ °٤٤"E	34° 4'55.81"N ٤٠,٦٢'٥٨°٤٣"E
Trans-٦	Southeastern Ishaqi area towards Abu-Safa area منطقة جنوب شرق الأسحاقي نحو منطقة ابو صفة	5.41	34°3'30.30"N ٤٧,٦١'٠ °٤٤"E	34° 1'43.19"N ٢٨,٦٣'٢ °٤٤"E

Wild Mammals

A line transect approach was also applied for mammals (Sutherland, 2006). This was complemented by semi-structured interviews with local community members (n = 3) to support detection of species presence/likelihood under limited observation time. Mammal identification followed Harrison and Bates (1991).

Amphibians and Reptiles

A line transect approach was applied; however, survey coverage was limited due to: (i) the winter season, when many reptiles are inactive/hibernating; and (ii) constraints on time, personnel, and specialized survey equipment (e.g., capture–mark–release, pitfall traps). Community interviews (n = 4) were therefore used to supplement field observations, undertaken by Dr. Omar Al-Sheikhly (author of Auer et al., 2025).

Fish

No dedicated ichthyological field sampling was undertaken due to limitations in time, personnel, and aquatic survey equipment. Instead, interviews with local fishermen (n = 2) were conducted at two locations on the eastern bank of the Tigris River near Al-Ethayah to obtain preliminary information on fish community composition and economically important species. Interview points were: Site 1 = 34° 3'25.99"N, 44° 3'39.90"E and Site 2 = 34° 3'41.73"N, 44° 2'8.91"E.

Flora

Vegetation landcover and habitat conditions were documented through visual observation along transects, with periodic stop intervals (typically 10–20 minutes) to record dominant vascular plant species (i.e., species estimated to represent 50–80% land cover). Plant identification followed Guest (1966). Determination of whether the site qualifies under IPA criteria was not concluded and would require additional assessment.

Invasive Species

Potential invasive alien species (flora and fauna) observed during the rapid survey were screened against the Global Invasive Species Database and the checklist included in Annex (4) of Iraq's Sixth National Report to the Convention on Biological Diversity (2018). Given the ecological sensitivity of invasive species in Iraq and the limitations of a one-day snapshot, further work would be required to characterize invasion pathways and potential long-term impacts in a robust manner.

Critical Habitat Assessment

Despite Critical Habitat Assessment at the targeted area above required prolonged in-depth research on both aqua/landscaping and understanding the overlaps of the niches of biotic elements; however, we based on the Guidance Notes of Critical habitat Assessment that provide guidance for the Borrower on the application of the Environmental and Social Standards (ESSs), which form part of the World Bank's 2016 Environmental and Social Framework (ESF).

Critical Habitat

23. Critical habitat is defined as areas with high biodiversity importance or value, including:

(a) Habitat of significant importance to Critically Endangered or Endangered species, as listed in the IUCN Red List of threatened species or equivalent national approaches;
(b) Habitat of significant importance to endemic or restricted-range species;
(c) Habitat supporting globally or nationally significant concentrations of migratory or congregatory species;
(d) Highly threatened or unique ecosystems; and
(e) Ecological functions or characteristics that are needed to maintain the viability of the biodiversity values described above in (a) to (d).

Survey Limitations and Challenges

Despite the one-day access constraint, the survey recorded multiple fauna and flora observations. Key limitations and considerations for any future surveys include:

- Findings from field work and desktop review should be validated through engagement with local communities and relevant stakeholders.

- Scarcity of baseline data and limited post-2014 field survey coverage may result in incomplete characterization of aquatic ecosystems and taxa without additional targeted surveys.

4.3.1.1.2.6 Results

1. Habitat Types Along the Corridor

Using the IUCN Habitats Classification Scheme (Version 3.1), habitat suitability is typically interpreted as "Suitable" where a species occurs regularly/frequently, and "Marginal" where occurrence is irregular/infrequent or involves only a small proportion of individuals. Given the one-day, rapid nature of the survey, habitat–species associations at the site also retain an "Unknown" element where the importance of a habitat to a given species could not be confirmed with confidence. Based on field observations and the surrounding land-use context, the preliminary habitat types represented within the survey area include:

- **Wetlands (inland)**
  - **5.1 Permanent rivers/streams/creeks**
  - **5.4 Bogs, marshes, swamps, fens, peatlands** (localized wetland features associated with the river corridor and low-lying areas)
- **Artificial – Terrestrial**
  - 14.1 Arable land
  - 14.2 Pastureland
  - 14.3 Plantations
  - 14.4 Rural gardens
  - 14.5 Urban areas **(settlements and built-up clusters)**
- **Artificial – Aquatic**
  - **15.3 Aquaculture ponds**
  - **15.6 Wastewater treatment areas**
  - **15.7 Irrigated land (including irrigation channels)**
  - **15.8 Seasonally flooded agricultural land**
  - **15.9 Canals and drainage channels/ditches**

The survey site can be described as two broad landscape units separated by the Balad–Samarra major highway:

(i) Eastern sector (highway to the Tigris River): riparian–agricultural mosaic
The eastern part of the site encompasses most of the Ishaqi area and forms a largely continuous riparian landscape extending to the western bank of the Tigris River. This unit is dominated by cultivated orchards (fruit and date palm) interspersed with shrubby vegetation, thickets, and areas transitioning to desert shrubland. The underlying geology is dominated by alluvial sediments, and the broader landscape is arid. Along the Tigris corridor, the land is locally constrained by elevated rocky cliffs extending southwards toward the Balad area. Dispersed rural settlements occur within and adjacent to cultivated fields, orchards, and open farms. Agricultural production includes vegetables and fruit farms, with grape and citrus reported as common crops.

Closer to the river, habitat structure changes: shrubs and bushes become less dense where river margins become stony and gravelly, while poplar trees and extensive Phragmites reed beds line both

banks. Within the Tigris channel, small stony islands/islets support scattered Tamarix spp., which provide potential nesting and roosting habitat for waterbirds. The eastern bank of the Tigris (outside the primary survey corridor) presents a broadly similar agricultural setting toward the Samarra area, characterized by date palms and orchards and fields cultivated with wheat and barley.

(ii) Western sector (highway westwards): open arid plain with irrigated agriculture
The western part of the site is characterized by an open arid plain with scattered wheat and vegetable farms. Agricultural plots include circular/center-pivot irrigation farming, extending along the highway corridor and westward toward the southeastern Al-Jazira area and the eastern edge of the Tharthar valley and Tharthar Lake landscape.

2. Avifauna Survey

A total of 39 bird species were recorded at the survey site (Table 4-16). All recorded species are classified as IUCN Least Concern (LC). Although no globally threatened bird species were directly recorded during the one-day survey, the site remains ecologically compatible with nearby IBAs/KBAs and, accordingly, may be used by globally threatened migratory species (e.g., soaring birds, raptors, and waterfowl) during migration and wintering periods; confirmation of this requires additional, targeted ornithological surveys.

Large raptors, including Steppe Eagle, Eastern Imperial Eagle, Greater Spotted Eagle, and vultures such as Egyptian Vulture, Cinereous Vulture, and Griffon Vulture, may migrate through the wider area during winter (see Al-Sheikhly et al., 2017). No indications of bird collision were observed during the current survey; however, precautionary monitoring for raptor movement during the Expressway No. 2 construction phase remains warranted.

The arid plateau and semi-desert habitats of eastern Samarra, extending through Al-Jilam and Al-Eath, are known to witness autumn migration of Saker Falcon and Asian Houbara (formerly breeding in the wider landscape), and the area is subject to annual falconry activity (see Al-Sheikhly et al., 2020). There is no indication that these species occur within the Ishaqi survey area based on the current survey; however, this requires verification through additional fieldwork, particularly in the western portion of the survey site covered by Transect 1.

Further investigation is considered important for potential passage and winter use of the area by the Critically Endangered Sociable Lapwing, as arid lands, open cultivated fields, and grazing/pasture areas align with the species' known landscape preferences during migration. Previous survey efforts by Nature Iraq (2010) reported winter flocks in parts of Saladin Governorate. The site is considered ecologically suitable for passage migrants/wintering individuals as indicated by Donald et al. (2021) and as illustrated in Bhagwat et al. (2026). Accordingly, winter and spring surveys (at least two consecutive years) are recommended—coordinated with the Ministry of Environment, BirdLife International (Middle East), and Iraqi Green Climate Organization (IGCO)—to confirm whether the site is used regularly prior to construction. If confirmed, presence of this species during construction could raise concerns related to disturbance and habitat alteration, requiring heightened avoidance/mitigation measures.

Although Slender-billed Gull (Chroicocephalus genei) was recorded at the site, the recorded numbers are insufficient to meet IBA congregatory thresholds (e.g., A4i: ≥1% of a biogeographic population of a congregatory waterbird species).

The habitat profile is also considered suitable for other globally threatened bird species that have been recorded in the wider region, including Red-footed Falcon (VU), European Turtle-dove (VU), and Common Pochard (VU) (see Nature Iraq, 2017). These species were not recorded during the current rapid survey, but their potential occurrence remains plausible and would require confirmation through more comprehensive seasonal surveys.

Table 4-16: Bird species recorded at the survey site

No.	Common name	Scientific name	IUCN Red List Category	Direct / indirect observation	If indirect, type of sign	No. of individuals
1	White-throated kingfisher	*Halcyon smyrnensis*	Least concern	Direct	n/a	5
2	Spanish sparrow	*Passer hispaniolensis*	Least concern	Direct	n/a	23
3	Long-legged buzzard	*Buteo rufinus*	Least concern	Direct	n/a	1
4	Eurasian magpie	*Pica pica*	Least concern	Direct	n/a	≥30
5	Wood pigeon	*Columba palumbus*	Least concern	Direct	n/a	≥200
6	Cattle egret	*Bubulcus ibis*	Least concern	Direct	n/a	4
7	House sparrow	*Passer domesticus*	Least concern	Direct	n/a	26
8	Indian roller	*Coracias benghalensis*	Least concern	Direct	n/a	3
9	Spur-winged lapwing	*Vanellus spinosus*	Least concern	Direct	n/a	4
10	White-eared bulbul	*Pycnonotus leucotis*	Least concern	Direct	n/a	18
11	Eurasian collared dove	*Streptopelia decaocto*	Least concern	Direct	n/a	20
12	Rock dove	*Columba livia*	Least concern	Direct	n/a	4
13	Little grebe	*Tachybaptus ruficollis*	Least concern	Direct	n/a	2
14	Eurasian moorhen	*Gallinula chloropus*	Least concern	Direct	n/a	7
15	Eurasian coot	*Fulica atra*	Least concern	Direct	n/a	5
16	Black francolin	*Francolinus francolinus*	Least concern	Direct	n/a	1
17	Black-winged kite	*Elanus caeruleus*	Least concern	Direct	n/a	2
18	Mesopotamian crow	*Corvus cornix capellanus*	Least concern	Direct	n/a	8
19	Red-wattled lapwing	*Vanellus indicus*	Least concern	Direct	n/a	6
20	Eurasian kestrel	*Falco tinnunculus*	Least concern	Direct	n/a	1
21	Eurasian sparrowhawk	*Accipiter nisus*	Least concern	Direct	n/a	1
22	Afghan babbler	*Argya huttoni*	Least concern	Direct	n/a	7
23	Iraq babbler	*Argya altirostris*	Least concern	Indirect	n/a	At least 2
24	Graceful prinia	*Prinia gracilis*	Least concern	Direct	n/a	1
25	Common chiffchaff	*Phylloscopus collybita*	Least concern	Direct/Indirect	Song/calls	5
26	Western marsh harrier	*Circus aeruginosus*	Least concern	Direct	n/a	1
27	Mallard	*Anas platyrhynchos*	Least concern	Direct	n/a	4
28	Great cormorant	*Phalacrocorax carbo*	Least concern	Direct	n/a	31

29	Pygmy cormorant	*Microcarbo pygmaeus*	Least concern	Direct	n/a	2
30	European stonechat	*Saxicola rubicola*	Least concern	Direct	n/a	1
31	Rook	*Corvus frugilegus*	Least concern	Direct	n/a	55
32	European robin	*Erithacus rubecula*	Least concern	Indirect	Song/calls	1
33	Tree pipit	*Anthus trivialis*	Least concern	Direct	n/a	1
34	Crested lark	*Galerida cristata*	Least concern	Direct	n/a	2
35	Eurasian skylark	*Alauda arvensis*	Least concern	Direct	n/a	5
36	Armenian gull	*Larus armenicus*	Least concern	Direct	n/a	7
37	Slender-billed gull	*Chroicocephalus genei*	Least concern	Direct	n/a	18
38	Black-headed gull	*Chroicocephalus ridibundus*	Least concern	Direct	n/a	31
39	Caspian gull	*Larus cachinnans*	Least concern	Direct	n/a	2

3. Mammals Survey

A total of 14 wild mammal species were recorded based on local interviews and field evidence, including direct observations of rodent burrows and wild boar rooting areas. The Long-eared Hedgehog was reported by local residents as occurring in grasslands and cultivated fields and is frequently encountered in the area.

Based on habitat suitability and known zoogeographic distribution, there is a high likelihood that two bat species occur in the wider survey area—Botta's Serotine and Kuhl's Pipistrelle—although no trapping or targeted bat survey was undertaken, and their occurrence was inferred from expert judgement and local confirmation. The Crested Porcupine is reported as a common rodent in the area, associated with the Tigris riparian zone and cultivated fields with vegetated hedgerows and thickets; it is also targeted by local communities for consumption. Rodent burrows were observed near scattered settlements, open fields, and gardens; however, given that no trapping was conducted, rodent species identification relied on expert judgement and local confirmation.

Local informants also reported the presence of Small Indian Mongoose, Jungle Cat, Wild Cat, Asiatic Jackal, and Red Fox. Large herds of Wild Boar were reported to raid cultivated fields and fruit orchards (Table 4-17).

The mammal species of highest conservation concern reported for the survey area is the Eurasian Otter (Lutra lutra; Near Threatened). Fishermen indicated that otters are still observed in the Tigris River watercourse near Ishaqi. Accordingly, it is recommended to undertake further targeted surveys and to develop a single-species conservation management plan for the Eurasian Otter in coordination with the Ministry of Environment, focusing particularly on the period prior to and during construction of the Expressway No. 2 river crossing works. This conservation action should aim to identify the population's home range, family structure, and the potential presence of color aberration (mutant) individuals reported historically from the area. Failure to address this risk could result in disturbance, habitat loss, and fragmentation affecting a small otter population of local importance, with potential adverse implications for the Project's environmental performance and reputation (see Al-Sheikhly et al., 2022).

Table 4-17: Wild mammalian species recorded at the survey site.

No.	Species Common name	Scientific name	IUCN Red List	Count
1	Long-eared Hedgehog	*Hemiechinus auritus*	Least concern	Common
2	Botta"s Serotin	*Eptesicus bottae*	Least concern	Common
3	Kuhl"s Pipistrelle	*Pipistrellus kuhli*	Least concern	Common
4	Crested Porcupine	*Hystrix indica)*	Least concern	Common
5	Small Indian Mongoose	*Urva auropunctata*	Least concern	Common
6	Jungle Cat	*Felis chaws*	Least concern	Rare
7	Asiatic Wild Cat	*Felis silvesteris*	Least concern	Rare
8	Asiatic Jackal	*Canis aureus aureus),*	Least concern	Common
9	Red Fox	*Vulpes vulpes*	Least concern	Common
10	Eurasian Otter	*Lutra lutra*	Near Threatened	Rare
11	Wild Boar	*Sus scrofa*	Least concern	Abundant
12	Black rat	*Rattus rattus*	Least concern	Abundant
13	House mouse	*Mus musculus*	Least concern	Abundant
14	Indian Crested Porcupine	*Hystrix indica*	Least concern	Common

4. Herpetofauna Survey

A total of six reptile species were recorded during the rapid survey. No amphibian species were directly observed; however, the site remains ecologically suitable to support amphibians such as the Marsh Frog (Pelophylax ridibunda) and the Middle East Tree Frog (Hyla savignyi), and their occurrence should be confirmed through more detailed field surveys, particularly during seasons and periods of higher amphibian activity.

Local interviews indicated frequent occurrence of the Euphrates Soft-shell Turtle (Rafetus euphraticus; Endangered) within the main Tigris River watercourse. Informants reported repeated observations (typically 2–3 individuals seen during fishing activities, occurring regularly). Given its conservation status, this species represents a potential ESS6 priority biodiversity feature and may trigger Critical Habitat considerations depending on confirmed occurrence, habitat use, and population context. Interviews also confirmed the presence of the Caspian Turtle ("Ragga") along the Tigris River banks.

Among terrestrial reptiles, the Yellow-belly Gecko was described as abundant in cracks, buildings, and settlement structures. The Golden Grass Mabuya, Dice Water Snake, and Large Whip Snake were reported as common in cultivated fields and along the densely vegetated thickets and trees bordering the Tigris. The Large Whip Snake ("Erbid") is locally known and is frequently observed near poultry holdings during hot summer months (Table 4-18).

It is important to highlight that areas around the northern end of the surveyed section (near the survey endpoint: 34° 4'59.76"N, 44° 0'38.29"E) transition into more arid plains and sparsely vegetated steppe south of Samarra. These habitats may potentially support a localized population of the Egyptian Spiny-tailed Lizard (Uromastyx aegyptia; Vulnerable). If present, it could be encountered during construction activities in arid/steppe portions of Expressway No. 2, and may require a species handling, rehabilitation, and relocation protocol (subject to legal requirements and authority coordination), with potential implications for construction scheduling. Targeted herpetological surveys at the relevant season and habitats are therefore recommended to confirm presence/absence and define any required management measures in advance.

No venomous snakes were reported by local communities during interviews. However, given habitat suitability and regional similarity, there remains a possibility that the Blunt-nosed Viper (Macrovipera lebetinus) may occur, representing a potential occupational health and safety risk to workers. Further intensive herpetological surveys—particularly during summer, when reptile detectability is higher—are recommended to refine the baseline and inform risk management measures.

Table 4-18: Reptile species recorded at the survey site

No.	Species Common name	Scientific name	IUCN Red List	Count
1	Euphrates Soft-shell turtle	*Rafetus euphraticus*	Endangered	Common
2	Caspian Turtle	*Mauremys caspica capsica*	Least Concern	Common
3	Yellow-belly Gecko	*Hemidactylus flaviviridis*	Least Concern	Common
4	Golden Grass Mabuya	*Heremites auratus auratus*	Least Concern	Common
5	Large Whip Snake	*Dolichophis jugularis*	Least Concern	Common
6	Dice Water Snake	*Natrix tessellate*	Least Concern	Common

5. Ichthyofauna Survey

A total of 11 fish species were identified based on information obtained through interviews with local fishermen/correspondents, as no dedicated fish sampling or netting surveys were undertaken during the rapid assessment. The recorded ichthyofauna includes three IUCN Red Listed Vulnerable species—Yellowfin barbell, Binni, and Shabout—which are of particular relevance under ESS6 due to their conservation status and potential sensitivity to in-water works, localized pollution, and habitat disturbance. In addition, one non-native/invasive species, the Redbelly tilapia, was reported as abundant within the surveyed aquatic setting (Table 4-19). The presence of an invasive species is relevant to baseline characterization and may influence future biodiversity management considerations, particularly if changes in habitat condition facilitate further spread.

Table 4-19: Fish species recorded at the survey site

No.	Species Common name	Scientific name	IUCN Red List	Count
1	Yellowfin barbell	*Luciobarbus xanthopterus*	Vulnerable	Common
2	Binni	*Mesopotamichthys sharpeyi*	Vulnerable	Rare
3	Shabout	*Arabibarbus grypus*	Vulnerable	Common
4	Tigris Asp	*Leuciscus vorax*	Least Concern	Common
5	Common carp	*Cyprinus carpio*	Least Concern	Common
6	Tigris catfish	*Silurus triostegus*	Least Concern	Common
7	Abu mullet	*Planiliza abu*	Least Concern	Common
8	Tigris mystus	*Mystus pelusius*	Least Concern	Common
9	Stinging catfish	*Heteropneustes fossilis*	Least Concern	Common
10	Redbelly tilapia	*Coptodon zillii*	Least Concern	Abundant
11	Euphrates spiny eel	*Mastacembelus mastacembelus*	Least Concern	Common

6. Flora Survey

A total of 28 plant species were recorded (Table 4-20). Yet further comprehensive field survey(s) is required for IPA assessment at the site.

Table 4-20: Plant species recorded at the survey site.

No.	Species Common name	Scientific name	Notes
1	Common Date Palm	*Phoenix dactylifera*	n/a
2	Species of marigold plant	*Calendula persica*	n/a
3	Slender or Italian thistle	*Carduus pycnocephalus*	n/a
4	Wild Safflower	*Carthamus oxyacantha*	n/a
5	Pale Centaury, Pale Knapweed	*Centaurea pallescens*	n/a
6	Prickly Lettuce, Milk Thistle	*Lactuca serriola*	n/a
7	Blessed Milk Thistle, Marian Thistle	*Silybum marianum*	n/a
8	Rough Cocklebur, Common Cocklebur	*Xanthium brasilicum*	n/a
9	Heart-podded Hoary Cress, Whitetop	*Cardaria draba*	n/a
10	Jerusalem caper	*Capparis spinosa*	n/a
11	Unarmed Saltwort	*Salsola inermis*	n/a
12	Castor-oil Plant, Castor Bean	*Ricinus communis*	n/a
13	California Burclover, Toothed Bur Clover	*Medicago polymorpha*	n/a
14	Small-flowered Mallow, Cheeseweed Mallow	*Malva parviflora*	n/a
15	Great Brome, Ripgut Brome	*Bromus diandrus*	n/a
16	Hairy Crabgrass, Large Crabgrass	*Digitaria sanguinalis*	n/a
17	Indian Lovegrass, Soft Lovegrass	*Eragrostis pilosa*	n/a
18	Wall Barley	*Hordeum glaucum*	n/a
19	Wild Barley, Squirell Tail Grass	*Hordeum spontaneum var*	n/a
20	Common Reed	*Phragmites australis*	n/a
21	Annual Beard Grass, Annual Rabbitsfoot Grass	*Polypogon monspeliensis*	n/a
22	Aleppo Sorghum, Johnson Grass	*Sorghum halepense*	n/a
23	Bread Wheat, Common Wheat	*Triticum aestivum*	n/a
24	Syrian Christs Thorn	*Zizyphus spinachristi*	n/a
25	Euphrates Poplar	*Populus euphratica*	n/a
26	Willow-of-the-brook, Sharp-leaved willow	*Salix acmophyla*	n/a
27	Southern Cattail	*Typha domingensis*	n/a
28	River Red gum	*Eucalyptus camaldulensis*	Invasive

4.3.1.1.2.7 Endemicity

Despite the rapid nature of the assessment and the limited temporal coverage, the field survey identified several flora and fauna species with relevance to endemicity and restricted-range biodiversity features.

Avifauna endemicity and restricted-range features. Bird endemicity and biome association are indicated by the presence of the Iraq Babbler (Argya altirostris; possibly breeding), a biome-restricted species associated with the Sahara–Sindian Desert biome (IBA A3 trigger). The species was heard at the site, but the available evidence does not indicate that the site meets the IBA A2 restricted-range species criterion at this stage. The White-eared Bulbul (Pycnonotus leucotis; breeding resident) was recorded during the survey. In total, 39 bird species were recorded during the one-day survey; however, given seasonal and migratory variability, the site may support additional species at other times of the year. Based on habitat similarity, the site is also ecologically suitable for the Dead Sea Sparrow (Passer moabiticus), another restricted-range species that may breed in summer, but it was not recorded during the rapid survey and therefore requires further verification.

Two bird subspecies/races considered endemic to Iraq were recorded and add conservation value to the site: the Iraqi Little Grebe (Tachybaptus ruficollis iraquensis; possibly breeding) and the Mesopotamian Crow (Corvus cornix capellanus; breeding resident).

Freshwater fish of the Tigris–Euphrates basin. Several key freshwater fish species recorded through interviews are native to the Tigris–Euphrates basin, including Shabout (Arabibarbus grypus), Binni (Mesopotamichthys sharpeyi), Yellowfin barbell (Luciobarbus xanthopterus), Euphrates spiny eel (Mastacembelus mastacembelus), and Abu mullet (Planiliza abu). These taxa are relevant for baseline characterization and may warrant focused consideration in impact assessment and mitigation planning where works interface with riverine habitats.

4.3.1.1.2.8 Initial Critical Habitat Assessment

The rapid field survey provided a snapshot of the general habitat profile of the Ishaqi area, as described in the Habitats and Land Uses section above (Figure 4-60). In addition, a rapid, initial Critical Habitat Assessment (CHA) was undertaken using the World Bank (2016) Critical Habitat criteria. The preliminary CHA results are summarized in Table 4-21 and Table 4-22 .

However, a robust differentiation between Critical Habitat (CH) and any remaining Natural Habitat (NH) requires longer-term ecological studies supported by sufficient baseline data and metadata, including spatially and temporally representative evidence from relatively intact ecosystems. Given the one-day nature of the rapid survey, it was not possible to confidently screen and segregate remaining natural habitat features into CH versus NH, as key lines of evidence—such as confirmed species occurrence patterns, habitat extent and condition, and ecological services provided to priority biodiversity features—remain insufficiently characterized. Establishing such differentiation based on a rapid assessment would require multi-season and multi-year monitoring, consistent with the recommendations presented in this report.

Notwithstanding these limitations, based on in-situ observations, the primary biodiversity feature with the highest potential relevance to CH/NH considerations at the site is the Tigris River watercourse, which is also highlighted as the principal biodiversity hotspot in the report narrative.The preliminary CHA was therefore based on expert judgment, recognizing the following constraints:

- The assessment required fuller access to the geographical survey area—particularly aquatic habitats within the Tigris River watercourse/basin—and some areas were not accessible due to the presence of private settlements.
- Seasonal and annual survey coverage is needed to detect and confirm the occurrence of IUCN Red List species (flora and fauna) that may use the site intermittently, including migratory and seasonal taxa.
- The islet system within the Tigris River (small islands within the main watercourse) represents a distinctive aquatic ecosystem of potential significance within the upper and lower Tigris basin; however, it could not be evaluated adequately due to time constraints and limitations in logistics, security clearances, aquatic transport, and required local permits.

Table 4-21: Initial Critical Habitat Assessment Matrix of the surveyed areas (Tigris River)

Initial Critical Habit Assessment Criteria		Tigris River crossing Area	Potential Adverse impact
a	Habitat of significant importance to Critically Endangered or Endangered species, as listed in the	Qualified - due to presence of the IUCN Red Listed Endangered Euphrates Soft-shell turtle is confirmed.	For the Endangered Euphrates Soft-shell turtle, construction of the Expressway EX 2 may directly impact on species potential nesting/basking/foraging sites (especially in the

	IUCN Red List of threatened species or equivalent national approaches;		Tigris River islands system and river muddy banks) though habitat destruction and fragmentation, species disturbance, and pollution by construction wastes. It is also possible that indirect threat on the species biological requirements such as fish/plants abundance may be impacted through long-term disturbance and pollution (mainly by plastic and chemical wastes). Comprehensive CHA is highly recommended.
b	Habitat of significant importance to endemic or restricted-range species;	Qualified - due to habitat suitability for one restricted range Reptile Species (Endangered Euphrates Soft-shell turtle) and five species of fishes Yellowfin barbell, Binni, Shabout, Euphrates spiny eel, Abu Mullet which native/endemic to the Tigris-Euphrates Basin were recorded.	For the Endangered Euphrates Soft-shell turtle, Construction of the Expressway EX 2 may directly impact on species potential nesting/basking/foraging sites (especially in the Tigris River islands system and river muddy banks) though habitat destruction and fragmentation, species disturbance, and pollution by construction wastes. It is also possible that indirect threat on the species biological requirements such as fish/plants abundance may be impacted through long-term disturbance and pollution (mainly by plastic and chemical wastes). Construction may also adversely impact on fish species population though species persecution and habitat destruction and disturbance to their critical spawning/breeding sites/habitat and/or their aquatic biological food chain from microfauna which yet need to be defined in the site. Direct species persecution though illegal fishing (mainly through electrofishing and/or poisoning may performed by uncontrolled construction workers/contractors), a critical issue warrants awareness and prevention. Comprehensive CHA is highly recommended.
c	Habitat supporting globally or nationally significant concentrations of migratory or congregatory species;	Unknown - one congregatory bird species (Slender-billed Gull) was observed but exact migration/wintering population was not estimated as required successive wintering counts; therefore, additional monitoring is required.	
d	Highly threatened or unique ecosystems;	Qualified - as the Tigris River Ecosystem within Mesopotamian Shrub Desert Ecoregion is unique to Iraq and threatened by several High threat impacts (see Threat Assessment of the site).	Directly impact on the extent (possible area size reduction) of the Mesopotamian Shrub Desert ecoregion, a Vulnerable ecoregion with 211,000 km^2 global geographical expansion and 129,995 km^2 area extent in Iraq (62%) of Iraq's total area. Due to multi-years accumulative urbanization and development which impacted the ecoregion area coverage is expected in the project. However, out of the ROW route, identification of remaining natural landscapes withing this ecoregion is required. Comprehensive CHA is highly recommended.
e	Ecological functions or characteristics that are needed to maintain the viability of the biodiversity	Unknown - The site suitability to meet (e) criterion is unknown as its ecological functions that are needed to maintain the viability of the biodiversity values described above in (a) to (d) required further comprehensive research.	

	values described above in (a) to (d).	

Table 4-22: Initial Critical Habitat Assessment Matrix of the surveyed areas (Ishaqi River)

Initial Critical Habit Assessment criteria		Ishaqi Area	Potential Adverse impact
a	Habitat of significant importance to Critically Endangered or Endangered species, as listed in the IUCN Red List of threatened species or equivalent national approaches;	Unknown - one critically endangered bird species (Sociable Lapwing) was reported in similar surrounding habitats in winter but exact migration/wintering population was not estimated as required successive wintering counts; therefore, additional monitoring is required.	
b	Habitat of significant importance to endemic or restricted-range species;	Qualified - due to habitat suitability for Aves endemicity as two of endemic races Mesopotamian crow, Iraqi Little Grebe, two restricted-range White-eared Bulbul and Iraq Babbler.	For the endemic and/or restricted-range species, construction of the Expressway EX 2 may directly impact on species potential breeding/foraging sites (especially dense reed beds on the Tigris River banks and Palme date orchids) though habitat destruction and fragmentation, species disturbance, and pollution by construction wastes. Removing Plam date orchids and perennial trees may reduce nesting/roosting sites for the Mesopotamian crow and White-eared Bulbul. It is also possible that high direct threat on White-eared Bulbul and Iraq Babbler local populations at the site through illegal tapping (adults are netted to be sold as cage birds and raiding on nest sites and kidnapping of checks to be raised as tamed cage birds) may performed by uncontrolled construction workers/contractors), a critical issue warrants awareness and prevention. Comprehensive CHA is highly recommended.
c	Habitat supporting globally or nationally significant concentrations of migratory or congregatory species;	As in criterion (a)	
d	Highly threatened or unique ecosystems;	Unqualified - mixed artificial habitats with ecological traces of few remaining natural ecosystems which threatened /potentially threatened by high anthropogenic impacts.	
e	Ecological functions or characteristics that are needed to maintain the viability of the biodiversity values described above in (a) to (d).	Unknown - The site suitability to meet (e) criterion is unknown as its ecological functions that are needed to maintain the viability of the biodiversity values described above in (a) to (d) required further comprehensive research.	

