APPENDIX 1
HISTORICAL SITE BASELINE FIELD SURVEY RESULTS

Soil

Table A1.1 Soil analytical survey results, mg/kg

Parameter	S1	S2	S3	S4	S5	Project standard
Mercury	BCL	BCL	BCL	BCL	BCL	1
Arsenic	4.65	5.98	4.12	7.42	5.32	20
Zinc	24.2	26.1	23.8	20.7	23.9	200
Cyanide	BCL	BCL	BCL	BCL	BCL	10
Cadmium	1.1	4.1	1.1	2.6	37	3
Chromium*	46	35	23	25	54	$1^{VI}/400^{III}$
Manganese	423	433	354	222	362	500
Magnesium	58.6	65.5	40.4	31.8	72.8	-
Copper	31.8	38.8	42.0	32.1	39.7	100
Lead	4.1	3.8	8.5	9.4	8.3	300
Nickel	43	27	34	32	75	60
Iron	32.4	32.1	29.3	42.6	34.2	-
TPH	3.2	5.2	5.2	6.3	10.2	-

Source: MapCom (2010)

Notes: Red = exceeds Project standard, TPH = total petroleum hydrocarbons (unspecified fraction), BDL = below detection limit (detection limit not reported), * = valency unspecified, III = Chromium III, VI = Chromium VI.

Table A1.2 Chemical properties of soil sampling sites in the study area of Khor Mor block

Extractable metals/ sampling sites	Unit of measurement	Canadian guideline for agricultural	Canadian guideline for residential/industrial commercial	KM-SS1	KM-SS2	KM-SS3	KM-SS4	KM-SS5	KM-SS6	KM-SS7	KM-SS8	KM-SS9	KM-SS10	KM-SS11	KM-SS12
Major cations															
Aluminum	mg/kg DW			22500	19500	16200	20600	22000	27500	19600	16200	15200	17800	14700	22700
Antimony	mg/kg DW	7.5	40	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Arsenic	mg/kg DW	11	18	6.05	2.95	1.56	4.72	5.09	4.29	4.88	3.57	3.83	4.83	3.40	6.75
Barium	mg/kg DW	390	670	62.3	81.6	31	99.5	106	77.8	97.8	89.9	96.2	103	139	57.4
Beryllium	mg/kg DW	4	8	0.745	0.602	0.544	0.717	0.793	0.832	0.748	0.500	0.465	0.535	0.490	0.755
Bismuth	mg/kg DW			<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Boron	mg/kg DW	120	120	5.6	4.4	3	6.1	8.4	11.1	6.4	9.4	8.7	10.4	9.3	6.1
Cadmium	mg/kg DW	1.2	1.9	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40
Calcium	mg/kg DW			98800	62200	88700	100000	92300	88700	93500	166000	168000	149000	140000	103000
Chromium	mg/kg DW	160	160	53.0	44.2	36.1	38.4	43.3	60.0	37.8	56.8	55.6	63.0	53.7	49.6
Cobalt	mg/kg DW	22	80	12.7	10.8	9.04	11.1	12	15.2	11.3	11.2	10.3	11.6	10.6	12.4
Copper	mg/kg DW	140	230	28.3	17.7	14.7	22.0	22.4	30.6	21.1	20.7	19.1	21.6	22.2	28.4
Iron	mg/kg DW			31700	28500	25200	29700	31400	36500	29400	23300	21600	24300	22200	31300
Lead	mg/kg DW	45 (120)	120	9.4	7.2	6.2	9.5	9.7	10.4	10.1	6.3	5.5	6.0	8.3	9.5
Lithium	mg/kg DW			49.6	33.8	29.7	46.3	50.3	56.5	43.5	28.0	27.2	30.2	27.5	49.3
Magnesium	mg/kg DW			18100	12500	10200	13100	14200	18100	11400	16300	15700	19200	12100	17400
Manganese	mg/kg DW			638	788	682	639	628	638	618	506	455	466	514	531
Mercury	mg/kg DW	0.25 (0.27)	3.9	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Molybdenum	mg/kg DW	6.9	40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	0.64	0.57	0.53	0.49	<0.40
Nickel	mg/kg DW	100	270	70.4	50.6	39.1	48.3	53.8	80.0	48.6	80.6	75.6	86.9	74.8	66.4
Phosphorus	mg/kg DW			474	450	410	446	492	491	510	550	415	490	791	462
Potassium	mg/kg DW			2710	1810	1330	2200	2620	3360	2220	3250	2430	3110	3440	2680
Selenium	mg/kg DW	2.4	5.5	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Silicon	mg/kg DW			196	240	232	228	230	226	217	201	192	200	235	207
Silver	mg/kg DW	20	40	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Sodium	mg/kg DW			134	71	44	116	123	162	106	177	176	199	117	111
Strontium	mg/kg DW			800	110	123	212	420	234	206	353	426	320	183	829
Sulphur	mg/kg DW			112	88	83	97	121	110	126	402	333	369	323	121
Tellurium	mg/kg DW			<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Thallium	mg/kg DW	1	3.3	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Tin	mg/kg DW			<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Titanium	mg/kg DW			166	476	444	244	343	362	310	406	410	426	303	166
Vanadium	mg/kg DW	86	86	45.1	43	42.9	38.6	40.2	48.0	37.9	44.8	43.2	47.2	39.8	45.0
Zinc	mg/kg DW	340	340	57.4	49.3	41.7	56.3	59.8	68.4	57.0	40.0	34.5	40.0	42.5	56.8
Zirconium	mg/kg DW			<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Petroleum hydrocarbons															
C10 - C12 fraction	mg/kg DW			<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
C10 - C40 fraction	mg/kg DW			<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
C12 - C16 fraction	mg/kg DW			<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
C16 - C35 fraction	mg/kg DW			<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
C35 - C40 fraction	mg/kg DW			<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Physical parameters															
Dry matter @ 105°C	%			90.2	89	86.9	90.2	90.2	89.9	89.6	84.7	86.3	85.7	83.8	91.1
pH (H2O)				8.5	8.4	8.2	8.2	8.3	8.3	8.2	8.3	8.2	8.2	8.2	8.1
BTEX															

Benzene	mg/kg DW			<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Toluene	mg/kg DW			<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Ethylbenzene	mg/kg DW			<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
meta- & para-Xylene	mg/kg DW			<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
ortho-Xylene	mg/kg DW			<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Sum of BTEX	mg/kg DW			<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090
Sum of xylenes	mg/kg DW			<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030

Source: MapCom (2018)

Water

Table A1.3 Physical, chemical and biological properties of groundwater and surface water system in the study area (MapCom, 2010)

S.N	Parameter (units)	W1	W2	W3	W4	W5	WB Norms
1.	Temp. (ºC)	22.4	19.8	20.6	19.5	21.7	-
2.	pH	7.7	8.1	8.2	7.3	7.8	6.5 – 8.5
3.	EC (µs.cm^{-1})	685	742	514	683	455	400 – 600
4.	T.S.S. (ppm)	82	110	65	92	45	250
5.	D.O. (mg.l^{-1})	4.8	5.2	6.8	4.7	7.2	7.0
6.	B.O.D$_5$ (mg