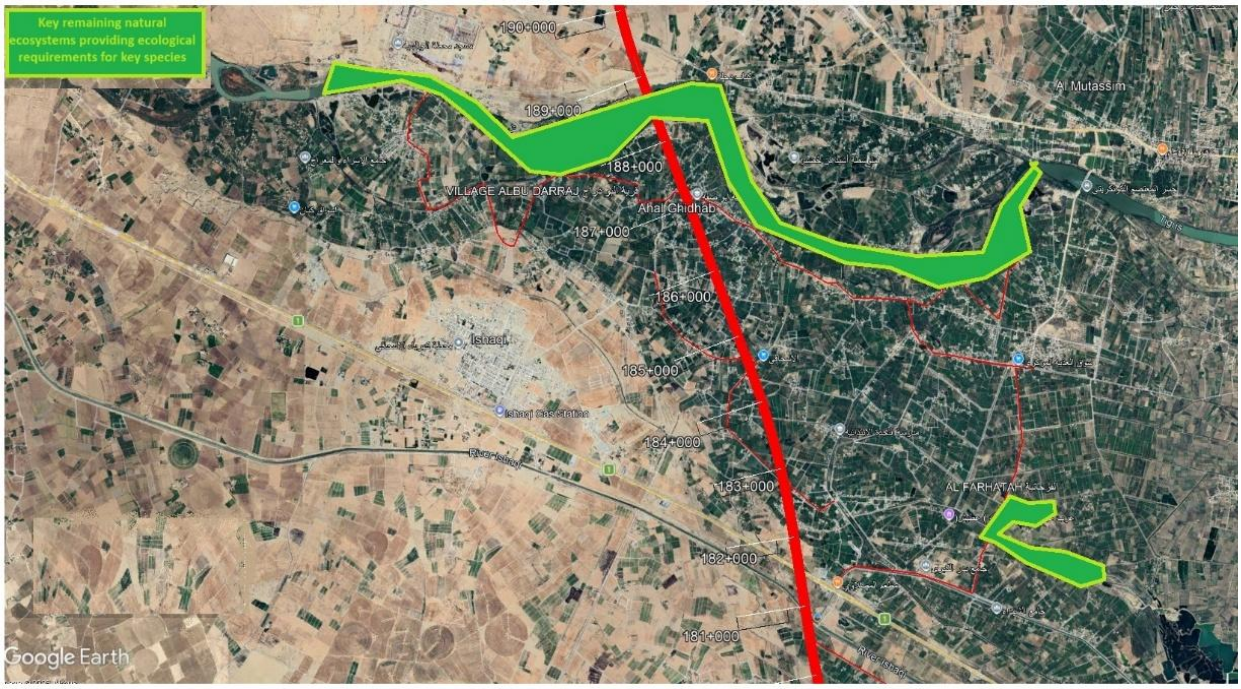


Figure 4-60: Polygons of Key remaining natural ecosystems of the Mesopotamian Shrub Desert Ecoregion at the Survey site of Ishaqi area providing ecological requirements as Critical Habitats for key species flora and fauna.

4.3.1.1.2.9 Island/Islets system in the Tigris River

Within the Tigris River freshwater ecosystem, several islands/islets occur at different locations within the main river watercourse. These islets are broadly homogenous with the adjacent riparian landscapes along both riverbanks. They are dynamic geomorphological features, formed primarily through sediment deposition and shifting river channels, and influenced by anthropogenic interventions (including dam construction) and, in some locations, rubble accumulation from destroyed bridges. These islands are reported to be more concentrated in the northern part of the Tigris River watercourse extending southwards toward Baghdad (Mahmoud, 2025).

Vegetation on the islets is dominated by dense Tamarix spp. thickets and Phragmites australis reed beds along islet edges, with scattered Populus euphratica and Phoenix dactylifera trees. The substrate is typically composed of stones and gravels, with muddy shorelines.

These isolated islets may provide refuge, roosting, and breeding habitat for a range of wildlife species. Based on habitat similarity and expert judgment, their muddy shores may provide suitable nesting habitat for the Endangered Euphrates Soft-shell Turtle (e.g., burrowing sites for gravid females and basking areas for adults). Reed-dominated margins may also provide secure cover that could support denning by Eurasian Otter populations along the river. In addition, the riparian aquatic vegetation may provide spawning habitat for fish species of conservation concern, including Vulnerable taxa such as Yellowfin barbell, Binni, and Shabout.

The islets may also serve as roosting locations for migratory waterbirds, including species that could occur seasonally in the broader riverine system (e.g., Common Pochard and Curlew Sandpiper, both Vulnerable, although not recorded during the current rapid survey). Further, scattered date palms and Euphrates poplar trees may provide seasonal breeding habitat for species such as the European Turtle-

dove (Vulnerable, not recorded in the current survey but potentially present in summer) and may also support nesting by biome restricted-range species such as the Dead Sea Sparrow, subject to confirmation through targeted breeding-season surveys.

Based on ground-truthing of the Expressway No. 2 river crossing area at Ishaqi, the alignment is understood to pass through one such island located at approximately 34° 4'1.00"N, 44° 1'42.06"E, near the Al-Ghudhaeab area on the western bank of the Tigris River. As part of the broader islet ecosystem within the river corridor, this feature may provide ecological services to native biodiversity as described above. However, due to the survey constraints noted earlier, the ecological functions and the extent of biodiversity reliance on these islets could not be fully assessed under the one-day rapid survey. As a result, if islet habitats are not further evaluated, they may represent a potential biodiversity sensitivity, particularly during the construction phase if works interact directly or indirectly with the river channel, islet margins, or associated riparian vegetation.

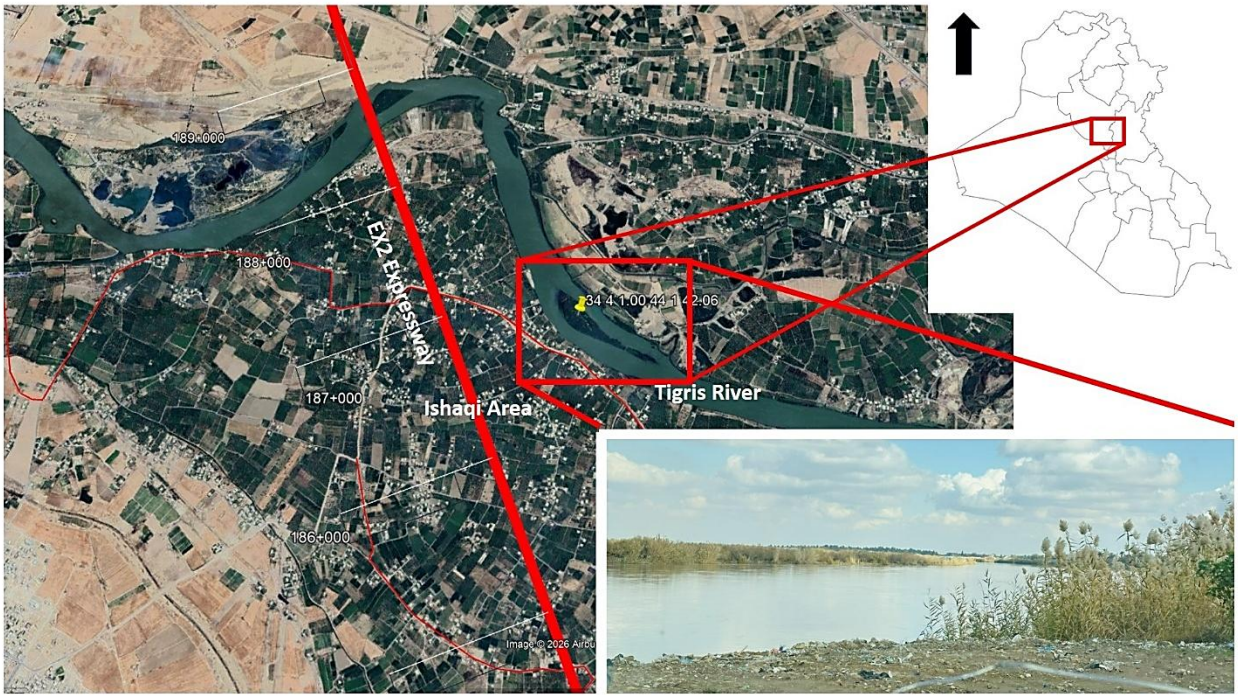


Figure 4-61: Example of Islands/islets systems of Tigris River in project area at Ishaqi-Saladin Governorate, central Iraq.

4.3.1.1.2.10 Rapid Threat Assessment

A rapid threat assessment was conducted using the Pressure–State–Response (PSR) model outlined by BirdLife International (2006) and adapted by Nature Iraq (2017) for IBA monitoring, to provide a preliminary screening of key pressures affecting biodiversity within the survey site. The PSR approach evaluates: Pressure (drivers/stressors acting on biodiversity), State (current condition and extent of impact), and Response (existing management or control measures), which are combined to generate an overall threat score.

As summarized in Table 10, the scoring indicates that Agricultural expansion and intensification, Over-exploitation, persecution and species control (including hunting and persecution), and Pollution

(notably solid waste and plastic waste pollution) represent Very High threats (total score 8). These threats were assessed as currently occurring, affecting a large proportion of the site and its biodiversity receptors, and associated with an expected rapid to moderate deterioration trend, based on expert judgment during the one-day rapid survey.

Additional pressures were ranked as High, including Residential and commercial development (score 7) and Human intrusions and disturbance (score 7), reflecting ongoing and expanding pressures within the broader landscape context. Other pressures were ranked as Medium, including Energy production and mining, Transportation and service corridors, Natural system modifications, and Invasive and other problematic species and genes (scores 4–5). Geological events were scored 0, while Climate change and severe weather was recorded as Unknown, reflecting the limitations of the rapid survey approach and available site-specific information.

The PSR scoring outputs are presented in Table 4-23, and the comparative threat profile is illustrated in Figure 4-62. While the assessment provides a defensible rapid screening, it remains subject to refinement through additional field surveys and updated evidence, particularly to confirm threat extent, intensity, and seasonal variation.

Table 4-23: Threat Assessment Pressure-State-Response (PSR) Model adopted by BirdLife International (2006) with scoring scheme of 0-2 (0 Low), 3-5 (1 Medium), 6-7 (2 High), 8-9 (3 Very High).

No.	IUCN Threat Category	Pressure	State	Response	Score[27]	
1	Agricultural expansion and intensification	3	3	2	8	Very High
2	Residential and commercial development	3	2	2	7	High
3	Energy production and mining	2	1	1	4	Medium
4	Transportation and service corridors	2	1	1	4	Medium
5	Over-exploitation, persecution and control	3	3	2	8	Very High
6	Human intrusions and disturbance	3	2	2	7	High
7	Natural system modifications	3	1	1	5	Medium
8	Invasive and other problematic species and genes	3	1	0	4	Medium
9	Pollution	3	2	3	8	Very High
10	Geological events	0	0	0	0	0
11	Climate change and severe weather	Unknown	Unknown	Unknown	-	Unknown

[27] Impact score of threat = Timings score +Scope score+ Severity Score (Result scores range from 0 to 9, and results scale is from 0 to 3).

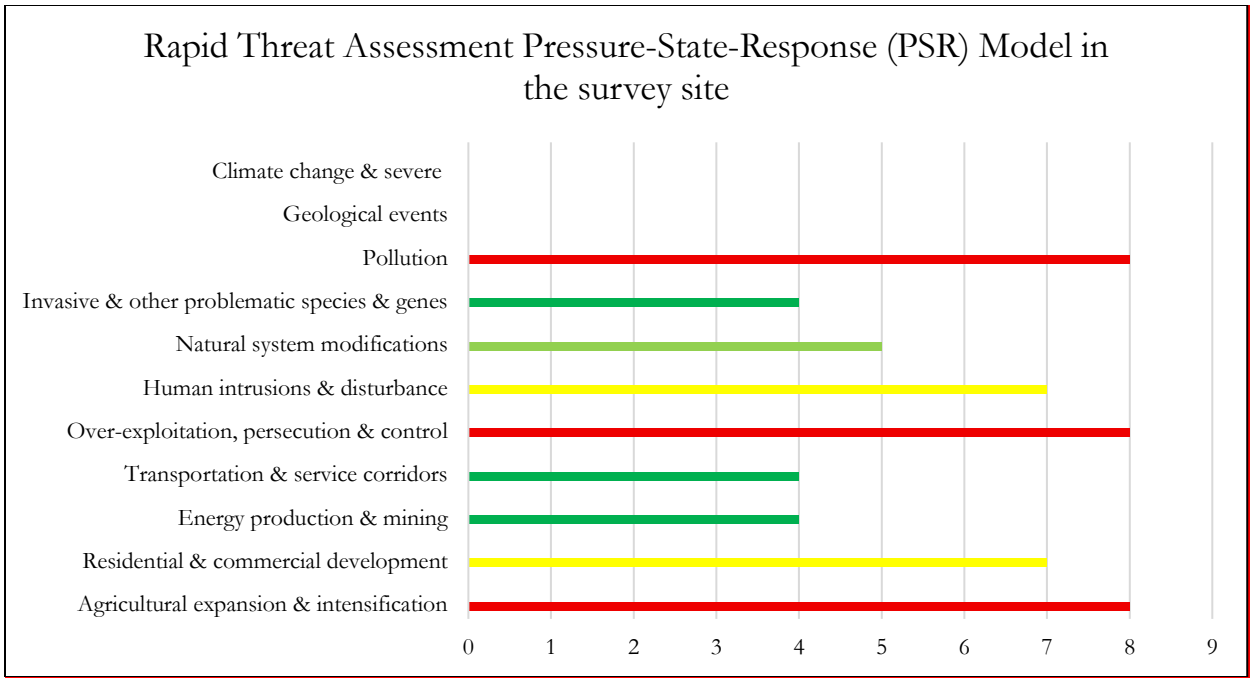


Figure 4-62: Diagram of the Threat Assessment Pressure-State-Response (PSR) Model analysis in the survey site

4.3.1.1.2.11 Invasive Species

In accordance with the Global Invasive Species Database and the checklist of invasive alien species reported in Annex (4) of Iraq's Sixth National Report to the Convention on Biological Diversity (2018), a preliminary screening of potential alien and/or invasive species was undertaken for the rapid field survey area. Species recorded during the survey that are introduced and/or potentially invasive are summarized in Table 4-24.

It should be noted that, due to the rapid nature of the survey and the absence of targeted invasion ecology fieldwork, the impacts, spatial distribution, introduction circumstances, pathways, and establishment dynamics of recorded non-native taxa were not assessed. Further investigation is therefore required—particularly for Plantae, invertebrates (hexapods), and rodents—through more intensive and seasonally representative field surveys and consultation with relevant authorities and specialists.

Table 4-24: List of Alien Invasive species recorded at the site

#	Taxonomic group	Species common name	Scientific name	Occurrence	Provenance	Invasiveness	Establishment / status	Likely pathway of introduction
1	Chordata – Aves	**Black-winged Kite** (Black-shouldered Kite)	*Elanus caeruleus*	Possibly established / breeding in the wider area	**Native / regional** (not an introduced alien in most references)	**Not treated as invasive** (range expansion possible)	Natural occurrence / range expansion	**Natural expansion** from regional breeding territories
2	Chordata – Actinopterygii	**Redbelly tilapia**	*Coptodon zillii*	Well established	Uncertain (non-native in many Iraqi freshwater contexts)	**Potentially invasive / high concern**	Established population	Aquaculture / fisheries introductions; secondary spread

								through connected waterways
3	Plantae – Myrtaceae	**River Red Gum**	*Eucalyptus camaldulensis*	Well established (planted)	**Introduced** (anthropogenic planting)	Potentially invasive in riparian settings (context-specific)	Widely planted / naturalized in places	Intentional planting (afforestation, roadside, shelterbelts); subsequent local spread

4.3.1.1.2.12 Conclusions and Recommendations

Survey results indicate that the Ishaqi area has elevated ecological value due to the confirmed presence of key faunal species and habitat features supporting their persistence. Four globally threatened taxa were confirmed at the site, including the Endangered Euphrates Softshell Turtle (*Rafetus euphraticus*) and three Vulnerable fish species: Yellowfin Barbel (*Luciobarbus xanthopterus*), Binni (*Mesopotamichthys sharpeyi*), and Shabout (*Arabibarbus grypus*). Additional fish species recorded include *Mastacembelus mastacembelus* (Euphrates spiny eel) and *Planiliza abu* (Abu mullet), which are native to the Tigris–Euphrates basin. The site also provides suitable habitat for bird taxa of particular biogeographic interest, including the Mesopotamian subspecies/races Hooded Crow (*Corvus cornix capellanus*) and Little Grebe (*Tachybaptus ruficollis iraquensis*), and restricted-range species such as White-eared Bulbul (*Pycnonotus leucotis*) and Iraq Babbler (*Argya altirostris*).

Given the limited survey duration and seasonal/timing constraints, there is a high likelihood that additional biodiversity features of conservation concern may be present. Accordingly, at this stage the following actions are recommended:

- Pre-construction surveys: Conduct additional field surveys prior to construction to strengthen baseline data, including (i) updated flora checklists, quantitative vegetation/land cover assessments, land use mapping, and GIS-based habitat mapping; and (ii) expanded fauna surveys with particular focus on aquatic taxa and terrestrial/aquatic invertebrates (including hexapods and associated groups).
- Critical Habitat assessment update: If screening indicates the potential presence of Critical Habitat features, RBD should complete an updated Critical Habitat Assessment (CHA) prior to construction and update it as needed during implementation to inform design refinements and mitigation measures consistent with ESS6.
- Biodiversity Management Plan: RBD should Prepare a Biodiversity Management Plan (BMP), based on the findings of the additional field surveys and the CHA, setting out the measures required to avoid, minimize, mitigate, monitor, and, where necessary, compensate for impacts on biodiversity values, natural habitats, and associated ecosystem services.
- Offsets / Net Gain: If Critical Habitat is confirmed and residual impacts remain after applying the mitigation hierarchy, assess whether biodiversity offsets are required to achieve applicable ESS6 outcomes (including Net Gain where required) through a Biodiversity Offset Management Plan, to be reflected in the Project's commitments as appropriate.

4.3.1.2 KRI Sub-projects

Sulaymaniyah–Chamchamal–Kirkuk Road (KRI)

1. Habitat Types Along the Corridor

The project corridor is situated within a landscape heavily shaped by long-term agriculture, dispersed industrial activity, and expanding sub-district urban areas. Habitat types along this section are predominantly modified environments, with only small, localized semi-natural elements linked to seasonal hydrology and foothill terrain.

Table 4-25: Habitat Types Found along the Sulaymaniyah–Chamchamal–Kirkuk Road

Habitat Type	Description (Sulaymaniyah–Chamchamal–Kirkuk Road)	ESS6 Habitat Classification
Agricultural Modified Habitat (Dominant)	Predominantly rain-fed agricultural land with large open fields on both sides of the corridor; in parts of the broader corridor setting, agriculture is intensified by the presence of approximately 1,200 plastic-cover nurseries.	Modified habitat
Urban and Semi-Urban Modified Habitat	Sub-districts and built-up clusters where agricultural land transitions into residential and commercial areas (dense housing pockets, roadside commercial strips, semi-urban development).	Modified habitat
Industrial Habitat (Scattered)	Intermittent industrial premises (factories, workshops, quarries, storage yards), typically with compacted ground and largely bare surfaces.	Modified habitat
Roadside Planted Habitat (Artificial Vegetation)	Planted tree rows and managed vegetation along the roadside, embankments, and/or central median.	Modified habitat
Semi-Natural Seasonal Stream Channels (Localized Riparian Features)	Four seasonal wadis crossing beneath bridges/culverts that form narrow riparian micro-habitats with temporary wet-season vegetation: Wadi 1 (St. 11+375), Wadi 2 (St. 27+525), Wadi 3 (St. 37+655), Wadi 4 (St. 04+250).	Semi-natural feature (localized); not natural/critical habitat within footprint
Semi-Natural Dry Foothill Habitat (Localized)	Limited foothill sections that remain natural in structure, with very sparse vegetation driven by climatic and soil conditions.	Semi-natural feature (localized); not natural/critical habitat within footprint

No protected areas, reserves, or designated biodiversity sites are present within the project's area of influence. In line with ESS6, habitats along the alignment are considered predominantly modified, while the seasonal stream channels and localized dry foothill areas represent limited semi-natural features. No natural or critical habitat occurs within the project footprint.

2. Flora

Vegetation along this section reflects a landscape heavily shaped by agriculture, roadside planting, and settlement expansion. Natural formations are largely absent along the corridor.

The central median supports intentionally planted tree species established under earlier environmental programs, including pine, mulberry, and eucalyptus. These trees are ornamental or non-native

selections commonly used for shade, dust reduction, and aesthetic purposes. Along the shoulders, notable wild vegetation is generally absent, with only sparse opportunistic plants occasionally present.

Agricultural vegetation dominates the wider landscape outside the right-of-way, consisting mainly of wheat and barley fields, seasonal open-field crops, and large clusters of plastic-covered nurseries in parts of the corridor setting. Some artificially planted pine clusters may occur on adjacent hillsides, established for aesthetic and environmental enhancement rather than representing natural woodland.

No rare, threatened, or protected plant species are known to occur along the project corridor.

3. Fauna

Fauna along this section consists of species typical of agricultural and semi-urban landscapes in the Kurdistan Region. Commonly reported wildlife includes foxes, hares, wild pigs, hedgehogs, small rodents, and a range of resident birds. Livestock such as sheep and cattle are present where shepherding takes place near agricultural fields and grazing areas.

These species are generally adapted to modified environments. Seasonal stream channels with temporary vegetation may offer localized foraging or movement areas for birds and small mammals.

Animal movement is influenced by the absence of designated crossing points. Wildlife and livestock typically cross the road directly, which can result in interaction risks with vehicles.

The region lies within a flyway route for migratory birds from Eastern Europe and West Siberia to Mesopotamia and Africa. However, no species of conservation concern, critical habitats, or migratory bottlenecks have been identified within the project area.

Girsheen–Suhaila Road Upgrade and Girsheen Interchange (KRI)

1. Habitat Types Along the Corridor

Habitat types along the corridor are dominated by agricultural land and associated disturbed areas and are therefore classified as modified habitat. Land use along the alignment reflects long-established rain-fed cultivation, field margins, tracks, and other human land uses, with biodiversity values shaped primarily by ongoing agricultural activities and settlement-related disturbance. No protected areas, nature reserves, or designated biodiversity sites are located within the sub-project Area of Influence (AoI). In accordance with ESS6, habitats encountered within the AoI are considered modified habitats, and no natural or critical habitat is identified along the alignment.

2. Flora

Vegetation along the corridor reflects a long-modified agricultural landscape shaped by rain-fed cultivation and other human activities. Natural vegetation has been substantially altered, and existing plant cover is largely limited to common shrubs, grasses, and herbaceous species typically associated with agricultural margins, disturbed ground, and roadside environments. Based on available information, all plant species recorded within the AoI are widespread and classified as Least Concern (LC). No rare, threatened, endemic, or legally protected plant species are known to occur along the alignment.

Table 4-26: List of Identified Flora Species for the Girsheen–Suhaila Road Upgrade and Girsheen Interchange Sub-projects

Common Name	Scientific Name	Conservation Status
Spanish Flag	*Lantana camara*	Least Concern
Clary Sage	*Salvia verbenaca*	Least Concern
Nettleaf Sage	*Salvia urticifolia*	Least Concern
Sagebrush and mugwort spp.	*Artemisia* spp.	Least Concern
Sword Lily	*Gladiolus palustris*	Least Concern
Anemone	*Anemone coronaria*	Least Concern
Field Bindweed	*Convolvulus arvensis*	Least Concern
Asphodel	*Asphodelus albus*	Least Concern
Star of Bethlehem	*Ornithogalum umbellatum*	Least Concern
Persian oak	*Quercus brantii*	Least Concern
Thistle spp.	*Carduus*, *Cirsium*, and *Onopordum*	Least Concern

3. Fauna

Fauna within the AoI is typical of modified agricultural landscapes and disturbed roadside environments. The corridor lies within a broader regional migratory flyway used by birds moving between Eurasia and Africa; however, the AoI is not understood to function as a migratory bottleneck, a breeding concentration area, or a key stopover habitat. Available observations and records indicate the presence of common bird species and widespread small mammals, reptiles, and amphibians typically associated with agricultural mosaics and human-modified settings. Based on available information, all fauna recorded within the AoI are classified as Least Concern (LC), and no threatened, endemic, or legally protected fauna species are known to occur within the AoI. In accordance with ESS6, the AoI does not contain natural habitat or critical habitat for fauna.

4.4 Socio-economic Baseline

4.4.1 Administrative Context

4.4.1.1 Expressway No. 2 (Baghdad - Samarra)

The Expressway No. 2 alignment extends between Samarra and Baghdad and crosses multiple administrative jurisdictions in central Iraq. The corridor lies primarily within Salah Al Din Governorate in its northern and central sections and enters Baghdad Governorate toward the southern section, with an additional branch falling within Al Anbar Governorate. Within this overall administrative setting, the alignment intersects four districts that form the main units used for socioeconomic profiling and coordination: Samarra, Balad, Al Kadhimiyah, and Al Fallujah. These districts include a mix of rural villages, agricultural settlements, peri urban neighbourhoods, and transport-oriented activity zones that rely on existing highway and local road networks.

4.4.1.2 R9B Segment under Expressway No. 1

The R9B subproject is located within Al Anbar Governorate and covers the section of Road R9B connecting the Fallujah to Ramadi area. The corridor forms part of a strategic westward route that links Baghdad to the Jordanian border, with the R9B section beginning at approximately chainage 40 km and extending to approximately chainage 124 km, for an indicative length of 84 km. The alignment passes through a context shaped by major transport functions, roadside settlements, and service and maintenance activities associated with the existing roadway.

4.4.1.3 Girsheen–Suhaila Road Upgrade and Girsheen Interchange

This subproject is located in Duhok Governorate in the north western part of the Kurdistan Region of Iraq, within Zakho District and specifically the Batil Sub district. The corridor includes the Girsheen to Suhaila road section and the Girsheen intersection area on the Duhok to Zakho road, which functions as a key route supporting cross border transport movements toward the Ibrahim Khalil border crossing. The administrative setting is therefore defined by a combination of rural settlements, agricultural land uses, and transport and logistics activity associated with a high share of freight traffic.

4.4.1.4 Sulaymaniyah–Chamchamal–Kirkuk Road

This subproject is located within Sulaymaniyah Governorate in the Kurdistan Region of Iraq and forms part of the primary intercity corridor connecting Sulaymaniyah toward Kirkuk. The upgraded section extends from the Tasluja area toward Bani Maqan and runs in proximity to Bazian and Chamchamal districts. The corridor passes through a landscape that combines agricultural land, built up clusters, and a prominent industrial belt that generates substantial heavy vehicle movement alongside regular passenger and commercial traffic. Settlements and service clusters along the corridor include communities in direct contact with the road such as Allayi, Bazian, Tainal, Gopalla, Chamchamal, Shorsh, and Takiya.

4.4.1.5 Administrative oversight and institutional responsibilities for the federal Iraq and the KRG subprojects

Administrative oversight for the two federal Iraq road subprojects is led at national level by MCHMPW through the RBD, with day-to-day coordination undertaken through the relevant project management arrangements and the governorate and district administrations along each corridor. For Expressway No. 2, this includes coordination across Salah al-Din Governorate, Baghdad Governorate, and Al Anbar Governorate. For R9B, oversight is coordinated through the same national road authority interface with local administration in Al Anbar for corridor level implementation support. Across both federal corridors, local authorities and sectoral directorates provide the institutional interface needed for land and asset verification, service continuity, and community liaison, including district and sub district administrations, municipality directorates, land registration and cadastre offices, agriculture and water resources directorates, education and health directorates, social welfare entities, traffic police, and antiquities authorities. Mukhtars and community leaders support local level communication, validation of household and land use information, and facilitation of engagement activities.

Administrative oversight for the two Kurdistan subprojects is led under the KRG through the relevant governorate level road authorities, with implementation responsibilities carried by the road directorates in Duhok Governorate and Sulaymaniyah Governorate and supported by district and sub district administrations along each corridor. Similar to the federal setting, sectoral authorities provide the required interface for land administration, utilities and service coordination, traffic management, environmental compliance oversight, and cultural heritage management. Municipality directorates and local administrations act as the primary entry points for coordination with communities and for managing issues related to local access, roadside activities, and community facilities near the alignment.

Across all four road subprojects, this institutional structure provides the administrative basis for implementing land and access management measures, maintaining service continuity during works, managing traffic and community safety risks, coordinating with utilities, and carrying out stakeholder

engagement and grievance management in a manner that is consistent across federal Iraq and the Kurdistan Region while respecting the applicable administrative jurisdictions.

4.4.2 Demographic Profile

This subsection summarizes the main demographic features relevant to the road subprojects, focusing on population distribution and settlement patterns, age and household structure, and population mobility linked to displacement and return.

Households in federal Iraq are commonly family-based, with extended family living arrangements remaining prevalent in many locations. Iraq's national census results reported an average household size of around 5.3 persons, and that children under 15 represent about 36% of the population. Household composition also includes female-headed households, reported nationally at about 8.9%, which is relevant for vulnerability screening.

In the Kurdistan Region, census reporting indicates a smaller average household size around 4.6 persons, consistent with a long-term trend of declining household size. Displacement and return dynamics remain relevant to demographic patterns in several governorates crossed by the Project, including Al Anbar and Salah al Din, and in parts of the Kurdistan Region.

4.4.2.1 Expressway No. 2 (Baghdad–Samarra)

The corridor traverses a mix of dense urban and peri-urban settings around **Baghdad**, as well as smaller towns and rural communities in **Salah al-Din Governorate** and the corridor's western interface with **Al Anbar Governorate**. The demographic setting is therefore characterized by (i) high population concentration and daily commuter flows in the metropolitan Baghdad area, and (ii) more dispersed settlement patterns in the northern and western governorate segments where livelihoods and service access are more strongly linked to local towns and rural hinterlands. Recent official estimates place the population of Baghdad Governorate at about 9.0 million (2022)[28].

Across the corridor's federal governorate setting, population mobility remains an important baseline feature due to conflict-related displacement and subsequent return movements. Displacement and return trends are particularly relevant where the corridor intersects or connects to districts that previously experienced significant conflict impacts, influencing household composition, housing conditions, and access to livelihoods and services[29].

4.4.2.2 R9B Segment under Expressway No. 1

The R9B section is situated within **Al Anbar Governorate** and links major urban centers and peri-urban belts with surrounding rural and roadside communities. The demographic profile is shaped by the concentration of population in the main cities along the Euphrates corridor and the presence of smaller settlements, agricultural holdings, and roadside economic activities that depend on the regional road network for access to markets and services.

Population mobility is a defining characteristic of the Anbar baseline due to the legacy of conflict displacement and progressive return. Recent official estimates place Anbar's population at about 2.0 million (2022). The Governorate continues to host internally displaced persons (IDPs) while also

[28] European Union Agency for Asylum
[29] European Union Agency for Asylum

recording substantial return movements, which is relevant for understanding vulnerability, household recovery trajectories, and potential sensitivities to construction-related disruption[30].

4.4.2.3 Girsheen–Suhaila Road Upgrade and Girsheen Interchange

This corridor is located in the Kurdistan region setting within **Duhok Governorate**, with local demographics characterized by a combination of district-level urban concentrations and smaller village clusters along the alignment. The corridor is associated with settlement patterns around **Zakho** District and nearby subdistrict communities, with several villages located in the project's immediate zone of influence.

The wider Duhok context is strongly influenced by displacement-related mobility, as the Governorate is a major host area for IDPs within Iraq. The most recent displacement tracking indicates Duhok is among the highest IDP-hosting governorates nationally (with more than 200,000 IDPs recorded). This has implications for the baseline profile of service demand, housing pressures in some localities, and the composition of vulnerable groups along key transport corridors.

4.4.2.4 Sulaymaniyah–Chamchamal–Kirkuk Road

This corridor is located in the Kurdistan region setting within **Sulaymaniyah Governorate** and interfaces with surrounding districts that connect the Sulaymaniyah economic zone with strategic inter-governorate routes. The demographic setting includes a mix of town-centered populations and rural village clusters along the alignment, with local settlement patterns shaped by agriculture, small business activity, and commuting to nearby district centers.

As with Duhok, the wider Sulaymaniyah setting includes displacement-related mobility dynamics. Recent displacement tracking identifies Sulaymaniyah as a major IDP-hosting governorate. At the Kurdistan Region scale, preliminary census announcements indicate the region's population exceeds 6.37 million, underscoring the significance of regional urban growth and internal mobility.

4.4.3 Livelihoods and Land

Across Iraq, livelihoods along major road corridors are typically shaped by three interacting factors: (i) adjacent land use (agriculture, industry, desert fringe), (ii) the legal status and enforcement of RoW restrictions, and (iii) corridor-based income tied to movement of people and goods (transport, roadside services, small trade). Informal and semi-formal work remains a major feature of the labour market nationally, and many households rely on mixed income strategies that combine farming, daily wage work, and small trade.

4.4.3.1 Expressway No. 2 corridor (Baghdad–Samarra)

The Expressway No. 2 corridor intersects a predominantly rural to peri-urban landscape where irrigated agriculture is the main land use in large stretches, alongside settlement clusters and corridor-facing commercial pockets. Farming systems include cereal and vegetable cultivation and livestock keeping, supported by irrigation and drainage networks. Land and water-dependent activities are therefore directly linked to access routes, canal crossings, and seasonal movement of farm inputs and produce.

[30] European Union Agency for Asylum

Land tenure along rural segments commonly combines formal titles with customary arrangements, including leasing and sharecropping. These practices influence who depends on the land for income and how disruption risks are distributed between owners, tenants, and seasonal users. In post-conflict contexts, disputed claims and fragmented documentation can also influence compensation and livelihood restoration planning.

Beyond farming, the Expressway No. 2 corridor supports a strong road-economy layer: trucking and freight services, roadside retail and repair activities, and service functions that depend on uninterrupted mobility. Where aquaculture and grazing occur near the alignment, risks are typically linked to access restrictions, interference with irrigation and drainage, and road safety issues affecting livestock movement.

Based on the current preliminary land acquisition assessment for Expressway No. 2, the intended permanent land acquisition is expected to affect residential assets, fish farms, agricultural land under wheat/barley cultivation, and fruit orchards, with an estimated total affected population of 3,078 persons, as summarized in Table 4-27 below.

Table 4-27: Summary of Affected Assets, Fish Farms, Agricultural Area, and Affected Population for Expressway No. 2

Receptor / Asset Type	No.	Area [m²]	PAPs
Buildings	475	138,256	2,517
Schools	-	-	-
Mosques	-	-	-
Fish Farms	12	207,934	12
Agriculture Land – Wheat and Barley	460	1,726,047	460
Agriculture Land – Fruit Orchards	89	395,556	89
Total Affected Population			**3,078**

4.4.3.2 R9B Segment under Expressway No. 1

In Al Anbar Governorate, land use transitions between desert landscapes and more productive agricultural belts concentrated around watercourses and irrigated pockets. Livelihoods in settled areas commonly combine agriculture, livestock-related activity, public employment, and corridor-facing commerce. This creates a baseline where household income is sensitive to changes in access, water management features, and travel-time reliability.

RoW restrictions are an important baseline feature affecting how land can be used near public roads, including controls on encroachment and unlicensed use. In practice, the corridor can still include competing uses within or near the RoW, such as informal access points, small service structures, and utility interfaces.

The R9B corridor's road-economy layer is typically driven by movement between key urban centres, including Fallujah and Ramadi. Livelihood sensitivities commonly relate to roadside services (fuel, food, repair), rest area style investments, and any utilities intersecting the corridor (for example pipelines or transmission features where present). These activities are highly sensitive to traffic management, temporary closures, and changes to U-turns, junction access, and service road continuity.

4.4.3.3 Girsheen–Suhaila Road Upgrade and Girsheen Interchange

The corridor setting includes rural land uses dominated by agriculture and open land, with livelihood patterns that typically combine farming with trade and corridor-facing services. Around the overpass location, land use includes agricultural plots alongside clusters of roadside commercial activity (such as fuel, workshops, small retail, food outlets, and storage) that depend on passing traffic.

The overpass footprint interacts more directly with productive land and roadside economic uses. This creates a baseline sensitivity where agricultural land take and disruption to business access can affect income, even if the core road rehabilitation is largely within an established RoW.

Livelihood dependence is highest where commerce has formed around junction functions and traffic nodes. The most relevant sensitivities are (i) permanent loss of productive land where required for the overpass and tie-ins, and (ii) temporary disruption to business access, parking, customer flow, and local circulation during construction.

Based on the current preliminary land acquisition assessment for the Girsheen Interchange, the intended permanent land acquisition is expected to affect agricultural land, crop production, and localized economic activities, with an estimated total of 15 affected persons, as summarized below.

Table 4-28: Affected Assets under the Girshreen Interchange

Receptor / Asset Type	**Preliminary Estimate**
Affected Agricultural Land Area	65,000 m²
Affected Crop Production	20 Ton
Affected Economic Activity Area	900 m²
Physically Affected Population	**15 Persons**

4.4.3.4 Sulaymaniyah–Chamchamal–Kirkuk Road

The corridor includes a mixed economic landscape with strong agriculture and livestock presence, alongside industrial activity in parts of the wider area. A notable baseline feature is the presence of commercial-scale plant nurseries and related agricultural enterprises, as well as industrial facilities concentrated in designated industrial zones. This mix creates a livelihood baseline that is sensitive to land access, heavy vehicle movement, and continuity of feeder roads serving farms and industrial sites.

Even where no new land acquisition is planned, the baseline includes structures and productive assets located close to, and in some cases partially within, the RoW footprint. This increases sensitivity to construction staging, temporary access management, and clear communication on what is inside versus outside the working corridor.

The corridor supports a layered road economy that includes freight transport, industrial logistics, and roadside service clusters. Livelihood risks are typically linked to temporary disruption (access limitations, short-term business interruption, and changes in circulation patterns) rather than permanent livelihood loss, provided that access is managed and reinstated consistently.

4.4.4 Road Safety and Accident History

Road safety is an important baseline consideration for the Project given the nature of the proposed subprojects and their interface with existing interurban and regional road networks. Available official statistics indicate that road traffic injuries remain a significant issue in Iraq, with traffic-accident injuries recorded in emergency wards increasing from 96,588 cases in 2020 to 229,939 cases in 2024.

For governorates relevant to the Project Road corridors, the table below shows the road accidents and mortality rate for the year 2024:

Table 4-29: Road Accidents and Mortality Rate for the year 2024 across Project Governorates

Governorate	Road Accidents in 2024	Road Traffic Mortality Rate per 100,000
Baghdad	34,172	8.4
Al Anbar	41,461	16.1
Salah Al Din	3,370	11.4
Erbil	11,192	13.5
Duhok	4,237	6.7
Al Sulaymaniyah	5,624	8.7

The available data shows that road safety conditions vary considerably between governorates and that the Project is being developed in a context where traffic safety risk is already present and, in some corridors, substantial.

More localized evidence is also available for R9B section in Al Anbar Governorate. Official traffic police records for the period from 1 January 2025 to 27 October 2025, covering the expressway sector between Km 17 and Km 252, recorded 62 accidents, resulting in 20 deaths and 111 injuries. The same record notes that contributing factors include irregular openings, absence of protective and wire fencing, pavement defects and depressions along the expressway, and inadequate reconfiguration of overpasses used to transfer traffic between carriageways. This indicates that existing road safety constraints are linked not only to traffic volumes and driver behavior, but also to road geometry, access control, roadside protection, and pavement condition.

4.4.5 Services and Living Conditions

Across the Federal Iraq and Kurdistan Region corridors, living conditions and access to services are shaped mainly by (i) urban–rural differences, (ii) post-conflict recovery pressures in parts of the Federal corridors, and (iii) infrastructure reliability rather than "presence" of infrastructure. Service access is generally stronger in or near main towns and district centres, while smaller settlements rely on intermittent networks, private coping measures, and travel to larger service hubs.

Electricity access is widespread, but reliability remains a defining constraint. Nationally, grid supply has historically not matched demand, and households and businesses commonly rely on private generators to bridge daily outages. This is relevant to all corridors because outages affect water pumping, health services, education facilities, telecommunications uptime, and construction-phase safety and traffic management operations.

Water supply is typically delivered through municipal networks where available, but performance varies by locality. Communities often supplement with wells, tanker supply, storage tanks, and

household treatment where quality or continuity is a concern. In the Kurdistan Region, public reporting shows ongoing drinking water infrastructure investments and highlights network losses as a persistent issue.

Sanitation and wastewater services are uneven, with many communities relying on septic tanks where sewer networks are absent or incomplete. National WASH assessments and investment planning documents continue to identify sewerage coverage and treatment capacity as priority gaps.

Solid waste services vary by municipality and are frequently constrained by collection coverage, transfer capacity, and disposal practices. Country-level programming notes that a substantial share of waste is disposed of in unregulated landfill conditions, which influences local nuisance impacts (odour, vectors, burning) and health risks.

Health and education services are generally concentrated in larger towns, with smaller settlements depending on clinics, basic schools, and onward travel for higher-level services. This matters for impact assessment because construction detours, access restrictions, and traffic risk can affect time-sensitive access to clinics, schools, markets, and emergency response routes.

Digital connectivity is widely used, but service quality varies by location and power availability. Recent international statistics indicate that internet use is high nationally, supporting the feasibility of digital channels for stakeholder engagement, grievance uptake, and project communications where needed.

Overall, the baseline indicates that any access restrictions, detours, or prolonged service interruptions during construction could disproportionately affect rural settlements and low-income households, and therefore require careful traffic management and stakeholder communication.

4.4.6 Social Context

4.4.6.1 Social organization and local leadership

Across the project corridors in Iraq, community life is strongly shaped by extended family networks and locally recognized leadership structures. In rural and peri-urban settings, informal influence often sits alongside formal administration through community representatives (including mukhtars), tribal and clan leaders, and respected local figures who play practical roles in mediating disputes, validating social information, and convening households. This social structure affects how information is shared, how concerns are raised, and how community members participate in consultations, especially for topics linked to land, access, and compensation.

4.4.6.2 Social cohesion, security, and conflict sensitivity

Social cohesion and perceptions of safety vary by location and are influenced by the legacy of conflict, local governance capacity, and the presence of security actors. Community trust and acceptance of project activities are generally affected by whether households perceive processes as transparent and fair, particularly around land take, access changes, and employment opportunities. Security conditions and movement controls can also influence day-to-day mobility and participation, including the feasibility of gatherings, the ability of women and vulnerable groups to attend meetings, and the reliability of access to services during construction.[31]

[31] European Union Agency for Asylum

4.4.6.3 Displacement, return, and documentation dynamics

Displacement and return remain relevant social features across multiple parts of the corridors, shaping household vulnerability and the strength of tenure and documentation. The International Organization for Migration Displacement Tracking Matrix documents continued presence of internally displaced persons and returnees across governorates, with implications for housing stability, access to livelihoods, and administrative documentation. These dynamics matter for project design because households with weaker documentation or disrupted land records can face higher barriers to compensation processes, grievance uptake, and livelihood restoration support if impacts occur.[32]

4.4.6.4 Gender norms, participation, and gender-based violence sensitivity

Gender roles across the corridors are generally characterized by male-dominated public decision-making and more limited mobility and public participation for many women, especially in rural areas. National datasets indicate low female labour force participation compared with men, which affects how project-related employment and training opportunities are likely to be accessed and who benefits directly from short-term job creation.

Risks related to gender-based violence and under-reporting remain an important sensitivity in conservative contexts, particularly where cash-for-work, labour influx, or changes in mobility patterns occur. Referral pathways and survivor support services exist, but access and willingness to report can be constrained by stigma and limited coverage in some areas, which should be considered when designing worker and community grievance channels and awareness measures.[33]

4.4.6.5 Vulnerable groups and inclusion considerations

Vulnerability in the project corridors commonly relates to a combination of income insecurity, displacement history, disability and age-related mobility constraints, and dependence on land-based livelihoods. Groups that often face higher barriers to participation and access include female-headed households, low-income households relying on informal work, older persons, persons with disabilities, internally displaced persons and returnees, and households dependent on smallholder agriculture and roadside micro-businesses. These groups may experience disproportionate impacts from access restrictions, short-term business interruption, or disruption to service routes during construction, and they may require tailored communication methods and additional assistance to engage meaningfully.

4.4.7 Cultural Heritage Context

A review of available records, stakeholder information, and field observations indicates that cultural heritage conditions vary across the subprojects included under the Project.

For Expressway No. 2, cultural heritage is a relevant baseline consideration in specific sections of the corridor. Archaeological traces have been identified along parts of the alignment and, according to the Iraqi Antiquities Authorities, these traces may represent the course of an old river channel or the boundary of an ancient settlement. In addition, some access road sections in the Samarra area are located within areas that have not yet been screened for archaeological sites. As a result, it is not currently possible to confirm whether archaeological remains may be present in those sections, and further archaeological verification may be required prior to works.

[32] iraqdtm.iom.int
[33] iraq.unwomen.org

For the Sulaymaniyah–Chamchamal–Kirkuk Road in the Kurdistan Region of Iraq, the baseline indicates the presence of both archaeological and community heritage receptors in proximity to the corridor. Available information confirms the presence of archaeological sites near the alignment, including one site that is already fenced and under the supervision of the Directorate of Antiquities. The corridor also passes near community heritage features, including cemeteries and a martyr monument that holds local commemorative significance. This indicates that cultural heritage sensitivity along this subproject is not limited to archaeological remains, but also includes features of social and memorial importance to nearby communities.

For the Girsheen-Suhaila Road Upgrade and Construction of the Girsheen Overpass in the Kurdistan Region of Iraq, the available review indicates no known cultural heritage constraints within or in the immediate vicinity of the project area. Based on the available records and field observations, no known cultural heritage sites, archaeological remains, historically significant structures, cemeteries, or protected heritage sites have been identified along the corridor. The alignment does not appear to pass through designated cultural heritage zones.

Overall, the project-level baseline confirms that cultural heritage is a relevant but location-specific issue across the Project. Accordingly, cultural heritage should be treated as a project-relevant baseline topic, with the detailed identification and assessment of specific receptors to be addressed further in the subproject-specific environmental and social impact assessments.

4.4.8 Key Sensitivities for Impact Assessment

Across the four road corridors in Iraq and the Kurdistan Region, the baseline indicates the following priority sensitivities that should guide impact scoping, risk ranking, and mitigation design.

1. **Land access, tenure complexity, and compensation eligibility**: Corridor-adjacent land uses include cultivated areas, grazing routes, and roadside economic assets, with mixed tenure and use arrangements that can complicate asset verification, eligibility, and timely compensation, especially where documentation is weak or contested.
2. **Displacement and return as a vulnerability driver**: The presence of IDPs and returnees in parts of the federal corridors and in the wider Kurdistan Region context can increase sensitivity to project-induced disruption due to weaker tenure security, reduced coping capacity, and administrative documentation barriers.
3. **High dependence on informal and mixed livelihoods**: Many households combine seasonal farming, casual labour, transport-related income, and small trade, which increases sensitivity to even short interruptions to access, local circulation, and market connectivity.
4. **Roadside micro-business exposure to traffic management changes**: Roadside services and small commerce can be disproportionately affected by temporary detours, closure of informal access points, changes in U-turn locations, and loss of passing trade, even when land take is limited.
5. **Security conditions and movement constraints**: Localized security dynamics and checkpoints can influence mobility, access to communities, and the feasibility of consultation and supervision activities, and may affect emergency response routes during construction. Accordingly, the project will employ security personnel to safeguard workers, assets, and facilities during construction and rehabilitation. A standalone Security Management Plan has been developed, detailing the level of security needed for construction and operations. It will

assess health and safety risks from interactions between security staff, workers, and communities, and outline mitigation measures, including risk assessment, responsibilities, conduct protocols, training, and community engagement procedures. Security staff must follow a Code of Conduct set by the SEA/SH Prevention and Response Action Plan. Management of security personnel will adhere to proportionality, GIIP, ESS4, and national laws concerning hiring, training, equipping, monitoring, and oversight, to reduce risks to communities. Sub-project ESIAs/ESMPs and related documents will include mandatory mitigation during civil work, binding contractors and workers to protect community health and safety. E&S instruments will also provide emergency response measures for incidents such as fires, explosions, leaks, or spills, ensuring prompt action to prevent harm and address adverse impacts when necessary.

6. **Gender disparities in participation and benefit sharing**: Low female labour force participation and mobility constraints in many communities can reduce women's access to project jobs and consultation processes unless engagement and recruitment measures are designed to be inclusive and locally appropriate.
7. **GBV risk triggers during construction**: Construction labour dynamics, cash-based employment, and changes in local movement patterns can increase GBV risk in conservative contexts, making it important to integrate prevention measures, confidential reporting channels, and referral awareness into worker and community systems.
8. **Service continuity and utility interfaces**: Communities commonly experience service reliability constraints and rely on coping mechanisms; therefore, disruptions to water lines, electricity, local access roads, and telecom infrastructure can have outsized effects on daily living conditions and small businesses.
9. **Cumulative and induced development effects at nodes**: Upgraded Road connectivity can accelerate roadside development at junctions and service nodes, increasing pressure on land use, safety, and waste management unless controlled access and enforcement measures are coordinated with local authorities.

5 Impact Assessment

The Consultant applied professional judgement supported by verification using secondary information sources and relevant experience/data from comparable projects in the area in preparing this chapter.

The ESIA identifies and evaluates the significance of potential E&S impacts (positive and negative) associated with project activities during the pre-construction, construction, and operational phases. The impact assessment was undertaken through the following steps:

1. Identification of potential impacts.
2. Evaluation of impacts and determination of significance.
3. Identification of mitigation measures to avoid, minimize, or otherwise manage significant impacts.
4. Determination of residual impact significance after mitigation, recognizing that significance may decrease depending on mitigation effectiveness (e.g., major to moderate; moderate to minor; minor to negligible in some cases).

5.1 Impact Assessment Methodology

The identified potential environmental and social impacts are evaluated against baseline conditions at the proposed location, and the applicable E&S standards which are set during the project pre-construction, construction and operational phases of the project.

Each potential impact resulting directly or indirectly from the project is categorized based on the magnitude and the receptor sensitivity. Based on these two parameters, the impact significance is evaluated. The significance of each potential impact will depend on the project activities and the potential impacts on the environmental receptor. Impact Magnitude: The criteria for defining the impact magnitude includes assessing the following parameters as presented in Figure 5-1.

- Magnitude: describes the quantity of the resource (or receptor) potentially affected by the activity.
- Spatial extent: the geographical area over which the impact is experienced.
- Duration: the length of time over which the impact will be experienced. An impact may be present only while an activity is active, or it could persist long after the activity has ceased, in which case the duration may be regarded as the time the receptor needs to recover from the effect.

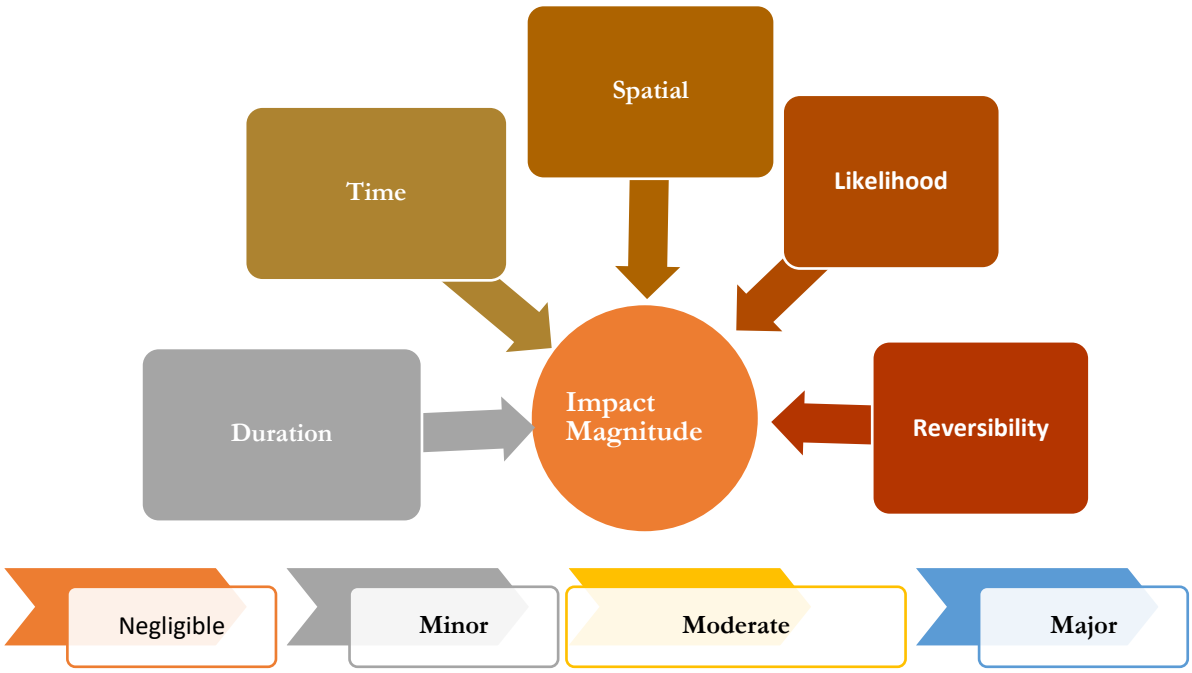


Figure 5-1: Impact Assessment Methodology

Each potential positive and negative impact resulting directly or indirectly from the project will be categorized based on Magnitude and Sensitivity of the receptor.

a) Magnitude of Impact: The impact resulting from the project will first be categorized as a positive or negative impact; the latter will be further analysed, and its magnitude assessed as: Negligible, Minor, Moderate, or Major. Various considerations come into play as the experts assess the impacts, the main parameters are:

- Duration - As the time duration of the impact increases, it is weighed more heavily. Special consideration is given to impacts that go beyond the project's anticipated life-expectancy.
- Time – The time of which an impact commences or occurs can be vital to construction and maintenance operations.
- Spatial – The area impacted is to be considered, as some impacts may extend beyond the project's boundaries or interfere with land regulations, etc.
- Likelihood – The chance of an impact occurring and its frequency is to be assessed
- Reversibility - The possibility and extent to which an impact can be intervened or mitigated for a factor to return to the Baseline environment

After an analysis of the various parameters, an impact's magnitude is categorized as follows:

- Negligible – No anticipated change to the baseline environment
- Low – Minor anticipated change to the baseline environment
- Medium – Moderate anticipated change to the baseline environment
- High – Significant anticipated change to the baseline environment

b) Sensitivity of the receptor: Sensitivity of the receptor is based on the relationship between the respective project and present baseline environment (the receptor). It is assessed based on vulnerability of the receptor, including the surrounding population and environment. As the effect of an impact is more readily absorbed and easily mitigated it is less sensitive; on the other hand, as an impact is more challenging to mitigate and cannot be absorbed by the population and environment it becomes more sensitive and requires an extensive management plan.

The sensitivity of the receptor is assessed as:

- Low- Existing capacity to absorb/mitigate impact
- Medium – Limited capacity to absorb/mitigate impact
- High – No capacity to absorb/mitigate impact

c) Impact Evaluation: The resultant of the magnitude of the impact and sensitivity of the receptor for each impact is evaluated to generate the impact's significance and overall assessment. The following table illustrates how the two factors are coupled.

Table 5-1: Impact Evaluation Matrix

Sensitivity of Receptor	**Magnitude**			
	High	**Medium**	**Low**	**Negligible**
High	**Major**	**Major**	**Moderate**	**Negligible**
Medium	**Major**	**Moderate**	**Minor**	**Negligible**
Low	**Moderate**	**Minor**	**Minor**	**Negligible**

5.1.1 Identification, Evaluation and Assessment of Key E&S Impacts

Impact Assessment will be carried out for:

1) Pre-Construction
2) Construction phase;
3) Operation and maintenance phase;

Impacts may occur directly (immediate effects of an activity), indirectly (effects that occur later in time or at a different location), or cumulatively (in combination with other past, present, or reasonably foreseeable activities). Each identified impact is evaluated against baseline conditions and categorized in terms of significance to determine the level of management required.

Impacts assigned Moderate or Major significance require targeted mitigation measures to avoid, minimize, restore, or otherwise manage the impact. Impacts assigned Minor significance are addressed through standard good practice measures and routine management controls, as appropriate. Following application of mitigation measures, residual impacts are reassessed to confirm the remaining significance level and to determine any additional management or monitoring requirements.

5.1.2 Scope and Application of the Impact Assessment

The impact assessment presented in this chapter has been undertaken at the Project level to identify and evaluate the principal E&S risks and impacts associated with the different ITREC sub-projects

and intervention types. This approach is appropriate given the range of activities covered under the Project and the fact that the location-specific design, construction arrangements, ancillary facilities, and certain site conditions will continue to be refined during subsequent stages of preparation and implementation. In this context, the assessment presented herein provides the overall basis for identifying impact pathways, determining significance, applying the mitigation hierarchy, and defining the overarching E&S management framework for the Project.

The findings of this Project level ESIA will be further elaborated and translated into site-specific ESIAs/ESMPs and other downstream instruments for the different sub-projects defined under the Project. Within those sub-project-specific instruments, additional surveys, assessments, and targeted management plans may be required for high-risk or design-sensitive components and locations, particularly where the final design may influence the nature, extent, or significance of potential impacts (e.g., impacts related to drainage and surface water management, river and canal crossings, biodiversity-sensitive areas, access arrangements, and land acquisition requirements) and the corresponding mitigation and management measures required. This includes, as applicable, greenfield sections, river crossings, biodiversity-sensitive areas, locations requiring additional land acquisition or access management measures, and other areas where further design refinement or site-specific assessment is needed prior to commencement of works or, where relevant, prior to operation.

Such downstream instruments will set out the detailed, sub-project-specific assessment, mitigation, monitoring, supervision, and institutional requirements, tailored to the location, design, sensitivities, and implementation arrangements of each sub-project. They will also identify any additional surveys, management plans, approvals, disclosure steps, and preconditions required before the relevant works proceed. The recommendations and requirements of those instruments will then be incorporated into the relevant bidding documents, contractual instruments, and contractors' management plans, as applicable, and implemented under the overall framework established by this ESIA.

5.2 Potential Positive Impacts

5.2.1 Potential Positive Impacts during Pre-Construction and Construction Phases

Implementation of the ITREC Project is expected to generate social and economic benefits during pre-construction and construction, primarily through employment generation, stimulation of local supply chains, and increased demand for goods and services in project-affected districts. Benefits are expected to occur through direct employment by contractors and subcontractors, as well as indirect opportunities created through procurement, logistics, and service provision supporting construction activities.

Employment and Skills Development

The Project is anticipated to generate direct employment opportunities across a range of occupational categories, including engineers, surveyors, site supervisors, equipment operators, drivers, mechanics, electricians, skilled trades, and general labor. Workforce levels will vary substantially by construction stage, work-front distribution, and staging approach, and are expected to peak during intensive works. Final workforce requirements will be confirmed by the appointed contractor(s) based on approved construction methodology, sequencing, and subcontracting arrangements.

In addition to direct jobs, indirect employment opportunities are expected to arise through locally sourced services and supply chains supporting construction activities, such as local transport providers, catering, cleaning services, minor equipment servicing, and supply of consumables.

Where feasible, the Project may support skills development through on-the-job training, toolbox talks, and targeted training for local labor, contributing to longer-term employability in construction and maintenance activities.

Labor management measures will be designed and implemented in line with World Bank ESS2 (Labor and Working Conditions), including requirements related to fair working conditions, occupational health and safety, worker grievance mechanisms, and prohibitions on child and forced labor.

Local Economic Activity and Supply Chain Stimulation

Construction activities are expected to increase local demand for goods and services, including fuel supply services, transport and haulage, small-scale procurement of consumables, accommodation-related services, and routine maintenance and repair services for construction equipment. This is expected to benefit small businesses and service providers in districts near construction sites and along support routes.

The Project is also expected to support local economic activity through contractor procurement and subcontracting, and to contribute to public revenues through applicable taxes, fees, and local purchasing.

Infrastructure and Community Co-Benefits during Construction

Some construction activities may result in localized co-benefits where reinstatement and upgrading works improve drainage performance, restore blocked culverts, remove accumulated debris, and improve roadside housekeeping conditions within the working corridor. These benefits are expected to be temporary during construction and become more durable where they are embedded into the final works.

5.2.2 Potential Positive Impacts during Operation Phase

During operation, the ITREC Project is expected to deliver sustained benefits through improved road condition and capacity at priority locations, enhanced road safety performance, improved reliability of travel, and improved access to services and markets for corridor-adjacent communities. Operation-phase benefits are expected to arise primarily from improved pavement condition, upgraded geometric and safety features, improved drainage performance, and improved functionality of crossings and structures.

Improved Accessibility, Mobility, and Network Performance

A key benefit during operation will be improved accessibility and mobility. Upgraded and/or newly constructed road infrastructure is expected to improve travel conditions by reducing delays at constrained locations, improving ride quality, and improving journey reliability for road users. These changes are expected to support access to employment areas, markets, education, and public services.

Improved Road Safety Outcomes

The Project is expected to improve road safety through a combination of design and operational features, which may include improved lane configuration and delineation, improved signage and road markings, improved roadside restraint systems (e.g., barriers/guardrails), improved management of access points (particularly on upgraded corridors), and improved safety performance at intersections/grade separations where introduced. These upgrades are expected to reduce conflict points and improve predictability for drivers and other road users.

In addition, where informal openings, illegal turning movements, and uncontrolled access points currently exist, the Project is expected to support safer movement patterns through access management measures (e.g., closure/regularization of unsafe openings, provision of safer turning arrangements, and improved channelization where applicable). This is expected to reduce risky crossing and turning behavior and improve overall corridor safety.

Reduced Vehicle Operating Costs and Asset Preservation

Improved pavement condition and drainage performance are expected to reduce vehicle wear and tear and contribute to more efficient vehicle operation compared to deteriorated or distressed road conditions. Rehabilitation and timely maintenance can extend the service life of existing assets, improving lifecycle performance and reducing recurrent repair needs over time.

Improved Freight and Logistics Efficiency

By improving the performance of priority road links and nodes, the Project is expected to support more reliable movement of goods and services and strengthen logistics efficiency. This can benefit freight operators and commercial users through improved travel predictability and reduced disruption from pavement failures or drainage-related damage.

Better Emergency Response and Incident Management

Improved road condition, clearer traffic management features, and upgraded safety infrastructure are expected to support more effective incident management and facilitate access for emergency response services, particularly at locations where the Project improves junction layouts, removes bottlenecks, or introduces grade separation. While emergency response outcomes depend on institutional capacity and operational arrangements, improved corridor functionality can support safer and more reliable access for emergency vehicles and response teams.

Local Economic Development and Service-Economy Opportunities

Over time, improved road performance may stimulate growth in roadside and corridor-adjacent commercial activity where market demand exists, including vehicle services, retail services, and logistics-support functions. Such effects are expected to be incremental and will depend on wider economic conditions and land-use controls.

Employment during Operation and Maintenance

During operation, the Project is expected to create permanent and semi-permanent jobs linked to routine operation and maintenance, including corridor inspections/patrols, routine maintenance interventions, drainage cleaning, upkeep of road furniture, and incident response support. Operation

and routine maintenance are expected to be undertaken by a relatively small workforce compared to construction, supported as needed by specialized contractors for periodic maintenance interventions. If tolling is implemented, additional roles may arise through toll operations and associated service functions.

5.3 Potential Negative Impacts

5.3.1 During Pre-construction and Construction Phases

5.3.1.1 Air Quality

Air quality impacts during construction of the ITREC Project have been assessed qualitatively, based on the anticipated construction activities and the best available information at this stage. The Project comprises a mix of greenfield road construction, rehabilitation and completion works, widening/expansion upgrades, and associated structure works (e.g., overpasses and tie-ins). These activities will introduce earthworks (where applicable), pavement works, material handling, and construction traffic to settings that include agricultural land and orchards, existing road corridors influenced by traffic, and areas in proximity to settlements. Baseline ambient air quality is expected to vary across sub-projects, with generally more favorable conditions in rural/agricultural areas and higher baseline levels in sections influenced by existing traffic and industrial activity. Sections of the corridors are in proximity to residential areas and other sensitive receptors such as schools, mosques, and health services; accordingly, construction-related dust and exhaust emissions may affect nearby receptors where separation distances are limited.

Potential sources of impacts to air quality during construction include:

- site preparation, clearance, and enabling works
- excavation and cut-and-fill works (where applicable), including embankment formation and earthworks for structures, loop ramps, and tie-ins
- pavement works, including milling/scraping of existing asphalt, removal of distressed layers, and placement/compaction of new pavement layers (rehabilitation and widening/expansion corridors)
- movement and operation of construction machinery and vehicles near active work zones, temporary access routes, and transport roads
- loading, unloading, and handling of materials (including aggregates, fill, asphalt, and cementitious materials)
- dust generated from stockpiles, exposed soils, loose spoil, and handling/transport of disturbed materials
- exhaust emissions from diesel-powered construction machinery and generators, including nitrogen oxides (NO_x), sulfur dioxide (SO_2), carbon monoxide (CO), and particulate matter (PM_{10} and $PM_{2.5}$)
- emissions associated with associated facilities and suppliers, where used, including asphalt plants, concrete batching plants, and quarries/borrow sources (e.g., particulate emissions and fugitive dust during processing and transport; and VOCs from asphalt production)

Dust is expected to be the principal air quality issue during construction, generated primarily by earthworks (where applicable), pavement milling and rehabilitation activities, loading/unloading,

transport, and movement of vehicles on disturbed or unpaved surfaces. Dust impacts may include: (i) localized irritation and nuisance effects, particularly for sensitive individuals; (ii) reduced visibility for drivers near active work zones; (iii) dust deposition causing inconvenience to nearby residents, properties, and vehicles; and (iv) dust deposition on adjacent agricultural land, which may affect crop surfaces and plant growth in the immediate vicinity of construction areas.

In addition, vehicle, generator, and equipment exhaust emissions may lead to localized increases in combustion-related pollutants (including NO_x, SO_2, CO, and particulate matter). The magnitude of emissions will depend on the intensity of equipment use, the frequency of vehicle movements, fuel quality, and equipment condition. Exhaust-related effects are expected to be most relevant where active construction areas and material transport routes are closest to residential areas and other sensitive receptors, and in locations where congestion and idling occur due to work-zone traffic management.

Meteorological conditions typical of Iraq, including dry periods and wind events, may exacerbate dust generation and transport, particularly where soil surfaces are exposed and where traffic volumes are high on unpaved or temporarily disturbed surfaces.

Overall, prior to mitigation, construction-phase air quality impacts are assessed as **moderate**, reflecting: (i) the intensity and duration of construction activities and construction traffic, (ii) the potential for dust generation from both greenfield and rehabilitation/expansion activities (including milling and asphalt works), and (iii) the presence of nearby receptors along sections of the corridors. It is important to note that impacts are expected to be temporary and localized.

Air Quality impacts are considered of Moderate significance.

5.3.1.2 Noise and Vibrations

5.3.1.2.1 Noise Impacts

Noise impacts during construction of the ITREC Project have been assessed qualitatively, based on the anticipated construction activities. The Project comprises a mix of greenfield road construction, rehabilitation and completion works, widening/expansion upgrades, and associated structure works (e.g., overpasses and tie-ins). Noise-sensitive receptors (e.g., residences, schools, mosques, and health services) are located in proximity to sections of the corridors, including peri-urban and built-up areas; accordingly, construction-related noise may be experienced by nearby receptors where separation distances are limited.

Potential sources of construction noise include:

- site preparation activities (clearance and grading)
- earthworks and formation works (excavation, cut-and-fill, compaction, and embankment works)
- operation of construction machinery and equipment at construction sites (e.g., excavators, bulldozers, loaders, graders)
- pavement works, including milling/scraping of existing asphalt, paving, and compaction using vibratory rollers (rehabilitation and widening/expansion corridors)

- vehicle movements along temporary access routes and transport roads, including transport of materials, equipment, and workers
- stationary noise sources associated with temporary facilities and camps, including generators
- structure works and crossings (e.g., bridge/overpass works, concrete breaking/placement, crane operations, and use of mechanical/pneumatic tools)

Construction noise is expected to result in temporary, localized increases in ambient noise levels in the vicinity of active construction sites, temporary facilities, and along transport routes. The primary effect is anticipated to be disturbance to nearby residents and other sensitive receptors due to elevated noise levels and intermittent high-noise events from heavy equipment operation, pavement activities, concrete breaking, loading/unloading, and truck movements. Noise impacts may also include temporary disruption to activities requiring low-noise environments, particularly at sensitive receptors such as schools, mosques, and health services. In addition, construction noise will affect workers directly through routine exposure to elevated noise levels at construction sites, with the potential for hearing-related risks if exposures are not controlled through appropriate occupational health and safety measures.

Overall, prior to mitigation, the construction-phase noise impact is assessed as **moderate**, with localized higher impacts where works occur close to receptors.

5.3.1.2.2 Vibration Impacts

Vibration impacts during construction of the ITREC Project have been assessed qualitatively, based on the anticipated construction activities. Ground-borne vibration may be experienced by nearby receptors where separation distances are limited, particularly where works occur close to residences and sensitive receptors and where heavy equipment operates adjacent to existing structures.

Potential sources of construction vibration include:

- earthworks and formation works, particularly compaction activities using rollers and vibratory compactors
- operation of heavy construction machinery and equipment at construction sites
- movement of heavy vehicles along temporary access routes and transport roads, particularly over uneven or unpaved surfaces
- structure works and crossings (e.g., bridge/overpass works), and any piling activities where required

Construction vibration is expected to result in temporary, localized increases in ground-borne vibration in the vicinity of active construction sites and transport routes. The primary effect is anticipated to be annoyance and disturbance to nearby residents and sensitive receptors. Where activities occur very close to buildings, there is potential for concern regarding vibration effects on building integrity and cosmetic damage, particularly for structures of lower construction quality. Vibration will also affect workers directly through exposure associated with equipment operation.

Overall, prior to mitigation, the construction-phase vibration impact is assessed as **moderate**, with localized higher impacts where compaction or structure works occur at short distances from buildings and sensitive receptors.

Noise and Vibration impacts are considered of Moderate significance.

5.3.1.3 Soil Quality

Soil quality impacts during construction of the ITREC Project have been assessed qualitatively, based on the anticipated construction activities. The Project comprises a mix of greenfield road construction, rehabilitation and completion works, widening/expansion upgrades, and associated structure works, with corridors passing through agricultural land, orchards, and areas with disturbed or modified soils. Soil quality is an important environmental receptor in the Project area due to its role in supporting agricultural productivity in rural sections and its function in infiltration and runoff control across all sub-projects. Accordingly, soil disturbance, erosion, and contamination risks are relevant, particularly where construction activities extend beyond the permanent footprint to include temporary access routes, laydown/staging areas, camps, borrow areas, and material stockpiles.

Potential sources of soil quality impacts during construction include:

- soil disturbance and excavation associated with construction works, which may result in loss of soil structure and localized reduction in soil quality
- stripping, handling, and temporary stockpiling of topsoil and excavated materials, including potential loss of topsoil through windblown dust and sediment entrained in surface runoff
- compaction of soils at construction sites, access routes, laydown areas, and temporary facilities due to movement and operation of heavy machinery and vehicles, which may reduce soil permeability and infiltration and increase surface runoff
- erosion of exposed soils and stockpiles during rainfall events, with potential sediment transport to adjacent land and drainage features; and wind erosion during dry periods where surfaces remain exposed
- accidental spills/leaks associated with storage, handling, and refueling of fuels and other hazardous materials (e.g., oils, lubricants, hydraulic fluids, and chemicals), particularly at camps and staging/maintenance areas
- contaminated surface runoff arising from spills/leaks or poor housekeeping at refueling/maintenance areas, material storage areas, and waste storage locations, which may mobilize hydrocarbons and chemicals to surrounding soils
- storage and disposal of non-hazardous waste and construction debris, and waste generation from worker camps and temporary facilities, which may result in localized soil contamination if not properly managed
- sourcing of construction materials and any associated borrow areas/quarries (where applicable), where inappropriate management could result in localized soil degradation and drainage/standing-water issues

Construction-related soil quality impacts are expected to include localized degradation of soil structure and fertility due to topsoil loss, mixing of soil horizons, erosion, and compaction, as well as localized

contamination risks where spills/leaks occur or where contaminated runoff mobilizes hydrocarbons or chemicals onto surrounding soils. In sections with productive agricultural land and orchards, these impacts may affect soil productivity in the immediate vicinity of active construction sites and temporary construction footprints if not managed appropriately.

Overall, prior to mitigation, the construction-phase soil quality impact is assessed as **moderate**, reflecting: (i) the potential for soil disturbance and compaction associated with earthworks and construction support activities, (ii) localized erosion potential during rainfall events and wind erosion during dry periods where soils are exposed, and (iii) contamination risks associated with fuel/chemical handling and waste management at temporary facilities. Impacts are expected to be localized to the construction footprint and temporary work areas and can be effectively managed through good construction practices.

Soil Quality impacts are considered of Moderate significance.

5.3.1.4 Surface and Groundwater

Surface water and groundwater impacts during construction of the ITREC Project have been assessed qualitatively, based on the anticipated construction activities and the best available information at this stage. The Project comprises a mix of greenfield road construction, rehabilitation and completion works, widening/expansion upgrades, and associated structure works. Across the Federal and KRI sub-projects, the corridors interface with water resources through major rivers, canals, lakes/reservoir systems, irrigation and drainage networks, and seasonal drainage features. These receptors are of high importance due to their role in sustaining irrigation supply, drainage conveyance, and broader water availability for agriculture and local communities, and because construction-phase pollutant and sediment pathways can be mobilized rapidly during rainfall events. Key water receptors for each sub-project is as follows:

- **Expressway No. 2 (Baghdad–Samarra):** multiple waterway interfaces, including major river crossings (including the Tigris River system and the Ishaqi River), as well as extensive irrigation and drainage channels/canals crossed via bridges and culverts. These receptors are important for sustaining irrigation supply, drainage conveyance, and broader water availability for agriculture and local communities.
- **R9B segment under Expressway No.1:** influenced by the Euphrates system and associated irrigation and drainage networks, with key surface-water bodies in the broader corridor setting including **Tharthar Lake** and **Habbaniyah Lake**, as well as associated canals and drainage features linked to agricultural production and rural settlements.
- **KRI sub-projects (Sulaymaniyah–Chamchamal–Kirkuk Road; Girsheen–Suhaila Road Upgrade and Girsheen Interchange):** Predominantly seasonal streams and runoff pathways that are dry for much of the year but convey intermittent flows during winter/spring rainfall and intense storm events. These drainage systems ultimately discharge to the Tigris River basin, increasing the importance of managing sediment and pollutant transport during rainfall periods.

Potential sources of impacts to surface water and groundwater during construction include:

- accidental spills/leakages of fuel, oils, lubricants, hydraulic fluids, and other chemicals from vehicles and machinery, particularly during refueling, maintenance, and equipment staging.

- pollution associated with improper storage/handling of construction materials and wastes that may be mobilized by rainfall and site runoff.
- unmanaged wastes, including hazardous wastes (e.g., oily wastes, contaminated absorbents, chemical containers, and maintenance-related wastes), and inappropriate waste storage or temporary disposal that may be washed into canals, drains, seasonal channels, lake margins, or river margins.
- runoff from exposed soils and earthworks and increased turbidity associated with site clearance, excavation, cut-and-fill, and embankment formation, particularly at canal/channel interfaces, seasonal drainage crossings, and structure works.
- domestic wastewater generation from temporary worker facilities and camps (where established), including risks associated with inappropriate discharge or leakage from sanitation systems.
- drainage rehabilitation and crossing works (culverts/bridges), including temporary diversions, localized dewatering, disturbance to channel beds and banks, and handling/stockpiling of excavated materials near active drainage features.
- concrete works near watercourses, including risks from uncontrolled concrete washout water and alkaline runoff.

The main potential impacts on surface water are as follows:

Construction-related impacts on surface water may include temporary increases in turbidity and suspended solids in irrigation/drainage canals, seasonal drainage features, and at river/canal crossing locations due to soil disturbance and wash-off during rainfall events. Localized contamination risks may occur if spills happen or if runoff from refueling/maintenance areas, material storage areas, or waste handling locations reaches canals, drains, seasonal channels, lake margins, or river margins. Drainage and crossing works also have the potential to temporarily affect local conveyance and flow conditions if canals/channels are obstructed, diversions are poorly managed, or culverts are undersized or clogged during construction, with knock-on effects for irrigation reliability, drainage performance, and localized flood/ponding behavior in low-lying areas.

The main potential impacts on groundwater are as follows:

Construction-related impacts on groundwater are expected to occur primarily through indirect pathways, notably infiltration of contaminated runoff to the subsurface in the event of spills, poor housekeeping, or uncontrolled wastewater management, particularly at refueling/maintenance areas, material storage locations, and waste handling areas. While direct interception of groundwater is not anticipated for most routine roadworks, groundwater quality can still be affected where contaminant sources are present and where infiltration pathways exist, including in localized low-lying settings and areas with wells located near work sites.

At the current stage, the assessment of surface water and groundwater impacts is based on the design information available at project level. However, for sections where the detailed design may affect the configuration of crossings and drainage structures, the interaction of the works with nearby water environments, or the extent of works undertaken in proximity to such environments, the corresponding impact assessment and mitigation requirements may require further refinement.

This is particularly relevant for Expressway No. 2, given its greenfield nature and its interaction with multiple water environments and crossing structures, including the Tigris River crossing, the Ishaqi River crossing, irrigation canals, main channels, distribution channels, canal-crossing bridges, and the numerous pipe culverts and box culverts identified along the alignment and Samarra access road. Additional impact assessments and corresponding mitigation measures based on the detailed design will be further analyzed and presented in the relevant site-specific ESIAs/ESMPs and additional downstream E&S studies as needed prior to commencement of the relevant works.

Overall, prior to mitigation, the construction-phase surface water and groundwater impact is assessed as **major**, reflecting: (i) the presence and importance of river, canal, lake/reservoir-connected, irrigation/drainage, and seasonal drainage receptors across the sub-projects; (ii) the potential for turbidity/suspended solids and temporary drainage interference during earthworks, drainage rehabilitation, and crossing works; and (iii) contamination risks associated with fuel/chemical handling, concrete works, wastewater, and waste management at temporary construction facilities. Impacts are expected to be localized to the construction footprint and active work areas but may be significant where works occur near watercourse interfaces or during rainfall events without appropriate controls.

Surface and Groundwater impacts are considered of Major significance.

5.3.1.5 Waste Generation and Management

Waste generation and management impacts during construction of the ITREC Project have been assessed qualitatively, based on the anticipated construction activities. Construction will generate a range of non-hazardous and hazardous waste streams associated with earthworks, pavement works (where applicable), structure works, operation and maintenance of equipment, and workforce requirements. Inadequate segregation, storage, transport, or disposal of these wastes may result in localized environmental pollution, including impacts on soil and surface water.

Potential waste streams during construction include:

- surplus excavated material and spoil, including unsuitable material removed from excavations
- vegetation and site clearance waste, including removed shrubs/trees and other biomass
- inert construction waste, including concrete rubble, broken masonry, asphalt fragments (as applicable), and general demolition-type debris
- scrap materials, including scrap metal, wood, and offcuts from construction activities
- packaging wastes, including paper/cardboard, plastics, pallets, and strapping
- domestic/municipal-type wastes from the workforce, including food waste and mixed general wastes
- wastewater from workforce welfare facilities and associated septic sludge from sanitation systems
- debris and sediments removed during cleaning/desilting of existing culverts, drainage channels, and associated drainage structures (where applicable)
- removed road furniture and components (e.g., guardrails, signposts, barriers, delineators) (where applicable)

- removed drainage/utility materials and debris from repairs/relocation works (where applicable)
- hazardous wastes from equipment operation and maintenance, including used oils and lubricants, oily rags, used filters, grease residues, and contaminated absorbents
- fuel and chemical containers, including contaminated empty containers and residual materials
- used batteries and electrical wastes, including batteries from vehicles/equipment and other electrical components
- waste tires and worn rubber parts from vehicles and heavy equipment
- waste paints, solvents, and adhesives and contaminated containers/brushes
- bituminous wastes from asphalt works, including bitumen residues and contaminated materials
- welding/cutting residues and consumables (e.g., spent electrodes)
- medical waste from first-aid and clinic activities supporting the workforce

Construction-related waste impacts may include:

- localized littering due to inadequate waste segregation, containment, and housekeeping, including windblown packaging and plastics along the alignment
- attraction of pests and vectors and associated community disturbances due to improper handling of domestic/household-type wastes generated by the workforce
- localized contamination of soils due to inappropriate storage, handling, or disposal of wastes, particularly hazardous wastes (e.g., oily wastes, contaminated absorbents, chemical containers, waste paints/solvents) and maintenance-related wastes
- worker health and safety hazards associated with hazardous wastes and chemical residues (such as used oils, contaminated absorbents, solvents/paints, batteries, and chemical containers), including risks of skin/eye contact, inhalation of fumes, cuts and punctures, and fire hazards during collection, handling, temporary storage, and loading/transport if not properly controlled
- localized contamination of adjacent irrigation and drainage canals/channels due to runoff transporting waste residues, fine solids, or contaminated materials from waste storage areas, laydown areas, and construction sites
- impacts associated with wastewater and septic sludge, including odors, localized soil contamination, and pollution of nearby drains/canals if leakage, overflow, or uncontrolled discharge occurs
- impacts associated with dewatering activities (where undertaken for excavations and crossing/structure works), including the generation of pumped water and removed sediments; if not properly managed, these may lead to increased turbidity/suspended solids in nearby canals/water bodies
- uncontrolled dumping of construction debris, removed materials, or surplus spoil in undesignated locations, resulting in land take and longer-term visual and environmental pollution

- blockage or reduced conveyance of irrigation/drainage channels due to waste accumulation, uncontrolled dumping, or disposal of debris near canal banks, with potential implications for local drainage performance
- uncontrolled burning of waste leading to localized air quality impacts (smoke/odors) and community disturbance, and generation of residual ash requiring disposal
- community health and safety risks due to the Project's proximity to communities, where inadequate waste containment and removal may lead to public exposure to wastes and debris (including hazardous residues), and increased vector attraction

Overall, prior to mitigation, the construction-phase waste generation and management impact is assessed as **moderate**, reflecting the range of waste streams expected and the proximity of sections of the corridors to communities and irrigation/drainage features, while recognizing that impacts are generally localized to construction sites, temporary facilities, and transport routes and can be effectively controlled through proper waste management practices.

Waste Generation and Management impacts are considered of Moderate significance.

5.3.1.6 Risk of Unexploded Ordinance (UXO)

The risk of unexploded ordnance (UXO) and explosive remnants of war (ERW) is relevant to the ITREC Project wherever ground-disturbing works are undertaken. This risk is expected to be highest for Expressway No. 2, given its greenfield nature and associated earthworks and temporary construction footprints. UXO clearance for Expressway No. 2 has already been undertaken(Annex I: Existing Minefield and ERW Hot Spots for Expressway No. 2).

For the R9B segment under Expressway No. 1 and the KRI sub-projects, UXO / ERW risk shall also be addressed wherever works involve earthworks, borrow areas, temporary access roads, temporary work areas, drainage works, localized alignment adjustments, or any other ground-disturbing activities. In such cases, landmine and ERW clearance letters shall be obtained from the Ministry of Environment / Directorate of Mine Action to ensure that all relevant work sites under the Project, and their access routes, are free of mines and explosive remnants of war (ERW). Each worksite clearance letter, together with the necessary supporting documentation, shall be shared with the Bank to demonstrate that the decontamination process has been conducted in accordance with Good International Industry Practice.

Prior to clearance, UXO / ERW risk is assessed as Major wherever ground-disturbing works are to be undertaken.

Risk of Unexploded Ordinance (UXO) are considered of Major significance.

5.3.1.7 Biological Environment

Biodiversity impacts during construction of ITREC road sub-projects have been assessed qualitatively, based on the anticipated construction activities and the best available baseline information at this stage, including the rapid in-situ biodiversity assessment undertaken for the Project AoI. The assessment reflects the different construction contexts across the sub-projects, including greenfield expressway construction for Expressway No. 2 and rehabilitation/upgrade works within existing corridors for R9B and the projects under the KRG. The rapid assessment highlights the elevated ecological

sensitivity of the Tigris River crossing area and associated riparian/aquatic habitats, and identifies key biodiversity features of concern, including the Endangered Euphrates Soft-shell Turtle (Rafetus euphraticus) and the Near Threatened Eurasian Otter (Lutra lutra), alongside a suite of Tigris–Euphrates basin fish species and other riparian/aquatic biodiversity values associated with the river system and connected irrigation/drainage networks.

The rapid assessment focused on the Tigris River crossing area (active channel, riparian vegetation on both banks, and adjacent floodplain habitats within and immediately outside the RoW) and the Ishaqi area, including agricultural–natural interfaces and irrigation/drainage canals connected to the Tigris River system; it also notes that the river islets system represents a distinct ecological feature.

Construction activities will create direct and indirect impact pathways affecting terrestrial, riparian, and aquatic biodiversity, with impact magnitude expected to vary by location. In general, the highest biodiversity sensitivity is expected at the Ishaqi river crossing area, the Tigris River crossing, and the network of irrigation/drainage channels and canals intersected by the alignment (where bridge/culvert works will be required). In addition, construction along rehabilitation/upgrade corridors (including R9B and projects under the KRG) will result in localized habitat and vegetation disturbance largely within the existing road corridor, including removal of planted trees in medians (where present) and limited roadside/opportunistic vegetation within the construction footprint. Localized disturbance to narrow riparian vegetation may also occur during bridge/culvert works at seasonal drainage crossings. Associated facilities supplying construction materials, including quarries and borrow areas, may contribute to additional vegetation removal and localized habitat disturbance at extraction and processing locations.

It is important to note that the level of biodiversity risk differs across the ITREC sub-projects according to the nature of the intervention and the sensitivity of the affected habitats. Lower biodiversity risk is expected for the R9B segment under Expressway No. 1 and the KRI sub-projects (Sulaymaniyah–Chamchamal–Kirkuk Road; Girsheen–Suhaila Road Upgrade and Girsheen Interchange), as these interventions are predominantly rehabilitation, widening, or upgrade works undertaken largely within existing road corridors and already disturbed footprints, where biodiversity interactions are generally more limited and are mainly associated with planted median trees, roadside vegetation, and localized disturbance at minor drainage features or seasonal drainage crossings. Higher biodiversity risk is expected for Expressway No. 2, given its greenfield nature and its interaction with more sensitive habitat features and crossing locations, particularly where works interface with riparian, aquatic, and canal-associated habitats, or where bridges, culverts, embankments, and other crossing-related works may affect habitat structure, water quality, and fauna movement. This is particularly relevant at the Tigris River crossing, the Ishaqi River crossing area, and the irrigation and drainage canals connected to the Tigris River system.

The following sub-impacts shown in Table 5-2 are expected.

Table 5-2: Expected Sub-impacts on the Biological Environment

Sub-Impact	Summary	Key Effects
Direct Habitat Loss and Vegetation	Vegetation clearance within the footprint.	• Direct loss of modified habitat (agricultural land) and loss/alteration of riparian vegetation

Clearance (Terrestrial and Riparian)		where works extend into riverbanks and canal margins • Reduction of habitat structure and cover used by fauna for resting, nesting, and foraging, particularly in vegetated canals and riparian strips that function as movement routes within an otherwise intensively managed agricultural matrix • Localized reduction in habitat connectivity
Habitat Modification Within Existing Road Corridors (Median / Roadside Vegetation Removal)	Upgrade/rehabilitation works within existing corridors may require localized clearance and earthworks within the roadway footprint and temporary work areas.	• Removal of planted trees in the central median (where present) and limited roadside/opportunistic vegetation within the construction footprint, generally with limited ecological function • Localized disturbance to narrow riparian strips during bridge/culvert works at seasonal drainage crossings • Vegetation removal and localized habitat disturbance associated with construction material supply areas (e.g., quarries and borrow areas), where applicable
Habitat Fragmentation and Barrier Effects	Greenfield expressway construction introduces a linear barrier.	• Fragment semi-natural patches and riparian/canals • Increase edge effects (dust deposition, human presence, and disturbance) along habitat boundaries • Constrain local wildlife movement and increase the likelihood of wildlife-vehicle interactions at construction sites during construction
Fauna Disturbance and Temporary Disruption of Wildlife Movement	Construction activity may temporarily disturb fauna and alter local movement patterns near active work zones and seasonal drainage crossings.	• Temporary displacement of mobile species due to noise, vibration, human presence, and construction traffic • Minor mortality risks for small or less mobile fauna during earthworks and site preparation • Reduced minor nesting/roosting opportunities for birds where limited roadside/median vegetation is removed • Temporary disruption of movement along seasonal drainage crossings and canal/drain corridors during culvert/bridge works • Additional localized disturbance at quarries/borrow areas supplying construction materials, where applicable
In-River and Near-River	Bridge works at the Tigris River crossing	• Disturbance of sediments and short-term increases in turbidity from bank works,

Works (Aquatic and Riparian)	and Ishaqi River crossing.	foundation preparation, and any in-channel activities, with potential effects on fish habitat conditions and feeding efficiency • Physical disturbance of riverbanks and riparian margins, affecting riparian vegetation structure and bank microhabitats used by reptiles and small mammals • Risk of direct harm to aquatic fauna during in-river works if access and plant movement are not tightly controlled • Dewatering activities can isolate riverbed sections, disturb sediments, and alter near-field habitat conditions
Pollution-Related Effects on Biodiversity	Localized contamination pressures affecting terrestrial and aquatic biodiversity.	• Accidental releases of fuel, lubricants, concrete wash water, and other chemicals at construction sites and near watercourses • Transport of fine solids, cementitious material, and contaminated runoff into canals/drains and rivers, affecting aquatic habitat quality • Ecological effects from unmanaged solid and hazardous wastes, with higher sensitivity where wastes can enter canals and riparian zones connected to the main river system
Invasive Alien Species Introduction and Spread	Construction activities can enable introduction/spread of invasive species.	• Movement of machinery and materials between construction sites • Soil stripping and disturbance that creates suitable colonization conditions in disturbed areas
Poaching and Increased Access	Increased access and workforce presence can create secondary pressures.	• Temporary access routes and increased workforce presence can increase opportunistic hunting/poaching and disturbance, particularly in riparian zones and canals where biodiversity values are higher

At the current stage, the assessment of biodiversity impacts is based on the design information available at project level and the baseline information currently available for the Project. However, for sections where the detailed design may affect the configuration of crossings and associated structures, the extent of vegetation clearance, the interaction of the works with riparian, aquatic, or canal-associated habitats, or the extent of works undertaken in proximity to biodiversity-sensitive locations, the corresponding impact assessment, mitigation measures, and management requirements are expected to require further refinement. This is particularly relevant for Expressway No. 2, given its greenfield nature and its interaction with ecologically sensitive locations and habitat features, including the Tigris River crossing, the Ishaqi River crossing area, riparian and aquatic habitats, river islets, and the irrigation and drainage canals connected to the Tigris River system, where the final design of crossings, culverts, bridges, and associated construction footprints may influence the extent and nature of habitat disturbance and associated biodiversity impacts. Additional impact assessment and

corresponding mitigation measures required on the basis of detailed design will be undertaken, through the relevant site-specific ESIAs/ESMPs and additional downstream E&S studies as needed prior to commencement of the relevant works.

Overall, prior to mitigation, construction-phase biodiversity impacts are assessed as **Major** due to the potential impacts at sensitive riverine and aquatic habitats and associated canal/drainage networks, including at the Tigris River interface for Expressway No. 2 and at Euphrates-adjacent works areas along R9B.

Impacts on the Biological Environmental are considered of Major significance.

5.3.1.8 Community Health and Safety

- Traffic accidents and road safety risks from construction activities

Construction will introduce high-risk traffic conditions due to heavy vehicle movements, temporary lane closures, diversions, reduced sight lines, and mixed traffic (cars, buses, trucks, motorcycles, agricultural vehicles, and pedestrians). Accident risk typically increases where works occur on live carriageways, near junctions, near settlements, and where informal crossings and uncontrolled access points exist. This is particularly relevant for rehabilitation and widening sections that must be executed while maintaining traffic flow, and for works around tie-ins and structures where traffic patterns change frequently. These conditions may lead to serious injury or fatality to road users and nearby residents, including children; increased risk for vulnerable road users (pedestrians, motorcyclists, cyclists).

The severity of these risks will depend not only on temporary traffic management during construction, but also on whether the engineering designs incorporates appropriate access control, safe junction treatment, pedestrian and livestock crossing provision, fencing or barriers, and speed-management features at settlement interfaces and other high-risk locations.

- Temporary access disruption and emergency response delays

Construction may temporarily affect community access to homes, farms, roadside businesses, schools, health services, and places of worship through detours, closure of informal access points, or restricted turning movements. If not managed carefully, these changes can delay ambulances and emergency services, reduce access to markets and livelihoods, and create unsafe crossing behaviour where people attempt to bypass controls. These conditions may bring about delayed emergency care; increased exposure to risky crossings; and localized social tension where restrictions are perceived as unfair or poorly communicated.

Where access to homes, farms, roadside businesses, community facilities, and emergency routes is a recurring interface issue, the need for safe crossings, frontage or service-road connections, turning arrangements, and emergency access provisions should be addressed through engineering designs.

- Public exposure to worksite hazards (open excavations, machinery, and temporary works)

Communities may be exposed to physical hazards from active work fronts, including open trenches, excavations, stockpiles, unstable edges, temporary barriers, and moving machinery. This includes risks at drainage and cross-drainage works, underpass construction, culvert repairs, and any bridge or canal-

crossing works. These hazards are elevated where work fronts are near settlements, roadside activity areas, or where children and livestock can access the worksite. Potential consequences include risks of falls, crushing incidents, drowning risk at water interfaces, injuries linked to inadequate segregation between public and construction zones.

- Dust, vehicle emissions, and noise and vibration nuisance with health implications

Construction activities such as earthworks, hauling, milling, asphalt works, and movement of heavy vehicles can increase dust and exhaust emissions, and generate noise and vibration. These effects are most relevant near sensitive receptors such as residences, schools, clinics, markets, and roadside communities, where it could cause respiratory irritation and reduced visibility that can also elevate road safety risk, and overall nuisance complaints.

- Community exposure to pollution incidents (fuels, oils, bitumen, and chemicals)

Construction requires fuel storage, equipment maintenance, and handling of oils, paints, and bituminous materials. Accidental spills or uncontrolled runoff can affect nearby soil and water pathways, including irrigation canals and local drainage. Fire risk also increases where fuels and bitumen are handled or stored near public areas. Such incidents may cause localized contamination of irrigation or drainage channels, slips and burns, smoke exposure from fires, and reputational and grievance escalation if incidents affect community resources.

- Solid waste, wastewater, and public health nuisance around work areas and worker accommodation

Worksites and any contractor facilities can generate solid waste, food waste, and wastewater. Poor management can attract pests, create odour, and increase disease vectors, particularly in warm seasons. Where communities already face constraints in municipal services, incremental waste burdens around construction zones and rest areas can become a visible and sensitive issue. Poor management may result in vector breeding, community complaints, and increased health risks for nearby households where waste accumulates.

- Communicable disease risks associated with workforce presence and community interaction

Construction workforces interact with local communities through service use, markets, transport, and daily movement. This can increase the risk of communicable disease transmission in settings where preventive health measures are limited or where accommodation is crowded. This may further lead to pressure on local clinics, community concern and rumor-driven tension if illness is perceived to be imported or unmanaged.

- Sexual Exploitation and Abuse and Sexual Harassment (SEA/SH), related gender-based violence, and child safeguarding risks

Construction may increase the risk of sexual exploitation and abuse and sexual harassment (SEA/SH), as well as related gender-based violence and child safeguarding concerns, through interactions between project workers, subcontractors, security personnel, transport operators, and local communities. Consistent with the Environmental and Social Review Summary (ESRS), SEA/SH risk is assessed as Moderate. Key risk drivers include labour influx, informal or unregulated hiring practices, unequal power relations, weak supervision of subcontractors, worker movement through nearby communities, use of local services and transport, inadequate lighting or access control around work areas and

contractor facilities, and the absence of safe, confidential, and survivor-centred grievance and referral arrangements. Women, girls, children, female-headed households, persons with disabilities, and other vulnerable groups may face heightened exposure. Potential impacts may include sexual harassment, sexual exploitation, abuse, intimidation, stigma, under-reporting, and reduced feelings of safety among community members in areas adjacent to worksites, haul routes, temporary facilities, and worker gathering points.

- Chance discovery of explosive remnants or hazardous legacy items

Given the broader national context, there is a potential that construction in some areas could encounter hazardous legacy items during excavation or works in previously disturbed ground. This is a low-frequency but high-consequence CHS risk, since it could lead to severe injury or fatality, and also large-scale work stoppage.

In relation to road safety and broader community health and safety risks, the primary mitigation approach should not rely solely on temporary traffic management, signage, awareness measures, or future operational controls. Key measures, including access control, crossing provision, fencing and barriers, junction treatment, roadside protection, and speed-management features, are required to be integrated into the final detailed design and reflected in the engineering drawings and technical specifications. Construction and operational controls will complement these embedded design measures, but will not substitute for them.

Overall, pre-mitigation, these risks can reach Major significance, particularly where works interface with live traffic, settlements, and sensitive receptors.

Community Health and Safety impacts are considered of Major significance.

5.3.1.9 Occupational Health and Safety

- Plant and vehicle interaction (struck-by, run-over, reversing)

Construction will require frequent movement of heavy vehicles and mobile plant within work fronts and along access routes. Without strict segregation and control, routine activities such as reversing, turning, and entering or exiting the corridor can result in workers being struck or crushed, particularly where visibility is restricted, work areas are congested, or multiple subcontractors operate in parallel. This risk is heightened across all corridors during peak material delivery periods and near temporary site entrances.

- Working near live traffic

Several works will occur while maintaining public traffic flow, especially for rehabilitation and widening sections and at tie-ins. These conditions create exposure to high-speed traffic, sudden changes in driver behaviour, and barrier limitations, which can lead to severe worker injury if an errant vehicle enters the work zone or if traffic switching is not controlled. The risk profile is typically higher where traffic volumes include heavy trucks and where access management is weak.

- Excavation and trenching hazards

Drainage works, culvert works, utilities interfaces, and localized foundation works require excavation. Unstable sidewalls, poor shoring, water ingress, or collapse can trap or bury workers, while striking

unknown or poorly mapped utilities can cause electrocution, fire, or sudden release of hazardous energy. These hazards are most relevant where works intersect existing services or where soils and groundwater conditions vary along the alignment.

- Working at heights

Structures and elevated works introduce fall-from-height exposure during formwork, scaffolding, bridge elements, and overpass components. Inadequate edge protection, incomplete scaffolding, unsafe access, or poor housekeeping can result in falls causing serious injury, and dropped objects can injure workers below. This is especially relevant for any bridge or overpass activities and during installation of lighting and roadside elements that require elevated platforms.

- Electrical hazards

Temporary electrical supplies, portable tools, lighting works, and interaction with overhead or underground services create electrocution and arc hazards. Improper grounding, damaged cables, wet conditions, or uncontrolled access to live panels can lead to severe injury and secondary incidents such as falls or fires. This is particularly relevant during night works, commissioning of lighting, and at utility crossing locations.

- Hot works and fire hazards

Hot works (welding, cutting) and asphalt works introduce ignition sources, while fuel storage and refuelling introduce flammable materials. Poor control of ignition sources, inadequate fire protection, or unsafe handling of hot bitumen can result in burns, smoke exposure, and fire escalation affecting workers and equipment. These hazards are relevant across all corridors and are more frequent during surfacing and mechanical maintenance activities.

- Dust and airborne contaminants

Earthworks, milling, cutting, and dry-season hauling generate dust that can cause respiratory irritation and, where silica-containing materials are present, contribute to longer-term occupational illness. Dust can also reduce visibility within work areas, which increases the probability of vehicle and plant incidents if traffic and plant movements continue under reduced sight conditions.

- Noise and vibration exposure

High-noise equipment and vibration-intensive activities can cause hearing damage and musculoskeletal strain if exposure is frequent and uncontrolled. This is most relevant during milling, compaction, breaking, and heavy plant operation, particularly where multiple machines operate simultaneously and workers remain in close proximity for extended periods without appropriate PPE.

- Heat stress, fatigue, and ergonomic strain

Construction activities in hot periods, extended shifts, and physically demanding tasks increase the likelihood of heat-related illness and fatigue-driven errors, which can in turn elevate the risk of incidents involving vehicles, tools, and working at height. Repetitive manual handling and awkward postures can also lead to sprains and strains that reduce fitness for work and increase accident susceptibility.

In view of the nature and severity of the anticipated OHS risks, contractors will be required to establish and maintain site-specific OHS arrangements proportionate to the hazards and scale of the works. At a minimum, each contractor shall appoint a full-time Health, Safety and Environment (HSE) Manager or HSE Lead for the contract package and maintain dedicated on-site HSE officer coverage for each active work front and work shift, with authority to stop unsafe work and require corrective action. Additional competent supervision shall be provided for high-risk activities, including works adjacent to live traffic, major lifting operations, excavation and temporary works, and activities undertaken during extreme heat conditions. Contractors shall also prepare task-specific risk assessments, emergency preparedness arrangements, and worker training procedures as part of the Contractor's Environmental and Social Management Plan and Occupational Health and Safety Plan.

The works involve multiple high-severity hazards with frequent daily exposure across work fronts, so serious injury and fatality risks are credible without strict controls, therefore the overall impact significance is considered Major.

Occupational Health and Safety impacts are considered of Major significance.

5.3.1.10 Traffic Flow, Road Access and Safety

- **Expressway No. 2 (Baghdad–Samarra) and Samarra feeder/access road**

Works will include new-build activities, large material haulage, and multiple interfaces with service roads and local crossings, so congestion and collision risk are most likely to increase at temporary tie-ins, detours, and crossing points. Access impacts are most pronounced where local movements (farm access, village access, and informal crossings) interact with construction traffic and temporary barriers, especially if traffic management changes frequently.

- **R9B Segment under Expressway No. 1**

Because the works are largely within an existing live corridor, the most significant construction-phase safety pressure points are lane closures, traffic switching, and work zones adjacent to moving traffic, particularly where heavy vehicles are common. Access and safety risks are most likely to spike at uncontrolled entrances and exits, informal U-turn locations, and encroachment areas, where drivers may attempt shortcuts when access is temporarily restricted.

- **Sulaymaniyah–Chamchamal–Kirkuk Road in the Kurdistan Region of Iraq**

Widening and rehabilitation within an operating corridor typically concentrates impacts around median-side construction, temporary narrowing, and staged lane reallocation, which can increase sudden lane changes and merging conflicts. Access impacts are most pronounced where there are frequent property accesses and junctions, as temporary closures or rerouting can push drivers toward unsafe turning movements if alternatives are not obvious. Road safety risk is likely to be highest where works coincide with busy commuter movements and settlement edges, especially during night works and periods of reduced visibility.

- **Girsheen–Suhaila completion works and the Girsheen overpass in the Duhok area**

Completion works will create intermittent short-term disruptions (for example during surfacing, barrier works, and lighting), with safety risk peaking where traffic runs close to active work fronts and where temporary road markings change frequently. The overpass construction introduces a concentrated set of traffic and access impacts around approach ramps, tie-ins, and any temporary diversions, which can increase confusion and conflict at an already busy node if staging is not intuitive. Localized access restrictions around the interchange zone can also drive risky behaviour unless temporary access routes and turning provisions are clearly signed and physically enforced.

Across the project, lane closures, traffic switching, and temporary access changes can materially increase crash risk and unsafe road-user behaviour, while also affecting access to services and emergency response routes, with credible severe outcomes if unmanaged. Accordingly, the overall impact significance is considered Major.

Traffic Flow, Road Access and Safety impacts are considered of Major significance.

5.3.1.11 Land Acquisition and Involuntary Resettlement

The Project includes both new road development and rehabilitation activities. As a result, land acquisition and land-related restrictions may be required to secure the right of way, create construction working areas, install ancillary infrastructure, and implement safety and access management measures. These requirements can affect people through:

- **Permanent land take and loss of assets:** acquisition of private or commonly used land and associated loss of crops, trees, irrigation features, boundary walls, kiosks, or other fixed assets located within the required corridor.
- **Physical displacement:** relocation of households or structures where residential buildings fall within the land take or cannot remain safely adjacent to the works.
- **Economic displacement:** loss of income or livelihood due to land take, loss of access to farmland or grazing routes, reduced customer access to roadside businesses, removal of encroaching structures, or restrictions on roadside stopping and trading.
- **Temporary land take and access restrictions:** temporary occupation of land for construction staging, detours, borrow and spoil handling, or utility interfaces, which can reduce access to homes, farms, and services during works and disrupt seasonal livelihood activities.
- **Tenure and eligibility risks:** in areas with mixed formal and customary tenure, overlapping claims, informal use, or post-conflict documentation gaps, affected people may face delays in recognition, disputes over eligibility, and prolonged uncertainty that increases vulnerability.
- **Community tension and grievance risk:** perceptions of unequal compensation, inconsistent treatment of encroachments, or lack of transparent valuation can trigger tension, particularly where livelihoods are fragile and trust in institutions is limited.

Across the sub-projects, the likelihood and magnitude differ:

- The **Expressway No. 2 corridor between** Baghdad and Samarra and the Samarra access road presents the **highest** potential for permanent land take, severance, and displacement-related impacts, because they introduce a new right of way and major crossings.
- The **R9B rehabilitation** between Fallujah and Ramadi is primarily within an existing corridor, so the dominant risks are typically economic displacement linked to access management, treatment of encroachments, and temporary restrictions rather than large-scale land take.

- The **Kurdistan Region Road sub-projects** are expected to be mainly within existing corridors, so impacts are most likely to arise through temporary construction easements, local access changes, and any localized acquisition needed for junction tie-ins or structures, rather than corridor-wide displacement.

The overall impact significance is considered major, since land acquisition and land-related restrictions can lead to severe and lasting effects for affected households and businesses, including loss of shelter, loss of productive land, and loss of income. These risks are amplified where livelihoods rely on agriculture and roadside trade, and where tenure documentation and land disputes can delay eligibility confirmation and compensation.

Land Acquisition and Involuntary Resettlement are of Major significance.

5.3.1.12 Labor and Working Conditions

The Project will require a large, multi-tier workforce (contractor staff, subcontractors, suppliers, drivers, and temporary labour) mobilized across several corridors and work fronts. This creates material labor and working conditions risks during construction. The key impact pathways are as follows:

- **Unfair or non-compliant employment conditions**

If recruitment, contracting, wages, working hours, overtime, leave, and end-of-service arrangements are not controlled consistently across contractors and subcontractors, workers may experience wage underpayment, excessive hours, unclear contract terms, or unequal treatment. This can lead to financial hardship, disputes, work stoppages, and increased vulnerability of lower-paid and temporary workers.

- **Child labour and forced labour risks in the supply chain and subcontracting tiers**

While primary contractors may have formal controls, lower tiers (small subcontractors, labour brokers, security and cleaning, transport, informal day labour) can introduce risks of underage work, coercive recruitment, or retention of identity documents. These risks are higher where documentation is inconsistent or where labor is hired informally.

- **Recruitment-related grievances and exclusion from job opportunities**

Communities commonly perceive road works as an employment opportunity. If the project lacks transparent local hiring procedures and clear criteria, disputes can arise around perceived favoritism, unequal access, and allocation of opportunities. This can increase community tension and pressure on site management.

- **Worker accommodation and welfare risks**

If workers are housed in camps or shared accommodation, poor conditions (overcrowding, sanitation, water quality, food hygiene, heat stress controls, fire safety, security arrangements) can result in illness outbreaks, injuries, conflict, and reputational risk. Even where camps are not used, inadequate welfare at work sites (drinking water, toilets, rest areas) affects health and productivity.

- **Harassment, SEA/SH, and gender-related risks**

Worker influx and power dynamics can increase risks of harassment among workers and risks of sexual exploitation and abuse or sexual harassment in interactions with communities, particularly near settlements and roadside services. Female workers may face barriers to safe participation and increased exposure to harassment if protections are weak.

The Project will likely involve a large workforce and multiple subcontracting layers across federal Iraq and the Kurdistan Region, creating credible risks of wage and hour violations, recruitment grievances, forced/child labor in lower tiers, harassment, and welfare shortcomings that can result in serious harm to workers and trigger significant disputes and reputational risk. Accordingly, the overall impact significance is considered Moderate.

Labor and Working Conditions are of Moderate significance.

5.3.1.13 Cultural Heritage

- **Expressway No. 2 (Baghdad–Samarra)**

This subproject includes extensive earthworks, drainage and cross-drainage structures, canal crossings, and associated excavation within a new right of way and along the access road. Ground disturbance creates a credible risk of encountering previously unknown archaeological materials, including subsurface traces associated with historic settlement patterns, old watercourses, or buried cultural deposits. In addition, where archaeological traces have already been identified along sections of the alignment and where screening is incomplete for the Samarra access road area, construction could lead to direct damage, loss of context, or unauthorized disturbance if works proceed without archaeological clearance and active supervision.

- **R9B Segment under Expressway No. 1**

This subproject is largely confined to an existing road corridor and focuses on pavement rehabilitation, localized repairs, safety upgrading, and right-of-way management. While the degree of deep excavation is expected to be lower than a new alignment, cultural heritage risks remain relevant where works require localized trenching for drainage and utilities interfaces, rehabilitation of rest areas, or installation of barriers and fencing that may involve ground penetration beyond previously disturbed layers. If chance finds occur and are not managed correctly, works could damage materials or lead to uncontrolled removal.

- **Sulaymaniyah–Chamchamal–Kirkuk Road**

The widening and upgrading works are intended to occur primarily within the existing corridor and working width. Cultural heritage impacts may still arise where widening, drainage improvements, or junction/interface works require ground disturbance outside the most heavily disturbed footprint, including excavation for culverts, drainage crossings, and roadside infrastructure. The corridor's regional context includes longstanding settlement history and potential for undocumented archaeological materials.

- **Girsheen–Suhaila Road completion works and Girsheen Interchange/Overpass**

The completion works for the road segment mainly involve finishing layers and road safety and lighting systems; cultural heritage risk is limited but still relevant where works involve trenching for

electrical and lighting ducts, foundations for gantries/poles, guardrail posts, or drainage reinstatement. The interchange/overpass component introduces higher ground-disturbance activities through foundation excavation, piling (if used), abutment construction, and earthworks for approach ramps and tie-ins. These activities may encounter buried archaeological materials. If the footprint is not cleared in advance and if chance finds are not managed, the overpass construction could damage subsurface resources or lead to unrecorded removal.

Across the Project, there is a credible risk of irreversible damage to archaeological resources because at least one subproject involves extensive new ground disturbance and known or suspected archaeological traces. At Project level, a single unmanaged high-risk work front is sufficient to elevate overall significance. Prior to mitigation, cultural heritage impacts during construction are therefore assessed as moderate significance, driven primarily by (i) the need to complete archaeological inspection and clearance for identified traces where relevant, and (ii) the potential for chance finds, particularly within unscreened sections in Samarra.

Cultural Heritage impacts are considered of Moderate significance

5.3.2 During Operation Phase

5.3.2.1 Air Quality

Air quality impacts during operation of the ITREC Project are expected to be driven primarily by vehicle exhaust emissions from road traffic (e.g., NO_x, CO, and particulate matter) and road-related dust (including resuspended dust from vehicle movements). Emission rates and resulting ground-level concentrations will vary by traffic volume, fleet composition, vehicle speeds, and traffic flow conditions.

Given that residential receptors and other sensitive uses are located in the vicinity of sections of the project corridors, operational emissions may contribute to localized increases in pollutant concentrations at and near the roads. Separation distance between the carriageway and receptors provides an important buffer in many locations; however, receptors located close to the corridors may still experience elevated exposure, particularly during periods of high traffic demand and under unfavorable dispersion conditions.

Across the rehabilitation and widening/upgrade corridors, operational conditions are expected to reflect a balance between potential increases in traffic volumes due to improved road conditions and the benefits of smoother traffic flow and reduced stop-start driving, which may reduce congestion-related emissions compared to existing conditions.

Overall, prior to operational controls, the significance of operational air quality impacts is assessed as **minor**, with localized effects most relevant near receptors located close to the corridors.

Air Quality impacts are considered of Minor significance.

5.3.2.2 Noise and Vibrations

Noise and vibration impacts during operation of the ITREC Project have been assessed qualitatively, based on the expected operating conditions, which are anticipated to be predominantly uninterrupted

traffic conditions (i.e., steady travel speeds with limited stop–start driving). During operation, noise will be generated primarily by vehicle movements, with contributions from engine and exhaust systems and tire–road interaction, and intermittent contributions from braking and acceleration near interchanges and junctions. The magnitude of operational noise at nearby receptors is mainly influenced by traffic volume, vehicle mix (including the presence of heavy vehicles), vehicle speed, and the distance between receptors and the roadway.

Residential receptors and other sensitive uses are located in the vicinity of sections of the project corridors; however, operational traffic noise is expected to be most relevant within the near-road corridor and to reduce with increasing distance from the roadway. Separation distance between the carriageway and receptors provides an important buffer in many locations; accordingly, operational noise effects are expected to be localized and, in most sections, limited to incremental changes in ambient noise conditions at receptors located closest to the corridors.

Along rehabilitation and upgrade corridors, improved pavement condition is expected to reduce noise generated by vehicle–road interaction compared to degraded pre-project pavement conditions. For the rehabilitation and upgrade components, operational noise and vibration conditions are therefore expected to be broadly comparable to existing conditions along the established road corridors, with changes mainly reflecting traffic volumes and pavement condition.

Traffic-induced vibration during operation is generally expected to be negligible for a well-maintained roadway. Where vibration is perceptible, it is typically associated with localized pavement irregularities, expansion joints, or the passage of heavy vehicles. Such effects are generally limited to the immediate road area and are not expected to propagate substantially to nearby receptors provided that pavement condition and structural joints are appropriately maintained.

Overall, prior to mitigation, operation-phase noise impacts are assessed as **minor** and vibration impacts are assessed as negligible.

Noise and Vibrations impacts are considered of Minor significance.

5.3.2.3 Soil Quality

For the rehabilitation and upgrade components, operational soil-related effects are expected to be broadly comparable to existing conditions along the established road corridors, since traffic-related dust deposition, minor vehicle leaks, and runoff already occur. Accordingly, operation-phase effects for these components are expected to be limited to incremental changes associated with changes in traffic volumes and improved pavement and drainage performance.

During operation of the ITREC Project, potential effects on soil are expected to be localized and mainly linked to traffic-related dust, small leaks or spills from vehicles, and routine road maintenance and drainage works. Given the importance of productive soils in agricultural sections of the corridors, including areas with orchards, protecting soil quality near the roadway is relevant for maintaining local land use and agricultural productivity.

For the rehabilitation and upgrade components, operational soil-related effects are expected to be broadly comparable to existing conditions along the established road corridors, since traffic-related dust deposition, minor vehicle leaks, and runoff already occur. Accordingly, operation-phase effects

for these components are expected to be limited to incremental changes associated with changes in traffic volumes and improved pavement and drainage performance.

Potential sources of effects on soil during operation include:

- deposition of dust and fine material generated by traffic and re-suspended from the road surface and shoulders, with potential settling on adjacent land and vegetation
- leaks from vehicles (e.g., fuel, oils, and other vehicle fluids) and occasional spills
- routine road maintenance and repairs, including cleaning of drainage systems and handling of wastes and materials, which may result in localized soil contamination if not properly controlled
- blockage or poor performance of drainage structures, which may lead to localized erosion or water accumulation and can worsen soil condition near the corridor
- littering by road users, which may accumulate along the corridor and create localized nuisance and pollution issues
- surface runoff from the road surface carrying fine sediments, oil/grease residues, tire and brake wear particles, and litter/debris

Overall, prior to mitigation, operation-phase soil quality impacts are assessed as **minor**, as any effects are expected to be localized to the roadway corridor and, for rehabilitation/upgrade sections, largely comparable to existing conditions and limited to incremental changes.

5.3.2.4 Surface and Groundwater

Surface water and groundwater impacts during operation of the ITREC Project have been assessed qualitatively, considering the baseline presence of sensitive water receptors within the Project AoI across the Federal and KRI sub-projects. Key receptors include major rivers and associated irrigation/drainage networks in the Federal sub-project settings, and seasonal drainage pathways and associated runoff conveyance systems in the KRI sub-project settings. During operation, potential effects are expected to be localized and primarily associated with road runoff, waste and litter, and periodic maintenance activities. In addition, the operational performance of rehabilitated and newly constructed drainage structures is expected to improve runoff conveyance and reduce localized ponding/flooding risk relative to existing conditions, particularly where drainage capacity is currently constrained.

Potential sources of impacts on surface water during operation include:

- runoff from the road surface carrying suspended solids, oil/grease residues, heavy metals, and vehicle-related residues to adjacent drains/canals, seasonal channels, and receiving water bodies.
- littering and unmanaged wastes along the road corridor, including the risk of waste transport to canals/drains or seasonal drainage pathways and localized water quality degradation.
- Periodic maintenance activities and material handling (e.g., minor repairs, cleaning of drainage structures, and vegetation management) that may generate localized releases if not properly controlled.

Potential sources of impacts on groundwater during operation include:

- infiltration of contaminated runoff and spilled materials through soils, particularly where drainage concentrates flows and where infiltration pathways exist.
- indirect effects where contaminated surface water in drains/canals or seasonal drainage features percolates to groundwater, particularly in localized low-lying areas and where groundwater is used through nearby wells.

Based on the available information, groundwater sensitivity varies across the ITREC sub-project settings, with groundwater typically deeper in the KRI sub-project corridors than in parts of the Federal corridors. This reduces sensitivity relative to shallow groundwater settings; however, localized groundwater contamination risks may still occur where contamination is persistent, where drainage pathways concentrate runoff, or where infiltration conditions allow transfer to the subsurface.

Overall, prior to mitigation, operation-phase impacts on surface water and groundwater are assessed as minor, as impacts are expected to be localized and generally manageable under normal operation and routine maintenance practices, and drainage improvements are expected to reduce localized flooding/ponding relative to existing conditions..

Surface and Groundwater impacts are considered of Minor significance.

5.3.2.5 Waste Generation and Management

During operation, waste generation will be associated mainly with routine road operation and maintenance activities and wastes generated by road users. If not adequately controlled, wastes may result in localized disturbance, pollution of soils, and transport of litter and debris to nearby drains, canals, and watercourses. In addition, the rehabilitation and widening/expansion components may lead to increased waste generation rates during operation due to higher traffic volumes, increased maintenance requirements, and more frequent cleaning of road surfaces and drainage features, which will require appropriate management.

Potential waste streams during operation include:

- road-user litter and general solid wastes (plastics, packaging, food waste, and mixed debris)
- accumulated debris from sweeping and routine cleaning of the roadway, shoulders, and drainage features
- vegetation management wastes from roadside maintenance
- wastes from routine maintenance and repair activities (scrap metal, concrete/asphalt fragments, used parts, and packaging)
- hazardous wastes from maintenance activities (used oils and lubricants, oily rags/absorbents, used filters, grease residues, contaminated containers, waste paints/solvents/adhesives, and used batteries)
- wastewater from operational buildings/maintenance facilities

Operation-related waste impacts may include:

- localized littering and visual disturbance along the corridors due to inadequate containment and removal of road-user waste

- blockage of drainage and irrigation channels due to waste accumulation, with potential implications for local drainage performance
- localized contamination of soils and adjacent canals/drains due to improper storage, handling, or disposal of wastes, particularly hazardous wastes and spill-cleanup residues
- localized odor and hygiene issues where organic wastes accumulate or where wastewater/septic sludge is not properly managed
- worker health and safety hazards during collection, handling, and transport of wastes (including non-hazardous wastes), including risks of cuts/punctures, contact with contaminated materials, and fire hazards if hazardous wastes are not properly controlled
- community health and safety risks in locations where wastes and debris are accessible to the public, including attraction of pests and potential contact with hazardous residues

Overall, prior to mitigation, operation-phase waste generation and management impacts are assessed as **moderate**, reflecting the likelihood of ongoing road-user littering and routine maintenance waste generation across the corridors, and the potential for increased waste generation rates in rehabilitation and widening/expansion components, while recognizing that impacts are expected to remain localized and can be effectively controlled through proper waste management practices.

Waste Generation and Management impacts are considered of Moderate significance.

5.3.2.6 Biological Environment

Biodiversity impacts during operation of the ITREC road sub-projects have been assessed qualitatively, considering the baseline context that substantial sections of the corridors pass through modified landscapes (including agricultural land and existing transport corridors), while higher ecological sensitivity is associated with riverine and riparian habitats and connected irrigation/drainage corridors. In particular, elevated sensitivity is expected at and near the Tigris River interface for Expressway No. 2 (including the Ishaqi area and associated canal/drainage networks) and at and near the Euphrates River interface for R9B, as well as at locations where drainage discharges to canals/channels and where riparian strips provide movement corridors within the wider agricultural matrix. Biodiversity features of concern include sensitive aquatic and riparian receptors linked to these systems, including the Endangered Euphrates Soft-shell Turtle (*Rafetus euphraticus*) within the Tigris–Euphrates basin, and the potential presence of other sensitive fauna associated with riparian–agricultural mosaics (including riparian birds and aquatic species linked to river and canal habitats). Key operation-phase biodiversity impacts may include:

- Fauna mortality from road traffic, including wildlife–vehicle collisions, with higher likelihood where fauna movements occur along canals/drains, riparian corridors, and at crossing points.
- Disturbance to fauna from continuous traffic noise and vehicle movement, which may reduce habitat use close to the road edge, particularly in areas where baseline disturbance levels are relatively low.
- Habitat fragmentation and reduced connectivity, as the expressway and expanded corridors form permanent linear obstacles that can restrict wildlife movement between habitat patches and along canal/riparian corridors.

- Modification of light conditions, including headlight glare and any permanent lighting at structures/interchanges, which may alter nocturnal behavior and movement patterns for some species.
- Surface water and aquatic biodiversity impacts related to runoff and accidental spills, particularly at the Tigris (Expressway No. 2) and Euphrates (R9B) interfaces and where drainage discharges to canals/channels, with implications for aquatic habitat quality and sensitive aquatic fauna.
- Poaching/illegal take and increased pressure on biodiversity values, as improved access can increase human presence in riparian areas and near river crossings, with elevated sensitivity where aquatic biodiversity values are higher.
- Pollution from roadside litter and unmanaged waste, as well as residues from vehicle operation (including tire and brake wear), which can create risks for fauna and may be transported to canals and river margins.

Overall, prior to mitigation, operation-phase biodiversity impacts are expected to be Moderate, driven by the presence of sensitive riparian and aquatic receptors and movement corridors at the Tigris River interface for Expressway No. 2 and the Euphrates River interface for R9B, and by the potential for collision, disturbance, fragmentation, and runoff/spill-related effects in these settings.

Impacts on the Biological Environmental are considered of Moderate significance.

5.3.2.7 Occupational Health and Safety

During operation, occupational health and safety risks are anticipated to be limited in scale across the Project, as routine activities will primarily involve inspections, periodic maintenance, drainage cleaning, vegetation control, pavement repairs, line marking, and maintenance of lighting, signage, guardrails, bridges, and interchange structures where applicable. These activities are expected to be infrequent, short-term, and localized.

However, maintenance works will often be undertaken adjacent to or within live traffic lanes, exposing workers to vehicle-strike risks. Additional hazards may arise from the use of maintenance equipment, mobile plant, lifting operations, work at height (particularly at overpasses and lighting structures), electrical maintenance, and exposure to noise and dust. Workers may also be exposed to hazardous materials and substances associated with maintenance activities, including fuels, lubricants, asphalt- or bitumen-related materials, paints, solvents, and welding fumes, depending on the nature of the works being undertaken. Heat stress is also considered a relevant occupational health risk given the outdoor nature of maintenance activities and the high temperatures that may occur during the summer period. On high-speed corridors and heavily trafficked segments, short-duration work fronts may present elevated risk if traffic management measures are not effectively implemented. Additional risk may arise where maintenance activities are undertaken at night, under reduced visibility, or in areas with limited shoulder width or constrained working space.

Unmitigated, these activities could present moderate occupational health and safety risks during operation across all subprojects. This is particularly relevant for routine and emergency maintenance activities carried out under live traffic conditions, where effective work zone control, worker visibility, safe access arrangements, and appropriate occupational health and safety procedures will be critical to reducing risk.

Occupational health and safety impacts are considered of Moderate significance.

5.3.2.8 Community Health and Safety

The primary operational risk across the Project relates to road traffic safety. The upgraded corridors are expected to accommodate higher vehicle speeds, improved traffic flow, and increased traffic volumes compared to existing conditions. While these improvements enhance regional connectivity, they may also increase the severity of traffic incidents, particularly in rural, peri-urban, and settlement-adjacent areas.

Communities along the corridors rely on road crossings to access farmland, grazing areas, markets, schools, healthcare facilities, and other services. Farmers, sheepherders, pedestrians, cyclists, and livestock may attempt to cross at informal locations where crossing facilities are limited, poorly located, or not aligned with established movement patterns. In settlement edges and roadside activity areas, vulnerable road users, including children and elderly persons, face elevated exposure to collision risk.

On high-speed segments and widened dual carriageways, vehicle–pedestrian or vehicle–animal collisions may result in severe injury or fatality. The combination of high potential severity and realistic likelihood of informal crossing behavior results in elevated community safety risk during operation.

Without appropriate mitigation, community health and safety impacts during operation are assessed as major.

Community Health and Safety impacts are considered of Major significance.

5.3.2.9 Traffic Flow, Road Safety and Access

During operation, traffic conditions and access patterns will change across all subprojects compared to the pre-project situation. While the Project will significantly improve inter-governorate and intra-regional connectivity, localized access challenges may arise for communities situated along or adjacent to the alignments.

In rural and agricultural areas, divided carriageways, controlled-access sections, and median barriers may alter traditional movement routes used to access farmland, grazing areas, water points, and community facilities. Where underpasses, overpasses, service roads, or junction arrangements are insufficient, poorly maintained, or misaligned with local travel demand, residents may experience longer travel distances and reduced convenience. This is particularly relevant for farmers and livestock owners requiring frequent cross-corridor movement.

If formal access and crossing arrangements do not adequately reflect community movement patterns, residents may resort to informal U-turns, illegal entry and exit movements, or unsafe crossings, undermining the intended safety function of corridor upgrades. Over time, inadequate access management may also generate community dissatisfaction and grievances if the perception arises that mobility burdens are imposed locally while benefits accrue regionally.

Prior to mitigation, traffic flow, road safety, and access impacts during operation are assessed as moderate to potentially major due to the combined effects of restricted movement and increased safety risk.

Traffic Flow, Road Safety and Access related impacts are assessed of Moderate significance.

5.3.2.10 Land Acquisition and Restrictions on Land Use

During the operation phase, no new land acquisition is anticipated across the Project, as permanent land take is expected to have been completed prior to operation. Nevertheless, residual impacts associated with permanent land acquisition and land-use restrictions may persist.

Permanent right-of-way acquisition may fragment agricultural land and alter traditional movement patterns, particularly where landholdings are divided by the corridor. Inadequate provision or maintenance of crossings and service roads may result in longer travel distances to fields and grazing areas, potentially affecting agricultural productivity and increasing operational costs for land users.

Operational restrictions such as safety setbacks, limits on construction near the corridor, and enforcement of controlled-access zones may constrain adjacent land use and future development opportunities. While necessary for road safety and operational integrity, such restrictions may affect livelihood options if not clearly communicated and fairly addressed.

If land acquisition and compensation processes were not fully implemented in accordance with WB ESS5, or if access arrangements are not maintained during operation, affected persons may experience ongoing access limitations and livelihood impacts.

Land Acquisition and Restrictions on Land Use impacts are considered of Moderate significance.

5.3.2.11 Labor and Working Conditions

The operation phase will require a relatively small workforce for inspections, routine maintenance, traffic management, and asset management functions. As a result, labor influx, large-scale recruitment pressures, and associated community impacts are not anticipated during operation.

Provided that labor management procedures consistent with national law and WB ESS2 continue to be applied, labor-related risks during operation are expected to remain limited and manageable. Labor and Working Conditions impacts during operation are assessed as negligible.

5.3.2.12 Cultural Heritage

No direct impacts on cultural heritage are anticipated during operation, provided that protected sites and any established buffer zones are respected and that routine maintenance remains confined to the established right-of-way. The primary residual risk relates to localized excavation during maintenance works (e.g., drainage repairs), which can be managed through application of chance-find procedures where relevant. Cultural heritage impacts during operation are assessed as negligible.

5.4 Cumulative Impact Assessment

5.4.1 Introduction

Cumulative Impact Assessment (CIA) is undertaken to identify and evaluate impacts that may arise from the interaction of the Project with other existing, planned, or reasonably foreseeable developments within the same area of influence. Such impacts may occur where the combined effect of multiple activities, even if individually limited, results in a greater or more widespread effect on environmental and social receptors than the Project acting alone.

Iraq is currently undergoing rapid development, with major infrastructure, industrial, urban, commercial, and public service investments being implemented or planned across different parts of the country. In this context, cumulative impacts may arise where the Project interacts with other developments of different types within the same area of influence, particularly where multiple activities affect the same environmental and social receptors over time.

A CIA therefore considers the combined and incremental effects of the Project together with other past, present, and reasonably foreseeable future developments, with the aim of identifying potential cumulative impact pathways and informing appropriate management and mitigation measures. Depending on the nature of the interacting developments and the receptors concerned, cumulative impacts may relate to land use, biodiversity, water resources, air quality, noise environment, traffic and transport conditions, community health and safety, resettlement and livelihoods, and access to services and resources.

5.4.2 Projects and Developments in the AoI

Cumulative impacts may arise from the interaction of the Project with other existing, planned, and reasonably foreseeable developments within the area of influence. In the context of Iraq's ongoing and rapid development, these developments include, but are not limited to, major transport infrastructure projects, urban and residential expansion, industrial and commercial development, utility and public service infrastructure, and quarrying and construction-material extraction activities.

Relevant examples include Baghdad Ring Road No. 4, the expansion of quarrying and construction-material extraction activities, and residential developments and housing compounds such as Al Kadhimiya Gate City, in addition to other existing and planned developments that may affect the same environmental and social receptors over time. Depending on their type, scale, location, and timing, these developments may interact with the Project and contribute to cumulative effects on land use, traffic and transport conditions, air quality, noise levels, biodiversity, water resources, community health and safety, livelihoods, and access to services and resources.

Cumulative impacts may also arise from future phases of Expressway No. 2 and associated road developments that may be advanced under the Multiphase Programmatic Approach (MPA). For the purposes of this ESIA, the MPA refers to the broader phased development framework under which subsequent phases of Expressway No. 2 and associated road developments may be implemented beyond the Baghdad–Samarra section currently assessed under this ESIA. As described in the project documentation, Expressway No. 2 extends for approximately 508 km from the Baghdad Ring Road to the Turkish border, while the section currently assessed comprises the initial 100 km Baghdad–Samarra segment.

5.4.3 Preliminary Assessment of Impacts

Table 5-3 provides a preliminary overview of the principal cumulative impacts that may arise from the interaction of the Project with other existing, planned, and reasonably foreseeable developments within the area of influence. Given the current level of project definition and the evolving nature of other relevant developments, the assessment is necessarily indicative and focused on identifying the main environmental and social receptors that may be affected by cumulative impact pathways. More detailed cumulative impact assessment will be undertaken, as appropriate, under the relevant site-specific standalone environmental and social assessment documents for future phases advanced under the MPA.

Table 5-3: Preliminary Identification of Cumulative Impacts

E&S Aspect	Overview of Cumulative Impacts
Air & Noise Emissions	During construction, earthworks, hauling, paving, quarry activities, and material transport associated with the Project and other concurrent developments may result in cumulative short-term deterioration of local air quality and increased noise levels, particularly near settlements and other sensitive receptors. During operation, increased traffic flows generated by the Project together with other road, residential, commercial, industrial, and infrastructure developments may create cumulative long-term pressures on ambient air quality and the acoustic environment.
Surface Waters and Groundwater	During construction, excavation, stockpiling, spoil disposal, runoff, and accidental spills associated with the Project and other developments may overlap, leading to cumulative sedimentation, localized flooding, drainage disruption, and deterioration of surface water quality. During operation, road runoff, altered drainage patterns, increased impermeable surfaces, and other nearby developments may create cumulative pressures on water quality, drainage performance, and water resources within the AoI.
Biodiversity	During construction, land clearance, excavation, quarry expansion, and other development activities may overlap, resulting in cumulative habitat disturbance, vegetation loss, wildlife displacement, and fragmentation of natural and semi-natural areas. During operation, the Project together with other existing and planned developments may contribute to cumulative habitat fragmentation, increased disturbance, reduced ecological connectivity, and greater long-term pressure on biodiversity values within the wider landscape.
Community Health Safety	During construction, concurrent road works and other development activities may create cumulative congestion, access restrictions, safety risks, dust, noise, and general nuisance affecting nearby communities. During operation, increased traffic volumes generated by the Project together with other transport, residential, industrial, and commercial developments may result in cumulative pressures on traffic conditions, road safety, pedestrian movement, and community health and safety.
Waste	During construction, waste, spoil, and surplus excavated material generated by the Project together with other infrastructure and urban developments may create cumulative pressure on available collection, transport, treatment, and disposal capacity. At the same time, increased demand for aggregates, fill material, and other construction inputs may place cumulative pressure on quarries, borrow areas, haul routes, and associated environmental and social receptors.
Livelihood and Land Acquisition	During construction, land take, temporary access disruption, and construction activities may affect agricultural land, roadside businesses, mobility, and livelihood activities along the corridor. Over time, improved connectivity together with other existing and planned developments may accelerate roadside settlement and

	commercial growth, increase pressure on agricultural and undeveloped land, and intensify cumulative disruption to local access, mobility, and livelihoods.
Security Arrangements	During construction and operation, the Project may contribute to increased security demands and movement of workers, vehicles, and equipment in areas affected by legacy conflict risks. In combination with other existing and planned developments, this may increase cumulative exposure to security-related risks, particularly where multiple work fronts, access routes, and development activities overlap.
Cultural Heritage	During construction, earth-disturbing activities associated with the Project and other ongoing developments may create cumulative risks to known and unknown archaeological resources, cultural landscapes, and access to cultural or religious sites. Where multiple developments proceed in parallel, cumulative disturbance, severance, or accidental damage to tangible and intangible cultural heritage may occur.

5.4.4 Cumulative Impact Management Framework

Effective management of cumulative impacts requires consultation, coordination, and information sharing among the different entities whose activities may contribute to such impacts within the area of influence. In many cases, the contribution of an individual project may appear limited in isolation, while the combined effect of multiple developments may result in a more significant cumulative impact on the same environmental or social receptor. As such, the management of cumulative impacts often extends beyond the capacity or control of a single project developer and may require action at a broader, inter-project and institutional level.

Accordingly, cumulative impact management should be guided by coordination among the relevant government entities, project proponents, and other stakeholders, as appropriate, to ensure that overlapping risks and impacts are identified and addressed in a coherent manner. Such coordination should support:

- the application of the mitigation hierarchy, namely avoidance, minimization, mitigation, and, where applicable, compensation, in relation to cumulative environmental and social impacts;
- the exchange of relevant information on planned works, construction schedules, traffic management measures, resource use, and other aspects that may influence cumulative impact pathways;
- the identification of opportunities for coordinated management measures where multiple developments may affect the same environmental and social receptors; and
- the strengthening of monitoring and oversight arrangements where cumulative risks may arise across a wider area or from multiple concurrent activities.

In the context of the broader development of Expressway No. 2, including future phases that may be advanced under the MPA, a more detailed assessment of cumulative impacts will be undertaken as part of the relevant site-specific standalone ESIA or other applicable standalone environmental and social assessment document prepared for each future phase of Expressway No. 2 and associated road developments under the MPA. This detailed assessment will consider the interaction of the relevant future phase with other existing, planned, and reasonably foreseeable developments and will define any additional mitigation, management, monitoring, and institutional coordination measures required.

6 Environmental and Social Management and Monitoring Plans

6.1 Institutional Framework

This chapter describes the institutional arrangements for implementation of the E&S instruments applicable to the ITREC Project. At the Project level, this ESIA provides the overarching E&S management framework for the different sub-projects. The findings of this ESIA will be taken forward, as applicable, through site-specific ESIAs/ESMPs and other downstream instruments for the different sub-projects, which will set out the detailed mitigation, monitoring, supervision, and institutional requirements relevant to each sub-project. The institutional framework presented below is intended to ensure that these instruments are prepared, reviewed, approved, supervised, and implemented in an effective and coordinated manner throughout the Project lifecycle.

Within this framework, implementation of the applicable ESMP requirements will involve various entities. For the ITREC Project, MoCHMPW has overall responsibility for the Project, and RBD, through MoCHMPW, is the lead implementing authority responsible for overseeing Project implementation and reporting. A PMT shall be maintained under the MoCHMPW/RBD implementation arrangement to support Project implementation, including management of environmental, social, health and safety risks and impacts across both the Federal Iraq and Kurdistan Region of Iraq sub-projects. The PMT shall be supported by a PMC at the coordination and systems level, while ESCs / Resident Engineers shall provide day-to-day field-level supervision of contractors' ESHS performance. For the KRG sub-projects, implementation shall be undertaken under the overall Project implementation arrangement led by MoCHMPW/RBD, in close coordination with the relevant KRG authorities, including the Ministry of Construction and Housing, GDRB, and other competent regional entities, as applicable. ESMP implementation will be carried out by the contractors appointed for each sub-project under the supervision of the ESCs / Resident Engineers and the overall oversight of the PMT within the MoCHMPW/RBD implementation structure. The following sub-chapters outline the roles and responsibilities of each entity.

6.1.1 Roles and Responsibilities

For the ITREC Project, MoCHMPW has overall responsibility for the Project, and RBD, through MoCHMPW, is the lead implementing authority responsible for overseeing Project implementation and reporting. A PMT shall be maintained under the MoCHMPW/RBD implementation arrangement to support management of ESHS risks and impacts across both the Federal Iraq and KRG sub-projects. For the KRG sub-projects, implementation shall be undertaken under the overall Project implementation arrangement led by MoCHMPW/RBD/PMT, in close coordination with the KRG Ministry of Construction and Housing, GDRB, and other relevant regional authorities, as applicable. Within this framework, the MoCHMPW / RBD / PMT implementation structure shall retain overall responsibility for ensuring that the Project is implemented in accordance with the ESIA, ESMP, SEP, LMP, resettlement instruments where applicable, and the World Bank Environmental and Social Standards.

The responsibilities of the MoCHMPW / RBD / PMT implementation structure shall include, at a minimum, the following:

a) Oversight and compliance

- Ensure that environmental and social requirements are integrated into bidding documents, contracts, technical specifications, and supervision arrangements.
- Ensure that the applicable site-specific ESIAs/ESMPs and other downstream instruments for the different sub-projects are prepared, reviewed, and approved prior to commencement of the relevant works, and that their requirements are integrated into bidding documents, contracts, technical specifications, supervision arrangements, and contractor management plans, as applicable.
- Review contractor environmental and social staffing arrangements, the Contractor Environmental and Social Management Plan (C-ESMP), and other contractor management plans for compliance with the ESIA, ESMP, and other applicable project instruments.
- Provide comments to contractors and require revision of submitted documents where necessary.
- Issue formal clearance of contractor environmental and social staffing and management plans prior to commencement of civil works.
- Monitor contractor performance throughout implementation, including compliance with occupational health and safety, community health and safety, labor management, grievance management, traffic management, waste management, hazardous materials management, stakeholder engagement, and other relevant requirements.
- Undertake field inspections and review contractor records, reports, incidents, grievances, and corrective actions.

b) Monitoring and reporting

- Conduct internal monitoring of environmental and social performance during pre-construction, construction, and operation, as applicable.
- Consolidate and report on implementation of environmental and social requirements in regular Project progress reports.
- Coordinate with consultants, supervision teams, Resident Engineers, and external specialists, where engaged, on environmental and social matters.

c) Stakeholder engagement and grievance oversight

- Oversee implementation of the stakeholder engagement process and functioning of the grievance redress mechanism.
- Ensure that grievances are recorded, tracked, and addressed in a timely manner.
- Support disclosure and communication with affected communities and other stakeholders.

d) Capacity building

- Ensure that relevant PMT, RBD, GDRB, Resident Engineers, and supervision teams receive appropriate environmental and social training.
- Provide direction and support to contractors on compliance expectations where needed.

The Resident Engineer shall support the PMT under the MoCHMPW/RBD implementation structure in day-to-day supervision of contractor compliance during construction. This shall include routine site

inspections, review of contractor records and monthly reports, verification of implementation of mitigation measures, follow-up on corrective actions, and prompt escalation of non-compliance issues through the established supervision and reporting arrangements.

6.1.2 Contractor Environmental and Social Staffing and Responsibilities

Within the Project implementation structure, the PMT under the MoCHMPW/RBD arrangement shall provide overall Project-level coordination and oversight of ESHS requirements, supported by the PMC at the coordination and systems level. At site level, the ESCs / Resident Engineers shall provide day-to-day supervision of contractors' ESHS performance. Within this framework, each contractor shall be responsible for implementation of the environmental and social mitigation, management, monitoring, and reporting requirements assigned to it under the applicable Project instruments and contract documents.

The contractor shall establish and maintain environmental, social, health and safety capacity proportionate to the scale, location, and risk profile of the works. At a minimum, each contractor shall:

a) Maintain E&S staffing

- Appoint qualified environmental, social, and health and safety personnel for the contract package.
- Maintain a full-time Health, Safety and Environment (HSE) Manager or HSE Lead for the contract package.
- Maintain adequate on-site HSE officer coverage for active work fronts and work shifts.
- Appoint a qualified Environmental Officer to oversee implementation of environmental mitigation measures, waste management, pollution prevention, hazardous materials management, and environmental monitoring requirements.
- Assign a qualified Social Officer or community liaison focal point to support stakeholder engagement, grievance follow-up, land-related communication where applicable, and communication with affected communities.
- Increase staffing and supervision where multiple work fronts or high-risk activities are underway.

b) Prepare and implement contractor plans

The contractor shall prepare, submit, update as needed, and implement a Contractor Environmental and Social Management Plan (C-ESMP), together with other theme-specific management plans and procedures required for the works. The contractor's plans and procedures shall be consistent with the applicable site-specific ESIA/ESMP and any other downstream instruments prepared for the relevant sub-project. Depending on the final scope and risk profile of each contract, these may include, as applicable:

- Occupational Health and Safety Plan;
- Traffic Management Plan;
- Community Health and Safety Plan;
- Waste Management Plan;
- Biodiversity Management Plan (BMP);

- Security Management Plan (SMP);
- Spill Prevention / Spill Management Procedures;
- Emergency Preparedness and Response Plan;
- Labor and worker camp management procedures, where camps are required;
- Chance Finds Procedure;
- SEA/SH Action Plan and associated procedures, where applicable; and
- Any other environmental and social management plans required by the ESIA, ESMP, technical specifications, or the MoCHMPW/RBD/PMT implementation structure.

c) Implement and monitor compliance

- Implement all approved environmental and social management measures on site.
- Ensure worker and subcontractor compliance with approved health, safety, environmental, and social procedures.
- Conduct inductions, toolbox talks, and task-specific training for workers.
- Maintain records of staffing, training, inspections, incidents, grievances, corrective actions, and monitoring results.
- Manage solid waste, liquid waste, hazardous materials, and hazardous waste in accordance with applicable legal requirements, approved procedures, and permit conditions.
- Submit regular environmental and social performance reports to the PMT and the Resident Engineer / supervision team, in accordance with the established reporting arrangements.
- Immediately notify the PMT / Project implementation structure of serious incidents and implement corrective and preventive actions.

6.1.3 Pre-Construction Submission, Review, and Clearance Requirements

Before commencement of civil works for the relevant sub-project, the applicable site-specific ESIA/ESMP and any other required downstream instruments shall be prepared, reviewed, and approved in accordance with the applicable Project and regulatory requirements. These instruments shall define the detailed E&S requirements for the relevant sub-project, including any additional surveys, management plans, disclosure steps, preconditions, and approval requirements applicable to the proposed works. Before mobilization of the relevant works, the contractor shall also submit for review and clearance its environmental and social staffing structure and the required contractor management plans. Civil works shall not commence until the Project Owner, namely RBD for the federal components and GDRB for the Kurdistan Region of Iraq components, has reviewed and formally cleared the contractor's submissions. Moreover, the relevant work sites, access routes, and ancillary areas shall be screened for landmine / UXO / ERW risk and landmine and ERW clearance letters shall be obtained from the Ministry of Environment / Directorate of Mine Action.

At a minimum, the following shall be submitted and cleared before mobilization of relevant works:

- Contractor environmental and social staffing structure, including names, positions, qualifications, reporting lines, and site presence arrangements;
- Contractor Environmental and Social Management Plan (C-ESMP);
- Biodiversity Management Plan (BMP);
- Waste Management Plan;
- Spill Management Plan / spill prevention and response procedures;
- Chance Finds Procedure;
- SEA/SH Action Plan and associated procedures, where applicable;

- Security Management;
- Worker Grievance Mechanism arrangements;
- Occupational Health and Safety Plan;
- Traffic Management Plan;
- Emergency Preparedness and Response Plan;
- Community Health and Safety measures and procedures; and
- UXO / ERW clearance letters
- Any additional theme-specific plans required by the ESIA, ESMP, or contract documents.

The PMT shall review these submissions, provide comments where necessary, and issue formal clearance only when the staffing arrangements and management plans are considered adequate for the nature and risks of the works. The contractor shall revise and resubmit documents as required until clearance is obtained. Any subsequent material revision to staffing arrangements or approved management plans shall also be subject to review and clearance by the PMT.

6.1.4 Required Resources and Capacity Building

The Project will require a structured capacity-building program to strengthen the ability of the PMT, RBD/GDRB implementation teams, PMC, ESCs / Resident Engineers, contractors, and other relevant implementing entities to manage environmental, social, health and safety requirements in accordance with the ESCP and the applicable World Bank Environmental and Social Standards. While relevant institutions and contractors in Iraq have experience in contracting and technical works, additional capacity building is required to support effective implementation of the Project's environmental and social instruments, supervision arrangements, monitoring and reporting obligations, stakeholder engagement, grievance management, labor and occupational health and safety requirements, community health and safety measures, and other ESHS commitments throughout the Project lifecycle.

The Project will therefore require targeted capacity building for PMT staff, RBD/GDRB implementation teams, PMC, ESCs / Resident Engineers, Social Development Officers, contractors, and relevant field teams to support effective ESMP implementation, supervision, monitoring, reporting, stakeholder engagement, grievance management, and other ESHS requirements. The capacity-building program shall cover, as applicable, ESF/ESS requirements, stakeholder engagement, grievance management, labor and working conditions, occupational health and safety, community health and safety, road safety and traffic management, biodiversity and cultural heritage management, waste and pollution prevention, SEA/SH risk mitigation and response, resettlement and livelihood restoration, monitoring and reporting, and inclusion of vulnerable groups. Training and awareness activities shall be undertaken prior to commencement of relevant works and continued throughout implementation, with refresher training provided as needed. The recommended training programs are presented below.

Table 6-1: Recommended Training Courses for RBD/GDRB staff and Res

Training course	Type of training	Participating parties	Proposed Scheduling
World Bank ESF/ESS requirements and ESCP implementation	Classroom and on-the-job training	PMT staff; Environmental Department staff of	At the beginning of Project implementation; refresher as needed

		RBD/GDRB; PMC; ESCs / REs	
Tailored training on environmental management and monitoring for the Project	Classroom and on-the-job training	PMT staff; Environmental Department staff of RBD/GDRB; ESCs / REs	Before detailed design of the Project and prior to project implementation
Sampling and measurements (water resources and environmental monitoring)	On-the-job training	PMT staff; Environmental Department staff of RBD/GDRB; ESCs / REs	Prior to project implementation
Occupational health and safety	Classroom and on-the-job training	PMT staff; Environmental Department staff of RBD/GDRB; ESCs / REs; contractors' HSE staff	Prior to project implementation; refresher during implementation
Community health and safety, road safety, and traffic management	Classroom and on-the-job training	PMT staff; RBD/GDRB staff; ESCs / REs; relevant field teams	Prior to project implementation; refresher during implementation
Biodiversity and cultural heritage management	Classroom and on-the-job training	PMT staff; Environmental Department staff of RBD/GDRB; ESCs / REs	Prior to works in sensitive sections; refresher as needed
Monitoring, reporting, incident notification, corrective actions, and record keeping	Classroom and on-the-job training	PMT staff; Environmental Department staff of RBD/GDRB; ESCs / REs	Prior to project implementation; refresher during implementation
Defensive driving and machinery operation safety	Classroom and on-the-job training	Drivers and operators	Periodical

Table 6-2: Recommended Training Courses for Social Development Officers in RBD/GDRB

Training course	**Type of training**	**Participating Parties**	**Proposed Scheduling**
World Bank Environmental and Social Standards with emphasis on involuntary actions, grievances, and livelihood restoration	One-day workshop and on-the-job training	Social Development Officers; relevant PMT social staff	During the beginning of project implementation
Communication skills and stakeholder engagement	Two-day workshop and on-the-job training	Social Development Officers; relevant PMT social staff	During the beginning of project implementation
Promotion of awareness-raising activities and inclusive outreach to vulnerable groups	Workshop and on-the-job training	Social Development Officers; relevant PMT social staff	Once before project implementation; refresher during implementation
Community participation tools	One-day workshop and on-the-job training	Social Development Officers; relevant PMT social staff	During the beginning of project implementation
Monitoring and evaluation mechanisms (M&E)	Two-day workshop and on-the-job training	Social Development Officers; PMT	During the beginning of project implementation

SEA/SH risk mitigation, confidential grievance handling, and referral pathways	Workshop and on-the-job training	Social Development Officers; relevant PMT social staff	Prior to project implementation; refresher during implementation

To promote efficient implementation and consistent application of requirements across all sub-projects, the above-mentioned capacity-building activities should, where appropriate, be delivered in the form of Training of Trainers (TOT), classroom sessions, on-the-job coaching, and refresher training. An information-sharing and coordination mechanism should be maintained between the PMT, RBD, GDRB, PMC, ESCs / Resident Engineers, and relevant contractors to support consistent application of environmental and social requirements across the Project. Training records, including topics covered, participants, timing, and completion status, should be maintained by the Project implementation structure.

6.2 Environmental and Social Management Plan (ESMP)

The management and mitigation measures presented in this section are defined at the Project level and are intended to guide the preparation of the site-specific ESIAs/ESMPs and other downstream instruments for the different sub-projects. As applicable, these measures will be further refined and tailored to the location, design, sensitivities, and implementation arrangements of each sub-project, including any additional surveys, management plans, and preconditions required prior to commencement of the relevant works. Site-specific ESIAs/ESMPs shall include detailed costing and budget allocation for the mitigation, monitoring, management, and supervision measures applicable to the relevant sub-project. Implementation of the measures shall be carried out by the contractors appointed for each sub-project, under the day-to-day supervision of the ESCs / Resident Engineers and the overall oversight of the PMT within the MoCHMPW/RBD implementation structure.

Table 6-3: Environmental and Social Management Plan (ESMP)

Receptor / Aspect	Impact	Impact Significance	Mitigation Measures	Means of Supervision	Residual Impact	Implementation Responsibility	Supervision	Estimated Cost
Pre-construction and Construction Phase								
Air Quality	Fugitive dust and diesel exhaust from earthworks and pavement works, material handling/stockpiling, and construction traffic may cause localized disturbance and temporary air quality deterioration near active construction areas, access routes, and sensitive receptors. Indirect air emissions may also arise from	**Moderate**	– Water spraying of dust-generating areas, particularly under dry conditions – Planning/siting stockpiles to minimize dust impacts considering wind direction and sensitive receptors – Minimize free-fall distance during loading/unloading to reduce dust generation – Locating stockpiles away from sensitive receptors where practicable – On-site speed limits for trucks on unpaved	– Site inspection and visual assessment with photo documentation – Review of records and logs – Complaints register – Ambient air quality monitoring as per monitoring schedule	**Minor**	Contractor	PMT and ESCs / Resident Engineer;	Included in contractor cost

Receptor / Aspect	Impact	Impact Significance	Mitigation Measures	Means of Supervision	Residual Impact	Implementation Responsibility	Supervision	Estimated Cost
	associated facilities and material suppliers.		surfaces (e.g., 20 km/h) and enforcement – Covering trucks transporting spoil or other dusty materials off-site before leaving the site – Wheel-washing facilities for trucks leaving the site to reduce track-out and secondary dust on public roads – Regular sweeping of public roads used by site traffic to prevent dirt accumulation and re-suspension – Minimizing idling / throttling down equipment between tasks – Prohibiting burning of waste or vegetation on site – Training equipment operators and truck drivers on air-pollution control practices – Routine/periodic washing of construction machinery and vehicles to minimize dust carryover and emissions – Establish and implement a documented preventive					

Receptor / Aspect	Impact	Impact Significance	Mitigation Measures	Means of Supervision	Residual Impact	Implementation Responsibility	Supervision	Estimated Cost
			maintenance program to ensure construction machinery and vehicles are maintained in good working condition and to minimize exhaust emissions – Communicate activity schedules to nearby residents in advance (for high-activity/dust periods) – Erect effective barriers/screens around dusty activities or along the site boundary where receptors are close – Conduct visual inspections of exhaust emissions from construction machinery and vehicles and take corrective action where excessive smoke is observed – Carry out periodic air quality monitoring at sensitive receptor locations to confirm effectiveness of controls and check against applicable standards					

Receptor / Aspect	Impact	Impact Significance	Mitigation Measures	Means of Supervision	Residual Impact	Implementation Responsibility	Supervision	Estimated Cost
			where monitoring is required – Phase earthworks to limit exposed soil area and duration – Complete and stabilize finished sections before opening new construction areas – Suspend or reduce dust-intensive activities during high wind conditions where dust cannot be effectively controlled – Source materials only from licensed/permitted asphalt plants, concrete batching plants, and quarries/borrow sources (where used), and maintain valid permits on file – Locate staging, refueling, and maintenance areas away from sensitive receptors where practicable – Water spraying of dust-generating areas, particularly under dry conditions – Planning/siting stockpiles to minimize dust impacts					

Receptor / Aspect	Impact	Impact Significance	Mitigation Measures	Means of Supervision	Residual Impact	Implementation Responsibility	Supervision	Estimated Cost
			considering wind direction and sensitive receptors – Minimize free-fall distance during loading/unloading to reduce dust generation. – Locating stockpiles away from sensitive receptors where practicable					
Noise and Vibrations	Construction activities may cause temporary, localized increases in noise and ground-borne vibration, resulting in disturbance to nearby residents and sensitive receptors.	**Moderate**	– Restrict construction hours to daytime periods near houses and other noise-sensitive receptors – Set and enforce site-traffic speed limits – Install temporary noise barriers (e.g., plywood or acoustic blankets) around high-noise equipment/activities near sensitive receptors – Train staff on construction best practice for noise and vibration control – Maintain equipment regularly (e.g., lubrication, tightening loose parts, replacing worn components) – Ensure all equipment is fitted with effective noise	– Site inspection and visual assessment with photo documentation – Review of records and logs – Complaints register – Noise levels monitoring as per monitoring schedule	**Minor**	Contractor	PMT and ESCs / Resident Engineer;	Included in contractor cost

Receptor / Aspect	Impact	Impact Significance	Mitigation Measures	Means of Supervision	Residual Impact	Implementation Responsibility	Supervision	Estimated Cost
			control devices (e.g., mufflers/silencers, shrouding, engine covers, vibration isolators) and keep them operational; inspect periodically - Use newer/quieter equipment and improved muffling where practicable - Shut down or throttle down machinery and vehicles when not in active use (minimize idling) - Orient noisy equipment to direct noise away from receptors - Locate stationary noisy equipment and temporary plants as far from receptors as practicable and apply temporary shielding/barriers where relocation is not feasible (e.g., generators, compressors) - Avoid transporting materials and off-site movements through community areas during					

Receptor / Aspect	Impact	Impact Significance	Mitigation Measures	Means of Supervision	Residual Impact	Implementation Responsibility	Supervision	Estimated Cost
			nighttime hours and route construction traffic away from sensitive receptors where feasible – Use material stockpiles and site structures to screen noise to sensitive receptors – Inform nearby residences in advance about noisy activities during construction phases including timing/duration and a contact point for complaints – Conduct periodic noise and vibration monitoring to demonstrate compliance with project limits and to support complaint investigations where required – Record, investigate, and respond to complaints through the established grievance mechanism – Use low-noise/low-vibration construction methods and equipment where practicable – Fit high-noise tools (e.g., jackhammers, pavement					

Receptor / Aspect	Impact	Impact Significance	Mitigation Measures	Means of Supervision	Residual Impact	Implementation Responsibility	Supervision	Estimated Cost
			breakers) with acoustic shrouds/attenuating shields – Schedule truck loading/unloading and material handling to minimize noise near noise-sensitive receptors – Provide workers exposed to high noise with hearing protection (earmuffs/earplugs) and enforce use – Require suppliers/contractors to ensure equipment complies with applicable noise standards – Maintain smooth temporary access/detour surfaces where used to reduce vehicle component rattling and avoid unnecessary noise – Identify structures located close to vibration-generating activities (e.g., vibratory compaction and heavy vehicle movements) and conduct visual checks for cracking/damage; modify methods if					

Receptor / Aspect	Impact	Impact Significance	Mitigation Measures	Means of Supervision	Residual Impact	Implementation Responsibility	Supervision	Estimated Cost
			vibration-related impacts are observed – Limit use of vibratory rollers and heavy compaction equipment to where technically necessary					
Soil Quality	Construction activities may cause localized soil degradation and contamination risks due to soil disturbance, topsoil loss/erosion, compaction, and spills/leaks (particularly within agricultural and orchard areas).	**Moderate**	– To avoid loss of the productive soil layer, all suitable topsoil and other material shall be saved and stockpiled separately for future reinstatement / recultivation – Stockpiles of removed topsoil shall be properly designed/shaped and managed – Temporary detention/containment measures to control silt runoff shall be provided – Soil compaction shall be reduced by keeping vehicles and machinery within defined temporary road/work boundaries – Embankment slopes shall be protected from erosion through stabilization measures and slope drainage	– Site inspection and visual assessment with photo documentation – Review of records and logs – Spill response records and evidence of contaminated soil removal / disposal where incidents occur	**Minor**	Contractor	PMT and ESCs / Resident Engineer;	Included in contractor cost

Receptor / Aspect	Impact	Impact Significance	Mitigation Measures	Means of Supervision	Residual Impact	Implementation Responsibility	Supervision	Estimated Cost
			– Disturbed areas shall be reinstated progressively after completion of works in each section – Temporary construction camps and storage areas shall be set up to minimize land take and reduce soil erosion impacts – Off-site fueling and maintenance shall be used as the default – Refueling, oil changes, and equipment maintenance shall not be undertaken near rivers, canals, drains, or other water bodies, including at or near crossing locations; all fueling/maintenance shall be limited to designated contained areas – Secondary containment (e.g., drip trays, bunds) shall be used to prevent leaks/spills during fluid handling; absorbent materials shall be available for immediate response – Vehicles and equipment shall be inspected					

Receptor / Aspect	Impact	Impact Significance	Mitigation Measures	Means of Supervision	Residual Impact	Implementation Responsibility	Supervision	Estimated Cost
			regularly for leaks; leaks shall be repaired immediately, and leaking vehicles/equipment shall not be permitted on site – A wastewater management plan and appropriate sewage collection and disposal systems shall be implemented for camps/facilities to prevent pollution of soils and nearby water bodies – No uncontrolled discharge or drainage of contaminated water (including runoff from work areas, refueling/maintenance areas, wash water, or dewatering effluent) shall occur onto adjacent agricultural land or orchards; such water shall be contained and managed through controlled drainage and, where required, settlement/filtration prior to discharge at approved locations					

Receptor / Aspect	Impact	Impact Significance	Mitigation Measures	Means of Supervision	Residual Impact	Implementation Responsibility	Supervision	Estimated Cost
			– No unauthorized dumping shall occur – Waste collection/storage areas shall be located on impermeable surfaces and arranged to prevent runoff from transporting contaminants to water bodies or agricultural soils (bunding and good housekeeping) – Materials designated for disposal shall be assessed and, where required, tested to confirm chemical characteristics so they can be classified and managed appropriately – Staff shall receive adequate training on environmental protection, spill prevention/response, and safe handling practices – Phase construction activities so exposed soils are limited to approved and active construction areas only, and prohibit soil disturbance outside the approved construction footprint					

Receptor / Aspect	Impact	Impact Significance	Mitigation Measures	Means of Supervision	Residual Impact	Implementation Responsibility	Supervision	Estimated Cost
			– Restrict construction traffic and equipment movement to designated access routes and working areas; prohibit operation or parking of heavy machinery on undisturbed soil – Confine temporary access roads and staging/laydown areas to designated locations and remove and restore them following completion of works – Store excavated soil and reuse for backfilling where technically suitable; avoid unnecessary on-site storage of surplus material – Identify and isolate soil affected by spills/leaks; remove contaminated soil and dispose of it through authorized facilities, in accordance with applicable requirements – Source raw materials only from authorized/licensed quarries and borrow sources (where used) – Restore agricultural land, roadside areas, and					

Receptor / Aspect	Impact	Impact Significance	Mitigation Measures	Means of Supervision	Residual Impact	Implementation Responsibility	Supervision	Estimated Cost
			temporarily occupied land to original or agreed conditions following completion of works					
Surface and Groundwater	Construction activities may cause localized deterioration of surface water and groundwater quality due to sediment runoff, spills/leaks, improper waste/material handling, and inadequate wastewater management, particularly near canals/drains and at river crossing locations and seasonal drainage features, including localized flood/ponding risk where drainage structures are obstructed, diverted, or not reinstated during phased works. The significance and extent of such impacts will require further refinement, once	**Major**	– A Spill Management Plan and Emergency Response Plan shall be implemented, and personnel shall be trained in spill prevention and emergency response procedures. – Once detailed designs are available for Expressway No. 2 and prior to commencement of the relevant works, undertake any additional surface water and groundwater assessment required for sections involving crossings, drainage structures, or works near water environments, including, as applicable, hydraulic / hydrological assessment, drainage-capacity verification, and review of dewatering arrangements, and reflect the resulting requirements in the relevant site-specific ESIAs/ESMPs.	– Water quality monitoring as per monitoring schedule – Site inspection and visual assessment with photo documentation – Compliance with the Spill Management Plan and Emergency Response Plan – Review of records and logs	**Moderate**	Contractor	PMT and ESCs / Resident Engineer;	Included in contractor cost

Receptor / Aspect	Impact	Impact Significance	Mitigation Measures	Means of Supervision	Residual Impact	Implementation Responsibility	Supervision	Estimated Cost
	detailed designs are available, for sections involving river crossings, canal-crossing bridges, irrigation canal crossings, culverts, drainage structures.		– Discharge of any untreated water to surface water bodies (rivers, canals, drains, and channels) shall be prohibited. – Runoff control and erosion / sediment control measures shall be implemented to prevent transport of soil / sediments to canals / drains and seasonal drainage features. – Earthworks and paving activities will be planned and managed to minimize runoff and sediment transport during rainfall; exposed soils, embankments, and stockpiles will be protected and stabilized. – Drainage systems and erosion / sediment controls will be inspected and maintained regularly. – Construction materials, and wastes shall be stockpiled and stored to prevent wash-off to surface water bodies; runoff shall be diverted					

Receptor / Aspect	Impact	Impact Significance	Mitigation Measures	Means of Supervision	Residual Impact	Implementation Responsibility	Supervision	Estimated Cost
			away from stockpiles and work areas using drainage trenches/ditches and containment measures. – Waste shall be segregated (non-hazardous and hazardous) and stored in appropriate, labeled containers within contained areas; storage shall allow inspection and spill control. – All wastes shall be transported and disposed of through licensed/authorized contractors and approved facilities; dumping near canals/drains or river margins shall be prohibited. – Worker camps/facilities shall implement appropriate sanitation and wastewater management; sewage and septic sludge shall be collected and disposed of through authorized providers and no uncontrolled discharge shall occur to land or surface water bodies.					

Receptor / Aspect	Impact	Impact Significance	Mitigation Measures	Means of Supervision	Residual Impact	Implementation Responsibility	Supervision	Estimated Cost
			– Refueling, oil changes, and equipment maintenance shall not be undertaken near rivers, canals, drains, or other surface water bodies all fueling/maintenance shall be limited to designated contained areas. – Fuel tanks, chemical storage, and hazardous materials storage shall be placed on impermeable surfaces within bunded/contained areas designed to retain spills and prevent runoff to surface water bodies. – Vehicles and equipment shall be inspected regularly for leaks; leaks shall be repaired immediately and leaking vehicles/equipment shall not be permitted on site. – Vehicle/equipment washing shall not occur near surface water bodies; where washing is required, it shall be conducted in controlled wash areas and wash					

Receptor / Aspect	Impact	Impact Significance	Mitigation Measures	Means of Supervision	Residual Impact	Implementation Responsibility	Supervision	Estimated Cost
			water shall be contained and managed. – Dewatering activities shall be managed to prevent pollution: pumped water shall be contained and treated for suspended solids prior to discharge; discharge locations and discharge controls shall be defined in accordance with the detailed design and site-specific conditions, and shall be controlled to prevent erosion and impacts on canals, drains, rivers, and other nearby water environments – At river and canal crossings, work areas shall be clearly defined and controlled; in-river and near-river works shall apply sediment control measures. – Water bodies shall be kept free of construction debris; measures shall be implemented to maintain drainage/irrigation conveyance during works and prevent obstruction.					

Receptor / Aspect	Impact	Impact Significance	Mitigation Measures	Means of Supervision	Residual Impact	Implementation Responsibility	Supervision	Estimated Cost
			– Crossings with surface water bodies and associated work areas shall be inspected routinely for evidence of erosion, elevated turbidity, oil/grease sheen, or waste accumulation.					
Waste Generation and Management	Construction activities may generate non-hazardous and hazardous wastes; inadequate segregation, storage, transport, or disposal may cause localized pollution and health and safety risks. Improper waste handling may also contribute to blockage/contamination of drains and canals and localized nuisance conditions.	**Moderate**	– Prepare and implement a detailed Waste Management Plan covering all solid wastes, liquid wastes, and hazardous wastes, in consideration of the applicable local waste management system, including roles and responsibilities (Contractor, supervision, and HSE staff), a waste classification/handling table (waste type, segregation method, storage method, collection frequency, and disposal route), and estimated waste quantities – Allocate a separate bin/container for each waste type and ensure	– Site inspection and visual assessment with photo documentation – Complaints register – Waste monitoring according to the monitoring schedule – Compliance with the Waste Management Plan and logs – Review of disposal documentation and contractor permits/licenses – Verification that surplus/unsuitable excavated material is transported only to approved disposal locations (records / tickets / manifests)	**Minor**	Contractor	PMT and ESCs / Resident Engineer;	Included in contractor cost

Receptor / Aspect	Impact	Impact Significance	Mitigation Measures	Means of Supervision	Residual Impact	Implementation Responsibility	Supervision	Estimated Cost
			clear labeling and segregation at source – Designate waste collection and storage areas within the construction sites and ensure adequate housekeeping and access control – Ensure waste storage areas are arranged to prevent mobilization by wind/rainfall and to avoid impacts on drains/canals – Reuse excavated material where technically suitable and dispose of surplus or unsuitable material only at approved disposal locations (with documentation) – Promote the 3Rs (Reduce, Reuse, Recycle) to minimize waste generation and maximize reuse/recycling opportunities – Prohibit open burning of waste and prohibit unauthorized dumping/fly-tipping					

Receptor / Aspect	Impact	Impact Significance	Mitigation Measures	Means of Supervision	Residual Impact	Implementation Responsibility	Supervision	Estimated Cost
			– Implement worker awareness and training on waste management, with emphasis on prevention of oil and fuel spills/leaks and proper handling of hazardous materials – Separate hazardous waste and dispose to appropriate treatment/disposal facilities – Store hazardous waste (e.g., contaminated soil, paint cans, epoxy containers, oily rags/absorbents, used filters, batteries, contaminated containers) in separate labeled containers in a controlled storage area – Implement spill response procedures, including availability of spill kits, immediate containment and cleanup, and management of contaminated absorbents/soil as hazardous waste – Ensure wastewater and septic sludge from					

Receptor / Aspect	Impact	Impact Significance	Mitigation Measures	Means of Supervision	Residual Impact	Implementation Responsibility	Supervision	Estimated Cost
			workforce facilities are collected in septic tanks and removed through authorized providers; prohibit any uncontrolled discharge – Enforce the use of appropriate PPE and safety precautions when handling hazardous wastes and contaminated materials – Conduct routine inspections of waste storage areas and housekeeping practices, and implement corrective actions promptly for any nonconformities – Use licensed/authorized contractors for non-hazardous and hazardous wastes; transport wastes only to legally permitted/approved facilities; and maintain a waste register with records of quantities removed/disposed (including manifests/tickets/receipts and disposal certificates where applicable)					

Receptor / Aspect	Impact	Impact Significance	Mitigation Measures	Means of Supervision	Residual Impact	Implementation Responsibility	Supervision	Estimated Cost
			– Where landmines, UXO, or ERW are identified and removed, implement site-specific handling and disposal procedures consistent with Good International Industry Practice and maintain the relevant records and supporting documentation.					
Risk of Unexploded Ordinance (UXO)	Ground-disturbing works may pose landmine / UXO / ERW risks to workers and nearby communities where works extend into unverified ground, including at greenfield sections, borrow areas, temporary access roads, drainage works, and other ancillary work areas.	**Major**	– Screen all relevant work sites, access routes, and ancillary areas for landmine / UXO / ERW risk prior to commencement of any ground-disturbing works. – Obtain landmine and explosive remnants of war (ERW) clearance letters from the Ministry of Environment / Directorate of Mine Action to ensure that all work sites under the Project, and their access routes, are free of mines and ERW. – Share with the Bank each worksite clearance letter and the necessary supporting	– UXO / ERW clearance letters issued by the Ministry of Environment / Directorate of Mine Action	**Insignificant**	PMT	PMT	Covered under Project implementation / PMT cost

Receptor / Aspect	Impact	Impact Significance	Mitigation Measures	Means of Supervision	Residual Impact	Implementation Responsibility	Supervision	Estimated Cost
			documentation demonstrating that the decontamination process has been conducted in accordance with Good International Industry Practice.					
Biological Environment	Construction activities may cause localized habitat disturbance and biodiversity impacts across the ITREC sub-projects, with higher biodiversity risk associated with greenfield Expressway No. 2 and lower biodiversity risk generally expected for the R9B segment under Expressway No. 1 and the KRI sub-projects, where works are predominantly within existing road corridors and disturbed footprints. Nevertheless, localized impacts may still occur at the Tigris and	**Major**	– For Expressway No. 2, undertake detailed biodiversity field surveys, once detailed designs are available and well in advance of commencement of construction works, to better understand potential direct and indirect impacts and to inform the design of appropriate mitigation and management measures. – For Expressway No. 2, undertake a Critical Habitat Assessment (CHA), once detailed designs are available and prior to construction, informed by the detailed biodiversity field surveys, to confirm the presence and extent of any Critical Habitat features and to	– Compliance with the Critical Habitat Assessment (CHA) and Biodiversity Management Plan (BMP) – Site inspection and visual assessment – Field surveys as per monitoring schedule – Review of records and logs	**Moderate**	PMT for the detailed biodiversity field surveys, CHA, and BMP Contractor for implementation of the remaining construction-phase biodiversity mitigation and management measures	PMT and ESCs / Resident Engineer;	Included in contractor cost

Receptor / Aspect	Impact	Impact Significance	Mitigation Measures	Means of Supervision	Residual Impact	Implementation Responsibility	Supervision	Estimated Cost
	Euphrates interfaces, seasonal drainage crossings, canal / drain intersections, and other riparian or aquatic habitat features.		inform the design of mitigation and management measures in accordance with ESS6. – For Expressway No. 2, Based on the findings of the detailed biodiversity field surveys and the CHA, prepare a Biodiversity Management Plan (BMP) prior to construction, including site-specific requirements for river/canal crossings, responsibilities, supervision arrangements, and monitoring. – Delineate and mark vegetation clearance and work limits prior to commencing works to minimize the area cleared and prevent encroachment outside the approved footprint. – Limit vegetation clearance and land take to the minimum required, restrict all works to the approved footprint, and reinstate disturbed areas after works, including revegetation using					

Receptor / Aspect	Impact	Impact Significance	Mitigation Measures	Means of Supervision	Residual Impact	Implementation Responsibility	Supervision	Estimated Cost
			appropriate native species with emphasis on riparian / canal-margin habitats – Maintain habitat connectivity at irrigation / drainage canal crossings and riparian interfaces by avoiding complete barriers and ensuring crossings do not obstruct movement pathways along canal margins and riparian strips. – Design and implement wildlife crossings at key movement routes, particularly where the alignment intersects riparian corridors and irrigation/drainage canals near the Tigris River, Ishaqi River and Euphrates River, using appropriately designed culverts / bridges / underpasses that can facilitate fauna passage. – Install wildlife-friendly fencing at high-risk sections, where relevant, to guide fauna toward crossing points and reduce wildlife–vehicle					

Receptor / Aspect	Impact	Impact Significance	Mitigation Measures	Means of Supervision	Residual Impact	Implementation Responsibility	Supervision	Estimated Cost
			interactions; ensure fencing design does not trap fauna and does not obstruct drainage flow. – Minimize movement of machinery within river channels and banks and restrict in-water equipment movement to cases where it is unavoidable for structure works. – Phase crossing works to reduce the extent of simultaneous disturbance at biodiversity-sensitive locations and avoid opening multiple high-sensitivity fronts at the same time. – Implement measures to minimize turbidity and sediment disturbance during crossing works (sediment controls appropriate to the activity and location), and manage dewatering to avoid impacts on aquatic habitats. – Use erosion and sediment controls at disturbed areas, particularly near					

Receptor / Aspect	Impact	Impact Significance	Mitigation Measures	Means of Supervision	Residual Impact	Implementation Responsibility	Supervision	Estimated Cost
			canals / drains and riparian habitats, to protect habitat quality and prevent siltation. – Reinstate disturbed riverbanks / canal margins promptly after completion of works at each location, including stabilization and revegetation using appropriate native riparian vegetation where practicable. – Implement invasive species prevention measures (cleaning of machinery / vehicles before moving between sensitive sites, control of disturbed soil/stockpiles, and prompt stabilization of disturbed areas). – Minimize night-time disturbance near river/canal crossings by restricting lighting to what is necessary for safety and directing lighting away from water bodies and riparian habitats.					

Receptor / Aspect	Impact	Impact Significance	Mitigation Measures	Means of Supervision	Residual Impact	Implementation Responsibility	Supervision	Estimated Cost
			– Prohibit hunting / poaching and wildlife harassment by the workforce; implement a worker code of conduct, awareness training, and enforcement, with enhanced supervision for teams working near the Tigris, Ishaqi and Euphrates crossings. – Provide training for staff on biodiversity protection requirements, including avoidance of vegetation damage outside marked work limits and requirements applicable at river/canal crossings. – Prepare site-specific method statements for each river / canal crossing (including access, in-water works, dewatering if required, sediment / turbidity controls, and reinstatement). – Where Natural Habitat loss is unavoidable, implement compensation measures consistent with No Net Loss objectives					

Receptor / Aspect	Impact	Impact Significance	Mitigation Measures	Means of Supervision	Residual Impact	Implementation Responsibility	Supervision	Estimated Cost
			through the BMP (e.g., riparian / canal margin restoration and rehabilitation measures). – If Critical Habitat is confirmed and adverse residual impacts cannot be avoided, implement additional measures to achieve Net Gain and, where required, prepare and implement offsets through a Biodiversity Offset Management Plan, consistent with applicable lender requirements.					
Occupational Health and Safety (OHS)	Accidental hazards, working conditions, and site housekeeping, as well as transmission of communicable diseases, including high-risk activities such as works adjacent to live traffic, major lifting operations, excavation and trenching, electrical works, and work under extreme heat conditions	**Major**	– Implementation of a project-specific OHS Management Plan. – Mandatory site induction for all workers. – Task-specific safety training. – Provision and enforcement of PPE. – Regular inspection and maintenance of equipment. – Safe work procedures for excavation and lifting. – Traffic control for workers near moving vehicles.	– Daily site inspections by HSE officers – Review of OHS Management Plan implementation – Verification of PPE use and safe work practices – Review of incident and near-miss reports – Review of staffing records, qualifications, and competencies of HSE personnel and	**Moderate**	Contractor	PMT and ESCs / Resident Engineer;	Included in contractor cost

Receptor / Aspect	Impact	Impact Significance	Mitigation Measures	Means of Supervision	Residual Impact	Implementation Responsibility	Supervision	Estimated Cost
			– Emergency response and first aid arrangements. – Reporting and investigation of incidents and near misses. – Toolbox talks conducted regularly. – Adequate lighting at work areas. – Restricted access to high-risk zones. – Appointment of qualified HSE officers. – Monitoring compliance with safety procedures. – Disciplinary action for repeated violations. – Appointment of a full-time Health, Safety and Environment (HSE) Manager or HSE Lead for each contractor package – Maintenance of dedicated on-site HSE officer coverage for each active work front and each work shift, with authority to stop unsafe work and require corrective action – Provision of additional competent supervision for high-risk activities	supervisors assigned to high-risk activities – Review of task-specific risk assessments, method statements, and permits for high-risk works – Verification of traffic management personnel presence during live traffic works – Review of lifting plans, lifting supervision records, and inspection records for lifting equipment				

Receptor / Aspect	Impact	Impact Significance	Mitigation Measures	Means of Supervision	Residual Impact	Implementation Responsibility	Supervision	Estimated Cost
			– Preparation of task-specific risk assessments and method statements for high-risk activities prior to commencement of works – Implementation of heat stress prevention and response measures – Designation of trained traffic management personnel for all works undertaken adjacent to live traffic – Designation of competent lifting supervisors and trained operators, riggers, and signalers for major lifting activities					
Community Health and Safety (CHS)	Construction and operation of the ITREC sub-projects may pose risks to community health and safety, mainly from increased traffic volumes and higher vehicle speeds. Pedestrians, livestock, and vulnerable road users face elevated risks at uncontrolled	**Major**	– Prepare and implement a Community Health and Safety Management Plan in line with ESS4 – Design and install continuous fencing to prevent uncontrolled access to the ITREC sub-projects – Provide grade-separated pedestrian and livestock crossings aligned with	– Field inspections of fencing, signage, and crossings – Review of Community Health and Safety Management Plan implementation – Review of accident and complaint records – Community site visits	**Moderate**	Contractor's health and safety officers	PMT and ESCs / Resident Engineer;	Included in contractor cost

Receptor / Aspect	Impact	Impact Significance	Mitigation Measures	Means of Supervision	Residual Impact	Implementation Responsibility	Supervision	Estimated Cost
	crossings, potentially leading to serious or fatal accidents if adequate safety measures are not implemented. In addition, during construction, interactions between project workers, subcontractors, transport personnel, security personnel, and local communities may increase the risk of sexual exploitation and abuse and sexual harassment (SEA/SH), as well as related gender-based violence and child safeguarding concerns.		community movement patterns – Install and maintain road signage, markings, and warning systems – Implement speed management measures near settlements and sensitive receptors – Provide adequate lighting at crossings, interchanges, and high-risk sections – Maintain service roads to ensure safe local mobility – Conduct road safety awareness campaigns for affected communities – Coordinate with traffic police and local authorities on enforcement and emergency response – Prepare, adopt, and implement a SEA/SH Action Plan, consistent with the ESCP, prior to commencement of relevant construction activities. – Include SEA/SH prevention and response requirements in contractor and	– Confirmation that the SEA/SH Action Plan has been prepared, adopted, and is under implementation – Review of contractor and subcontractor CoC records – Verification that confidential SEA/SH grievance channels and referral arrangements are operational – Review of corrective action records related to non-compliance with worker conduct or community protection requirements – Ensure that final detailed design incorporates access control measures, pedestrian and livestock crossing provisions, fencing				

Receptor / Aspect	Impact	Impact Significance	Mitigation Measures	Means of Supervision	Residual Impact	Implementation Responsibility	Supervision	Estimated Cost
			subcontractor contracts and contractor Environmental and Social Management Plans (C-ESMPs). – Require all workers, including subcontractors and security personnel, to sign and comply with Codes of Conduct addressing acceptable behavior, sanctions, and reporting obligations. – Provide mandatory induction and periodic refresher training for all project workers and subcontractors on respectful community interaction, and consequences of non-compliance. – Establish and maintain safe, confidential, and survivor-centred grievance uptake and referral arrangements for SEA/SH complaints, including linkage to available service providers.	or barrier systems, junction treatment, and speed-management features at settlements, sensitive receptors, and other high-risk interface locations – Reflect agreed Community Health and Safety design measures in the final engineering drawings, technical specifications, and tender documents prior to construction				
Land Acquisition	Land acquisition for the ITREC sub-projects	**Major**	– Implement the approved Resettlement Action Plan	– Review of the RP/LRP	**Moderate**	PMT	PMT and ESCs /	To be determined

Receptor / Aspect	Impact	Impact Significance	Mitigation Measures	Means of Supervision	Residual Impact	Implementation Responsibility	Supervision	Estimated Cost
and Involuntary Resettlement	may result in loss of agricultural land, access restrictions, and livelihood impacts for affected households. Fragmentation of land holdings and reduced access may persist during operation if crossings and service roads are inadequate or poorly maintained.		/ Livelihood Restoration Plan (RP/LRP) in line with ESS5 – Ensure compensation is paid prior to land take – Restore access to agricultural land and grazing areas – Provide service roads and crossings where land is fragmented – Implement livelihood restoration measures where required – Maintain regular engagement with affected households – Address land-related grievances promptly and transparently	– Compensation delivery – Meeting with the PAPs			Resident Engineer;	based on the RP/LRP
Traffic Flow, Road Safety and Access	Construction and operation will alter traffic patterns and local access routes. Temporary diversions and increased traffic may affect daily movement, while insufficient crossings during operation could encourage unsafe	**Major**	– Prepare and implement a Traffic and Road Safety Management Plan (TRSMP) – Maintain alternative access routes during construction – Schedule heavy vehicle movements outside peak community hours – Deploy trained traffic marshals at critical locations	– Site inspections near utility corridors – Review of coordination with service providers – Verification of utility reinstatement – Review of Traffic and Road Safety Management Plan (TRSMP) implementation	**Moderate**	District authority	PMT and ESCs / Resident Engineer;	Included in contractor cost

Receptor / Aspect	Impact	Impact Significance	Mitigation Measures	Means of Supervision	Residual Impact	Implementation Responsibility	Supervision	Estimated Cost
	crossing behavior, increasing accident risks, particularly in rural and agricultural areas.		– Install and maintain traffic signage and barriers – Maintain service roads and controlled access points during operation – Monitor unsafe crossing behavior and adjust mitigation measures					
Labour and Working Conditions	Risk of unfair labor practices, wage delays, excessive working hours, child or forced labor in lower tiers, inadequate worker welfare conditions, ineffective grievance mechanism, and potential labor disputes during construction.	**Major**	– Implement Labor Management Procedures (LMP) consistent with national law and ESS2. – Ensure signed employment contracts and age verification for all workers. – Prohibit child labor and forced labor. – Timely wage payment and regulated working hours. – Establish and operationalize the Worker Grievance Mechanism prior to commencement of relevant Project activities and before mobilization of the contractor's workforce, and maintain it throughout Project implementation in accordance with the LMP	– Site inspections. – Review of contracts and payroll records. – Review of grievance logs. – Worker interviews and toolbox meetings. – Accommodation inspections (if applicable).	**Moderate**	Contractor	PMT and ESCs / Resident Engineer;	Included in construction contract cost

Receptor / Aspect	Impact	Impact Significance	Mitigation Measures	Means of Supervision	Residual Impact	Implementation Responsibility	Supervision	Estimated Cost
			and applicable Project requirements. – Provide adequate welfare facilities (water, sanitation, rest areas). – Apply Code of Conduct and conduct induction training (including SEA/SH awareness). – Monitor subcontractor compliance.					
Cultural Heritage	Construction activities may affect cultural heritage resources in historically sensitive areas, particularly within the wider Samarra setting. The current alignment has been realigned to avoid six previously identified cultural heritage sites; however, residual risks remain due to the potential presence of archaeological traces and the possibility of previously undiscovered subsurface remains, especially along the	**Moderate**	– Confirm the final alignment coordinates with the State Board of Antiquities and Heritage (SBAH) and obtain formal no-objection/clearance prior to mobilization in culturally sensitive sections. – Develop and implement a site-specific Cultural Heritage Management Plan (CHMP) – Maintain avoidance of the six identified sites through demarcation on construction drawings and on-ground marking, and enforce no-works requirements within any agreed buffer zones	– Routine site inspections to confirm exclusion zones are in place and respected, and chance-find controls are implemented. – Photographic documentation of demarcated buffers/exclusion zones and any chance-find actions, including stop-work and clearance records.	**Minor**	The district authority	PMT and ESCs / Resident Engineer;	Included in contractor cost

Receptor / Aspect	Impact	Impact Significance	Mitigation Measures	Means of Supervision	Residual Impact	Implementation Responsibility	Supervision	Estimated Cost
	Samarra access roads located in an area not previously screened for archaeological sites.		– Undertake targeted archaeological screening/field verification for sensitive sections, with priority for Samarra access roads (unscreened area) and any locations flagged by SBAH. – Undertake site-specific cultural heritage surveys, where required by the applicable site-specific ESIA/ESMP or SBAH, prior to commencement of the relevant works, and use the results to inform final alignment, detailed design, buffer requirements, and site-specific mitigation / CHMP measures. – Implement a Chance Finds Procedure for all ground-disturbing works (excavation, trenching, earthworks, foundations, temporary facilities). – Provide mandatory worker and supervisor training on cultural heritage awareness and chance finds.					

Receptor / Aspect	Impact	Impact Significance	Mitigation Measures	Means of Supervision	Residual Impact	Implementation Responsibility	Supervision	Estimated Cost
			– If cultural materials are encountered: stop work immediately, secure the find location, notify SBAH, and resume only after written clearance and agreed management actions.					
Operation Phase								
Air Quality	Vehicle exhaust emissions and traffic-related dust may cause localized air quality deterioration near the sub-projects corridors, particularly where sensitive receptors are close to the alignment and during high-traffic or unfavorable dispersion conditions	**Minor**	– Arrange and maintain vegetation barriers/green buffers along the sub-projects corridors, particularly near settlements and other sensitive receptors, to reduce dust-related impacts and nuisance. – Support measures that promote more efficient vehicles and alternative/cleaner fuels to reduce transport-sector CO_2 and exhaust emissions (typically through coordination with the responsible transport/traffic authorities, as applicable). – Conduct periodic air quality checks/monitoring at representative sensitive receptor locations where	– Site inspection and visual assessment with photo documentation – Review of records and logs – Review of complaints register and closeout actions – Ambient air quality monitoring as per monitoring schedule	**Insignificant**	PMT	Local authorities and PMT	Operation / maintenance cost

Receptor / Aspect	Impact	Impact Significance	Mitigation Measures	Means of Supervision	Residual Impact	Implementation Responsibility	Supervision	Estimated Cost
			receptors are close to the alignment and elevated exposure is expected. – Apply dust and emission control measures during road maintenance activities (e.g., dust suppression, covering materials during transport, minimizing idling, and equipment maintenance). – Implement traffic regulation / management measures to minimize congestion and unnecessary idling, particularly near built-up sections and junctions – Apply water spraying for dust control during maintenance and cleaning activities where dust nuisance is observed					
Noise and Vibrations	Operational traffic may cause localized noise impacts near sensitive receptors; traffic-induced vibration is expected to be negligible under normal operating conditions	**Minor**	– Install noise barriers at sections where the corridor is close to residential areas and other sensitive receptors – Maintain smooth pavement surfaces and structural joints through routine O&M (including periodic pavement	– Site inspection and visual assessment with photo documentation – Review of records and logs – Review of complaints register and closeout actions	**Insignificant**	PMT	Local authorities and PMT	Operation / maintenance cost

Receptor / Aspect	Impact	Impact Significance	Mitigation Measures	Means of Supervision	Residual Impact	Implementation Responsibility	Supervision	Estimated Cost
			condition surveys), to minimize tire–road noise and prevent localized vibration associated with surface irregularities and heavy vehicle passage – Maintain bridges / overpasses and associated structural joints to prevent rattling and structure-borne noise at crossings – Implement a complaints management process for operational noise, including investigation, documentation, and corrective actions where recurring issues are identified – Provide advance notice to communities prior to planned maintenance and repair activities that may generate elevated noise, and restrict noise-generating maintenance activities near receptors to daytime working hours					
Soil Quality	Traffic-related dust, runoff, and incidental spills/leaks may cause	**Minor**	– Maintain roadside stabilization and revegetation limit dispersion of fine dust,	– Site inspection and visual assessment with photo documentation	**Insignificant**	PMT	Local authorities and PMT	Operation / maintenance cost

Receptor / Aspect	Impact	Impact Significance	Mitigation Measures	Means of Supervision	Residual Impact	Implementation Responsibility	Supervision	Estimated Cost
	localized soil degradation or contamination near the sub-projects corridors		reduce erosion, and support slope stability. – Implement awareness measures and enforce prohibitions on illegal dumping and littering by road users – Conduct regular maintenance and cleanup of the drainage system to prevent erosion, water accumulation, and localized soil deterioration. – Implement spill response procedures for maintenance activities – Ensure routine maintenance activities (including drainage cleaning) are carried out with proper housekeeping and controlled handling of wastes/materials	– Review of records and logs – Review of incident and spill records and closeout actions				
Surface and Groundwater	Road runoff, litter, and traffic-related spills may cause localized deterioration of surface water and groundwater quality, particularly near irrigation/drainage canals and seasonal	**Minor**	– Maintain and clean the ITREC Sub-projects drainage system regularly to prevent blockage and reduce transport of pollutants to canals/drains and the Tigris River, the Ishaqi River, the Euphrates	– Site inspection and visual assessment with photo documentation – Review of records and logs – Review of incident and spill records and closeout actions	**Insignificant**	PMT	Local authorities and PMT	Operation / maintenance cost

Receptor / Aspect	Impact	Impact Significance	Mitigation Measures	Means of Supervision	Residual Impact	Implementation Responsibility	Supervision	Estimated Cost
	drainage features, and at sensitive receptor interfaces including the Tigris River, the Ishaqi River, the Euphrates River, and Tharthar Lake and Habbaniyah Lake.		River, and Tharthar Lake and Habbaniyah Lake.. – Maintain routine roadside cleaning to prevent waste transport to canals/drains and surface water bodies. – Implement traffic-related spill response measures to prevent contaminants from reaching drains/canals and surface water bodies. – Apply pollution prevention controls during periodic maintenance works (contain materials within the work area, prevent wash-off to nearby drains/canals, and clean up any spills promptly). – Inspect and clean drainage structures, culverts, curb inlets, and roadside ditches to prevent blockage – Remove accumulated debris and sediment from drainage channels, culverts, and inlets					
Waste Generation	Road-user litter and maintenance wastes may	**Moderate**	– Implement a Waste Management Plan covering all solid wastes,	– Site inspection and visual assessment	**Minor**	PMT	Local authorities and PMT	Operation / maintenance cost

Receptor / Aspect	Impact	Impact Significance	Mitigation Measures	Means of Supervision	Residual Impact	Implementation Responsibility	Supervision	Estimated Cost
and Management	cause localized disturbance and pollution, including blockage of drains/canals and contamination risks where hazardous wastes or spill residues are not properly managed		liquid wastes, and hazardous wastes generated during operation and maintenance, including segregation, storage, transport, and disposal arrangements and responsibilities and ensure wastes are collected and transported through licensed/authorized contractors and disposed of at legally permitted facilities. – Provide bins/collection points and implement routine collection and removal of road-user litter to prevent accumulation along the sub-projects corridors. – Conduct regular cleaning of shoulders and drainage features and remove accumulated debris to prevent blockage of drainage and irrigation channels. – Segregate maintenance wastes (scrap metal, asphalt/concrete fragments, used parts,	with photo documentation – Review of records and logs – Review of disposal receipts and manifests – Verification of contractor permits and licenses – Periodic compliance audits and corrective action tracking				

Receptor / Aspect	Impact	Impact Significance	Mitigation Measures	Means of Supervision	Residual Impact	Implementation Responsibility	Supervision	Estimated Cost
			packaging) and transport them to approved disposal/recycling routes. – Store hazardous wastes from maintenance activities in labeled containers within a controlled storage area and transport them through authorized contractors to legally permitted facilities. – Manage spill-cleanup wastes as hazardous waste and transport them to legally permitted treatment/disposal facilities. – Manage wastewater from operational buildings/maintenance facilities through appropriate sanitation systems; collect septic sludge (if any) and remove through authorized providers; prohibit uncontrolled discharge. – Enforce housekeeping, PPE, and safe handling procedures during waste collection, storage, loading, and transport to					

Receptor / Aspect	Impact	Impact Significance	Mitigation Measures	Means of Supervision	Residual Impact	Implementation Responsibility	Supervision	Estimated Cost
			reduce worker health and safety risks. – Keep a waste register of quantities transported and disposed (by waste type) and retain disposal receipts/certificates. – Provide basic training/awareness for maintenance staff and road users on proper waste disposal and anti-littering. – Conduct periodic inspections/audits to verify waste management compliance and implement corrective actions.					
Biological Environment	Operation of the ITREC road sub-projects may cause localized biodiversity impacts, including wildlife–vehicle collisions and barrier effects, particularly near the Tigris and Ishaqi River crossings (Expressway No. 2), Euphrates-adjacent	**Moderate**	– Maintain and operate wildlife crossings at key movement routes, particularly at and near the Tigris River crossing, the Ishaqi River crossing and the Euphrates River crossing, to reduce wildlife–vehicle collisions and avoid habitat fragmentation. – Install and maintain wildlife-friendly fencing at high-risk sections to guide	– Site inspection and visual assessment with photo documentation – Field surveys – Review of records and logs, including wildlife collision and incident logs – Review of patrol logs and enforcement records for hunting and wildlife	**Minor**	PMT	Local authorities and PMT	Operation / maintenance cost

Receptor / Aspect	Impact	Impact Significance	Mitigation Measures	Means of Supervision	Residual Impact	Implementation Responsibility	Supervision	Estimated Cost
	sections (R9B), and along canals/drains and drainage crossings.		fauna toward designated crossing points and reduce collision risk; ensure fencing does not trap fauna and does not obstruct drainage flow. – Install wildlife warning signage at identified collision hotspots, particularly near riparian / canal interfaces and river crossings, and update locations based on incident records. – Maintain or restore riparian strips and canal-edge vegetation where present, particularly near the Tigris River, Ishaqi River and Euphrates River crossings, to support fauna movement and reduce fragmentation along water edges. – Maintain habitat connectivity during operation by keeping canal / drain crossings functional for fauna movement (e.g., keep culverts / underpasses and canal margins clear of	harassment prevention – Review of invasive species survey results and control and eradication records				

Receptor / Aspect	Impact	Impact Significance	Mitigation Measures	Means of Supervision	Residual Impact	Implementation Responsibility	Supervision	Estimated Cost
			debris and avoid blocking access). – Minimize disturbance from permanent lighting at structures / interchanges near sensitive areas by using only necessary lighting, directing lights downward, and avoiding light spill toward rivers/canals and riparian habitats. – Maintain drainage systems and implement routine pollution prevention measures to reduce transport of sediments and vehicle residues to canals/drains and to the Tigris River and Ishaqi River, with enhanced attention at river crossings. – Implement invasive species controls during operation and maintenance, including cleaning of maintenance vehicles / equipment when moving between sensitive areas, monitoring for invasive plants in disturbed					

Receptor / Aspect	Impact	Impact Significance	Mitigation Measures	Means of Supervision	Residual Impact	Implementation Responsibility	Supervision	Estimated Cost
			roadside areas, and rapid removal / control where detected. – Prohibit hunting / poaching and wildlife harassment by operation and maintenance personnel and contractors; implement awareness measures and enforce workforce requirements, with enhanced attention near river crossings and riparian areas.					
Occupational Health and Safety (OHS)	OHS impacts during operation are limited due to the small workforce involved in routine inspections and maintenance. Risks are mainly associated with working near live traffic, use of maintenance equipment, and short-term exposure to noise and dust during maintenance activities.	**Moderate**	– Implement an OHS Management Plan for maintenance activities – Apply traffic control measures during maintenance works – Provide task-specific safety training to maintenance staff – Enforce use of appropriate personal protective equipment – Ensure maintenance equipment is properly maintained – Restrict public access to maintenance work zones	– Review of maintenance safety procedures – Inspection of traffic control during maintenance – Review of incident records	**Minor**	PMT	Local authorities and PMT	Operation / maintenance cost

Receptor / Aspect	Impact	Impact Significance	Mitigation Measures	Means of Supervision	Residual Impact	Implementation Responsibility	Supervision	Estimated Cost
Community Health and Safety	During operation, the main community risk relates to road traffic safety. High vehicle speeds and traffic volumes increase the likelihood of severe or fatal accidents involving pedestrians, livestock, and vehicles, particularly at uncontrolled crossings near settlements and agricultural areas.	**Major**	– Prepare and implement a Community Health and Safety Management Plan in line with ESS4 – Install and maintain fencing along the ITREC sub-projects – Provide grade-separated pedestrian and livestock crossings – Install clear road signage and markings – Implement speed management measures near communities – Provide lighting at crossings and high-risk sections – Conduct periodic road safety audits	– Road safety audits – Review of accident and fatality statistics – Inspection of fencing, crossings, and signage – Availability of a Community Health and Safety Management Plan in line with ESS4	**Moderate**	PMT	Local authorities and PMT	Operation / maintenance cost
Traffic Flow, Road Safety and Access	While the ITREC Project improves regional connectivity, it may restrict local movement by severing traditional access routes. Inadequate access points may encourage unsafe crossing behavior and affect daily mobility for	**Moderate**	– Prepare and implement a Traffic and Road Safety Management Plan (TRSMP) – Maintain service roads and controlled access points – Provide adequate crossings aligned with community movement patterns – Install directional and warning signage	– Monitoring traffic behavior at access points – Field inspection of service roads and crossings – Review of access-related grievances – Availability of Traffic and Road Safety Management Plan (TRSMP)	**Minor**	PMT	Local authorities and PMT	Operation / maintenance cost

Receptor / Aspect	Impact	Impact Significance	Mitigation Measures	Means of Supervision	Residual Impact	Implementation Responsibility	Supervision	Estimated Cost
	farmers and nearby communities.		– Monitor traffic behavior near access points – Adjust access arrangements where safety issues persist					
Labor and Working Conditions	Risk of non-compliance with labor standards, inadequate working conditions during routine maintenance, and ineffective worker grievance handling.	**Insignificant**	– Maintain Labor Management Procedures for operation phase. – Ensure formal contracts and compliance with wage and working hour regulations. – Maintain Worker Grievance Mechanism. – Provide OHS training and welfare facilities during maintenance activities. – Periodic review of contractor compliance.	– Review of employment and payroll records. – Inspection of maintenance sites. – Review of grievance records. – Worker interviews.	**Insignificant**	PMT	Local authorities and PMT	Operation / maintenance cost
Cultural Heritage	No direct impacts on cultural heritage are anticipated during operation, provided maintenance activities remain within the right-of-way and avoid protected areas.	**Insignificant**	– Restrict maintenance activities to approved areas – Maintain awareness of heritage buffer zones – Apply chance-find procedures if unexpected finds occur – Coordinate with heritage authorities when required	– Verification that works remain within right-of-way – Application of chance-find procedures if required	**Insignificant**	PMT	Local authorities and PMT	Operation / maintenance cost
Land Acquisition and	No additional land acquisition is expected during operation.	**Moderate**	– Maintain access routes, service roads, and crossings	– Inspection of long-term access arrangements	**Minor**	PMT	Local authorities and PMT	Operation / maintenance cost

Receptor / Aspect	Impact	Impact Significance	Mitigation Measures	Means of Supervision	Residual Impact	Implementation Responsibility	Supervision	Estimated Cost
Restrictions on Land Use	However, long-term access restrictions and land fragmentation may continue to affect affected households if crossings and service roads are not maintained.		– Monitor long-term access and livelihood impacts – Address land-related grievances – Engage affected land users periodically	– Review of land-related grievances				

6.3 Environmental and Social Monitoring Plan (ESMoP)

Monitoring, supervision, and enforcement of environmental and social performance will follow a tiered approach.

1. The contractor will be responsible for day-to-day implementation, self-monitoring, recordkeeping, and immediate correction of non-compliance.
2. The Resident Engineer and/or supervision consultant will be responsible for routine verification of contractor performance through site inspections, records review, and follow-up of corrective actions.
3. The Project Management Team (PMT), under the relevant Project Owner, namely RBD for the federal components and GDRB for the Kurdistan Region of Iraq components, will provide overall oversight, periodic audits, review of serious incidents and repeated non-compliance, and application of contractual enforcement measures where required.

Monitoring results will be linked to corrective actions and escalation measures. Where non-compliance or ineffective mitigation is identified, the contractor shall implement corrective action within the timeframe specified by the Resident Engineer or PMT, depending on the nature and severity of the issue. Repeated or serious non-compliance may result in non-conformance notices, mandatory corrective action plans, intensified supervision, suspension of the affected activity, or other contractual remedies in accordance with the contract conditions and approved management plans.

The monitoring requirements presented in this section are defined at the Project level and provide the basis for the detailed monitoring arrangements to be established under the site-specific ESIAs/ESMPs and other downstream instruments for the different sub-projects. These sub-project-specific instruments will further define, as applicable, the relevant monitoring parameters, locations, methods, frequencies, responsibilities, and reporting requirements, tailored to the characteristics and risks of each sub-project. At the Project level, monitoring results shall be reviewed and consolidated by the PMT within the MoCHMPW/RBD implementation structure, based on contractor monitoring, site-level verification by the ESCs / Resident Engineers, and the applicable reporting arrangements for the relevant sub-projects.

Table 6-4: Environmental and Social Monitoring Plan (ESMoP)

Receptor / EHS Aspect	Monitoring Indicators	Monitoring Responsibility	Monitoring Frequency	Location of Monitoring	Monitoring Methods	Estimated Cost
Construction Phase						
Air Quality	- Number of air quality-related complaints - Equipment performance and maintenance records - Visible emissions (e.g., black smoke, dust) - Monitoring of major pollutants (PM, NOx, SOx)	Contractor PMT ESCs / Resident Engineer	Monthly Upon receipt of complaints	Construction sites Nearby sensitive receptors	Visual observations Measurement of emissions Photo documentation Maintenance records	Included in contractor cost

Receptor / EHS Aspect	Monitoring Indicators	Monitoring Responsibility	Monitoring Frequency	Location of Monitoring	Monitoring Methods	Estimated Cost
	- Dust suppression controls in use - Supplier permits/approvals on file for asphalt plants, batching plants, and quarries/borrow sources (where used)				Complaints logs	
Noise and Vibrations	- Number of noise-related complaints - Monitoring of noise levels (LAeq, LAmax, LAmin, LA10) - Compliance with approved working hours near receptors - Equipment performance and maintenance records; no unnecessary idling - Records of advance notifications to communities	Contractor PMT ESCs / Resident Engineer	Monthly Upon receipt of complaints	Construction sites Nearby sensitive receptors	Visual observations Measurement of noise levels Site inspection Complaints logs Photo documentation Maintenance records Community notification records	Included in contractor cost
Soil Quality	- Observation of accumulation of waste and hazardous materials - Observation of soil erosion signs - Evidence of fuel spills and lubricants	Contractor PMT ESCs / Resident Engineer	Weekly	Construction sites	Visual observations Photo documentation Review of spill/incident records and disposal documentation	Included in contractor cost
Surface and Groundwater	- Availability of the Spill Management Plan and Emergency Response Plan - Additional surface water and groundwater assessments and studies, based on the detailed design, conducted and completed - Observation of spills, leaks, or oil sheen near canals, drains, or rivers - Observation of untreated wastewater discharge or concrete wash water discharge to surface water bodies - Observation of elevated turbidity or sediment deposition at or downstream of crossings and work areas	Contractor PMT ESCs / Resident Engineer	Quarterly	Construction sites	Visual observations Photo documentation Water quality testing	Included in contractor cost

Receptor / EHS Aspect	Monitoring Indicators	Monitoring Responsibility	Monitoring Frequency	Location of Monitoring	Monitoring Methods	Estimated Cost
	- Observation of waste or materials wash-off or debris accumulation near surface water bodies - Water quality testing of rivers and surface water bodies (turbidity, TSS, pH, TDS, EC, Cl, NH3, N, Fe, As, coliforms) following spill incidents - Drainage structures, culverts, and inlets clean and functional; debris/sediment removed					
Waste Generation and Management	- Availability of the Waste Management Plan - Waste segregation in place - Adequacy of waste storage areas and containers, including labeling and containment - Evidence of waste accumulation, littering, or illegal dumping near work areas and along access routes - Hazardous waste handling and storage compliance, including spill prevention measures - Waste disposal at designated sites - Review contractor permits and licenses for waste transport and disposal - Excavated material reused where suitable - Wastewater management for camps/facilities in place and functioning (where applicable) - No discharge of wastewater to soil or drainage features	Contractor PMT ESCs / Resident Engineer	Weekly	Construction sites	Visual observations Photo documentation Waste logs review Disposal verification Permits/licenses for waste handlers and disposal sites	Included in contractor cost
	- UXO / ERW clearance letters issued by the Ministry of Environment / Directorate of Mine Action	PMT ESCs / Resident Engineer	Prior to commencement of any civil works	Construction sites, access routes, and ancillary areas	Document review	Included under RBD / Project implementation cost
Biological Environment	- Detailed Field surveys for Expressway No. 2 conducted at sensitive areas and key species presence recorded before construction	Contractor PMT ESCs / Resident Engineer	Weekly	Construction sites Area of Influence	Site inspections Specialist surveys by sub-contractor	Included in contractor cost

Receptor / EHS Aspect	Monitoring Indicators	Monitoring Responsibility	Monitoring Frequency	Location of Monitoring	Monitoring Methods	Estimated Cost
	commencement and once detailed designs available - Critical Habitat assessment for Expressway No. 2 conducted before construction commencement - Biodiversity Management Plan for Expressway No. 2 available and implemented - Vegetation clearance limits marked and no encroachment observed - Periodic biodiversity site inspections conducted and findings recorded - Wildlife crossings and guidance fencing in place and functioning - Wildlife vehicle collision and incident records maintained - Wildlife mortality events recorded and investigated - Nesting activity recorded and managed during works in sensitive areas - Invasive species prevention measures implemented				Incident and mortality logs Nesting records Photo documentation Review of invasive species control records	
Occupational Health and Safety (OHS)	- OHS plan available on site - Workers inducted - PPE worn - Equipment inspected - Incidents recorded	Contractor HSE Officers PMT ESCs / Resident Engineer	Daily / Weekly	Construction sites Camps	Site inspections Records review Incident logs	Included in contractor cost
Community Health and Safety (CHS)	- Availability and implementation status of Community Health and Safety Management Plan - Condition of fencing and signage - Crossings provided - Accident records - Community complaints	Contractor HSE Officers Contractor E&S Team PMT ESCs / Resident Engineer	Weekly	Near communities Crossings Access roads Contractor facilities and worker-	Field inspections Document review Community visits CoC records Training attendance records	Included in contractor cost

Receptor / EHS Aspect	Monitoring Indicators	Monitoring Responsibility	Monitoring Frequency	Location of Monitoring	Monitoring Methods	Estimated Cost
	- Availability and implementation status of the SEA/SH Action Plan - Availability of signed CoC for all workforce - Records of SEA/SH induction and refresher training conducted - Availability and functionality of confidential SEA/SH grievance uptake and referral arrangements - Records of corrective actions taken in relation to worker conduct or SEA/SH-related non-compliance			community interface areas	Verification of confidential grievance and referral arrangements	
Community – Child Labor	- Worker age documents - Audit reports - Non-compliance records	Contractor PMT ESCs / Resident Engineer	Monthly	Camps Construction sites	Records review Labor audits	Included in contractor cost
Community – Temporary Labor Influx	- Workforce composition - Grievance records - Camp inspection results	Contractor PMT ESCs / Resident Engineer	Monthly	Worker camps Nearby communities	Inspections Community consultations	Included in contractor cost
Community – GBV / SEA / SH	- Training attendance - Reporting mechanism functioning - Incident records	Contractor PMT ESCs / Resident Engineer	Monthly	Camps Community interface areas	Training review Confidential reporting review	Included in contractor cost
Labour and Working Conditions	- Number of workers engaged (direct, subcontracted, temporary) - Signed contracts and age verification records - Wage payment records and working hours compliance - Worker grievance records - OHS and Code of Conduct training records - Worker accommodation and welfare conditions	Contractor PMT ESCs / Resident Engineer	Monthly Spot checks	Construction sites Worker camps Contractor offices	Field inspections Review of employment and payroll records Review of grievance log Worker interviews Accommodation inspections	Included in construction contract cost

Receptor / EHS Aspect	Monitoring Indicators	Monitoring Responsibility	Monitoring Frequency	Location of Monitoring	Monitoring Methods	Estimated Cost
Community – Land Acquisition & Resettlement	- Compensation records - Access restored - Grievances resolved	PMT ESCs / Resident Engineer	Monthly	Affected plots Villages	Field verification Document review	To be determined (RP/LRP)
Community – Traffic Flow, Road Safety & Access	- Availability of Traffic and Road Safety Management Plan (TRSMP) - Traffic incidents - Access complaints - Signage condition	Contractor PMT District Authority	Weekly	Roads Diversions Access points	Field inspections Traffic observations	Included in contractor cost
Cultural Heritage	- Availability of Cultural Heritage Management Plan (CHMP) - Chance-find records - Training records - Authority approvals	Contractor PMT ESCs / Resident Engineer District Authority	Continuous in sensitive areas	Excavation areas	Site supervision Documentation review	Included in contractor cost
Operation Phase						
Air Quality	- Number of complaints related to air quality - Dust and emission controls applied during road maintenance activities - Monitoring of major air pollutants (PM, NOx, SOx)	Local Authorities PMT	Quarterly Monitoring will be carried out during the first two years of operation, and, if no adverse effects are observed, the frequency and scope of monitoring will be reduced.	ITREC sub-project corridors	Visual observations Measurement of exhaust emissions Photo documentation Complaints logs	Operation and maintenance cost
Noise and Vibrations	- Number of noise and vibration-related complaints - Noise barriers installed and maintained at sensitive receptor locations	Local Authorities PMT	Periodic	ITREC sub-project corridors	Visual observations Photo documentation Complaints logs	Operation and maintenance cost

Receptor / EHS Aspect	Monitoring Indicators	Monitoring Responsibility	Monitoring Frequency	Location of Monitoring	Monitoring Methods	Estimated Cost
	- Advance notices provided to communities prior to planned maintenance/repair activities that may generate elevated noise - Maintenance activities near sensitive receptors restricted to daytime working hours				Community notification records	
Soil Quality	- Condition and maintenance of roadside stabilization and revegetation - Observations of illegal dumping or littering along the ITREC Sub-projects - Drainage system condition and maintenance - Observation of spills and implementation of spill response procedures	Local Authorities PMT	Periodic	ITREC sub-project corridors	Visual observations Photo documentation	Operation and maintenance cost
Surface and Groundwater	- Drainage structures, culverts, and inlets condition and maintenance, debris / sediment removed - Routine roadside cleaning implemented and litter and debris removed - Pollution prevention controls applied during periodic maintenance works and evidence of no wash-off to drains, canals, and surface water bodies	Local Authorities PMT	Periodic	ITREC sub-project corridors	Visual observations Photo documentation	Operation and maintenance cost
Waste Generation and Management	- Record of waste types and quantities for hazardous and non-hazardous waste - Disposal receipts and manifests available - Waste segregation in place - Visual inspections of waste storage and handling areas - Cleanliness of the ITREC sub-project corridors - PPE use and safe handling procedures during waste collection, loading, and transport - Review contractor permits and licenses for waste transport and disposal	Local Authorities PMT	Monthly	ITREC sub-project corridors	Visual observations Photo documentation Waste logs review Disposal verification	Operation and maintenance cost

Receptor / EHS Aspect	Monitoring Indicators	Monitoring Responsibility	Monitoring Frequency	Location of Monitoring	Monitoring Methods	Estimated Cost
Biological Environment	- Habitat connectivity surveys - Evidence of unimpeded fauna movement at designated crossings - Wildlife crossing condition and maintenance records - Wildlife-friendly fencing condition and maintenance - Wildlife vehicle collision and incident logs - Poaching or wildlife harassment incident records - Routine invasive species surveys in roadside and disturbed areas - Invasive species control and eradication measures implemented	Local Authorities PMT	Monthly	ITREC sub-project corridors	Site inspections Habitat connectivity surveys Wildlife collision and incident logs Poaching and wildlife harassment incident records Routine invasive species surveys Photo documentation	Operation and maintenance cost
Occupational Health and Safety (OHS)	- OHS plan available on site - Maintenance safety records - PPE use - Incident logs	Local Authorities PMT	Periodic	ITREC sub-project corridors	Safety inspections Records review	Operation and maintenance cost
Community Health and Safety	- Availability of Community Health and Safety Management Plan - Accident and fatality data - Road safety audits - Condition of crossings	Local Authorities PMT	Periodic / Annual	ITREC sub-project corridors	Road safety audits Statistics review	Operation and maintenance cost
Traffic Flow, Road Safety and Access	- Availability of Traffic and Road Safety Management Plan (TRSMP) - Traffic behavior - Access complaints - Crossing condition	Local Authorities PMT	Periodic	Service roads Access points	Field inspections Traffic monitoring	Operation and maintenance cost
Cultural Heritage	- Maintenance within ROW - Chance-find records	Local Authorities PMT	As needed	ITREC sub-project corridors and RoW	Activity logs Authority coordination	Operation and maintenance cost

Receptor / EHS Aspect	Monitoring Indicators	Monitoring Responsibility	Monitoring Frequency	Location of Monitoring	Monitoring Methods	Estimated Cost
Land Acquisition and Restrictions on Land Use	- Access condition - Land-related grievances	Local Authorities PMT	Periodic	Adjacent lands	Field inspections Grievance review	Operation and maintenance cost
Labour and Working Conditions	- Existence of signed employment contracts - Timely wage payment records - Working hours compliance - Number of worker grievances received and resolved - OHS training records for maintenance staff - Evidence of age verification	Local Authorities PMT	Periodic	Maintenance depots Work fronts Contractor offices	Field inspections Review of grievance log Worker interviews	Operation and maintenance cost

7 Stakeholder Engagement Activities

7.1 Introduction

Stakeholder engagement is an integral part of the ESIA process and a key requirement under Environmental and Social Standard 10 (Stakeholder Engagement and Information Disclosure). In line with ESS10, stakeholder engagement has been undertaken as part of project preparation to support the identification and assessment of environmental and social risks and impacts, inform mitigation and management measures, and establish a basis for continued engagement during implementation. A separate Project Stakeholder Engagement Plan (SEP) has been prepared for the Project and serves as the primary document governing stakeholder identification and analysis, engagement methods, disclosure arrangements, future consultation activities, roles and responsibilities, grievance management, and monitoring and reporting. Accordingly, this ESIA provides only a concise summary of stakeholder engagement activities undertaken to date and the key issues raised, while full details are presented in the SEP.

7.2 Summary of Previous Stakeholder Engagement Activities

Stakeholder engagement activities were undertaken during ESIA preparation across the federal Iraq and Kurdistan Region of Iraq subprojects using a combination of Key Informant Interviews, Focus Group Discussions, community consultations, and phone consultations, as appropriate to the local context and stage of assessment. These activities involved relevant government entities, local authorities, road sector institutions, environmental and antiquities authorities, health and emergency response services, affected communities, land users, road users, and vulnerable groups. The purpose of these consultations was to disclose information on the Project, understand local conditions and stakeholder priorities, identify perceived risks and sensitivities, and obtain feedback on anticipated environmental and social impacts and proposed mitigation measures. Consultation records, including participant information and key outcomes, are summarized in this ESIA, while the full consultation approach and documentation are presented in the SEP.

7.3 Summary of Key Issues Raised

Consultations undertaken during ESIA preparation identified a number of recurring stakeholder priorities and concerns across the subprojects. The most frequently raised issues related to potential land acquisition and associated compensation, the risk of temporary or permanent loss of access to homes, farms, businesses, and community facilities, and the need to maintain safe and convenient movement for vehicles, pedestrians, and livestock. Road safety was a major concern, particularly in relation to uncontrolled crossings, speeding, unsafe turning movements, limited lighting, and the need for grade-separated crossings or other traffic safety measures in locations used regularly by communities. Stakeholders also highlighted the importance of managing construction-related nuisance, including dust, noise, vibration, waste, and visual disturbance, especially in areas close to settlements, schools, health facilities, and other sensitive receptors.

In addition, many stakeholders emphasized the need to protect agricultural land, irrigation and drainage networks, and local livelihoods, noting that partial land loss or severance could affect the viability of remaining plots and disrupt farming activities. Concerns were also raised regarding community health and safety, including access for emergency vehicles, worker-community interactions, and the need for effective grievance arrangements and timely communication with

affected people. In some locations, stakeholders highlighted the importance of protecting archaeological and cultural heritage resources and ensuring early coordination with the competent authorities. Across the consultations, a consistent message was the need for transparent information disclosure, fair and timely treatment of affected persons, and continued engagement throughout project preparation and implementation. These issues have informed the ESIA assessment and the development of mitigation and management measures, while full details of stakeholder-specific feedback and consultation outcomes are presented in the SEP.

7.4 Future Stakeholder Engagement

Stakeholder engagement will continue throughout the pre-construction, construction, and operation phases in a manner proportionate to project activities, risks, and stakeholder interests. Future engagement will include continued disclosure of relevant project information, consultation on implementation-related matters, communication of mitigation and management measures, and ongoing engagement with affected communities and other interested parties, including vulnerable groups. The detailed future engagement program, stakeholder-specific methods, disclosure tools, responsibilities, and reporting arrangements are presented in the Project SEP.

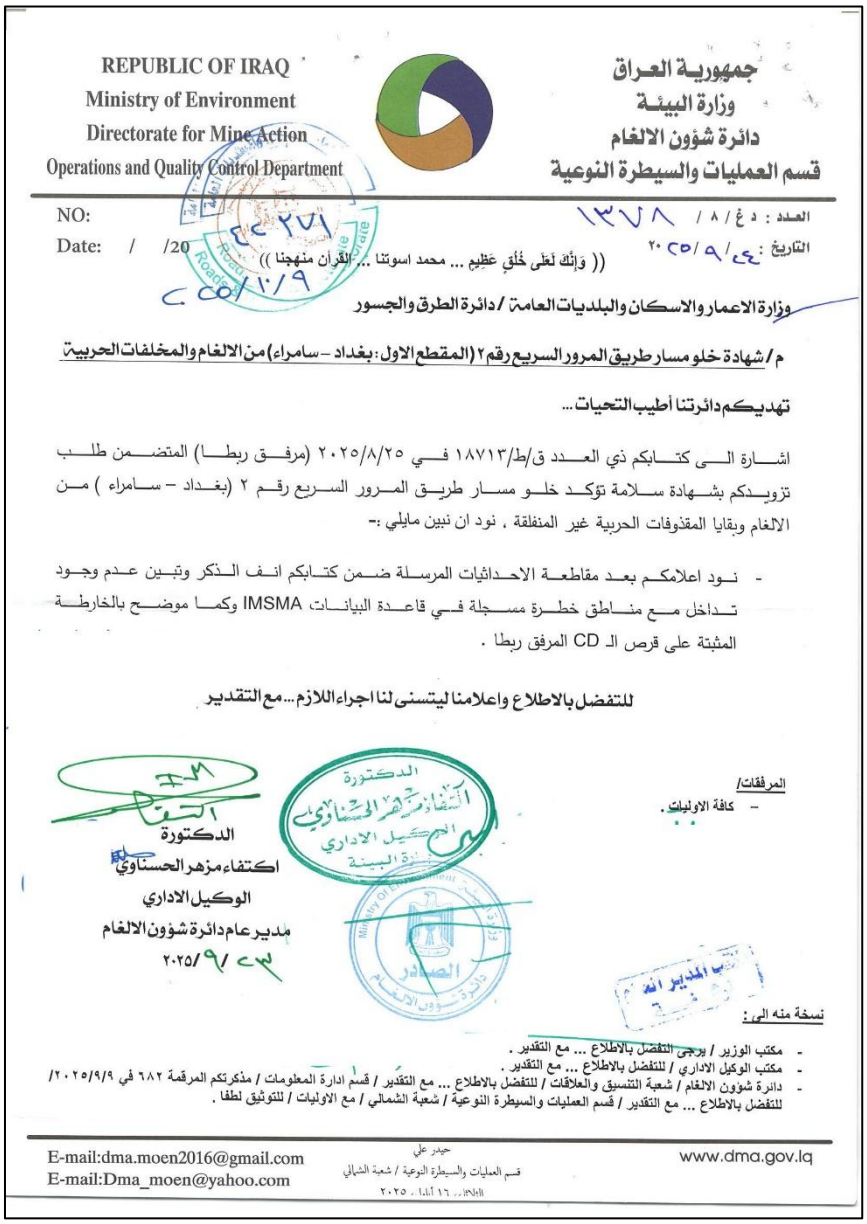
8 Grievance Redress Mechanism (GRM)

A Project-level Grievance Redress Mechanism (GRM) will be maintained to receive and facilitate the resolution of Project-related concerns and complaints in line with ESS10. The GRM shall be operated under the PMT within the MoCHMPW/RBD implementation structure and will build on and strengthen the existing institutional grievance arrangements available for Project implementation. For the KRG sub-projects, the Project-level GRM shall operate under the overall Project implementation arrangement led by MoCHMPW/RBD/PMT, in close coordination with the relevant KRG authorities, including GDRB, as applicable. The GRM will be available throughout pre-construction, construction, and operation and will cover a range of Project-related issues, including land-related concerns, access restrictions, construction nuisance, traffic and road safety, community health and safety issues, damage to assets, labor-related concerns raised by community members, and other environmental and social complaints. Sensitive complaints, including SEA/SH-related grievances, will be managed through confidential and appropriate procedures. The Project-level GRM shall be further strengthened through review of the existing grievance arrangements and implementation of any required enhancements for Project purposes. Specific grievance handling procedures shall be developed and applied for sensitive complaints, including SEA/SH- and GBV-related grievances, to ensure safe, confidential, and survivor-centered handling and referral, as applicable. Any interim grievance management measures required during early Project implementation shall be reflected in the applicable Project implementation procedures, while the detailed GRM structure, intake channels, handling process, responsibilities, timelines, and reporting arrangements are provided in the SEP, which serves as the primary document for grievance management.

9 Annexes

9.1 Annex I: Existing Minefield and ERW Hot Spots for Expressway No. 2

An official UXO/ERW clearance certificate for the Project alignment section was issued by the competent mine action authority under the Ministry of Environment based on the submitted alignment information and review against the national IMSMA records. The clearance certificate is shown in Figure 9-1 below. Prior to mobilization and any ground-disturbing works, the RBD and the Contractor shall confirm site-specific conditions and implement an UXO/ERW risk management procedure (including stop-work and reporting requirements) to address any unexpected discoveries during construction.



REPUBLIC OF IRAQ
Ministry of Environment
Directorate for Mine Action
Operations and Quality Control Department

جمهورية العراق
وزارة البيئة
دائرة شؤون الالغام
قسم العمليات والسيطرة النوعية

NO:
Date: / /20

العدد : د غ / ٨ / ١٣٧٨
التاريخ : ٢٠٢٥/٩/٢٤

((وَإِنَّكَ لَعَلَىٰ خُلُقٍ عَظِيمٍ ... محمد اسوتنا ... القرآن منهجنا))

وزارة الاعمار والاسكان والبلديات العامة / دائرة الطرق والجسور

م / شهادة خلو مسار طريق المرور السريع رقم ٢ (المقطع الاول : بغداد – سامراء) من الالغام والمخلفات الحربية

تهديكم دائرتنا أطيب التحيات ...

اشارة الى كتابكم ذي العدد ق/ط/١٨٧١٣ في ٢٠٢٥/٨/٢٥ (مرفق ربطا) المتضمن طلب تزويدكم بشهادة سلامة تؤكد خلو مسار طريق المرور السريع رقم ٢ (بغداد – سامراء) من الالغام وبقايا المقذوفات الحربية غير المنفلقة ، نود ان نبين مايلي :-

- نود اعلامكم بعد مقاطعة الاحداثيات المرسلة ضمن كتابكم انف الذكر وتبين عدم وجود تداخل مع مناطق خطرة مسجلة في قاعدة البيانات IMSMA وكما موضح بالخارطة المثبتة على قرص الـ CD المرفق ربطا .

للتفضل بالاطلاع واعلامنا ليتسنى لنا اجراء اللازم ... مع التقدير

الدكتورة
اكتفاء مزهر الحسناوي
الوكيل الاداري
مدير عام دائرة شؤون الالغام
٢٠٢٥/٩/٢٤

المرفقات/
- كافة الاوليات .

نسخة منه الى :
- مكتب الوزير / يرجى التفضل بالاطلاع ... مع التقدير .
- مكتب الوكيل الاداري / للتفضل بالاطلاع ... مع التقدير .
- دائرة شؤون الالغام / شعبة التنسيق والعلاقات / للتفضل بالاطلاع ... مع التقدير / قسم ادارة المعلومات / مذكرتكم المرقمة ٦٨٢ في ٢٠٢٥/٩/٩ / للتفضل بالاطلاع ... مع التقدير / قسم العمليات والسيطرة النوعية / شعبة الشمالي / مع الاوليات / للتوثيق لطفا .

E-mail:dma.moen2016@gmail.com
E-mail:Dma_moen@yahoo.com
حيدر علي
قسم العمليات والسيطرة النوعية / شعبة الشمالي
www.dma.gov.iq

Figure 9-1: Landmine/UXO Clearance Letter for the Expressway No. 2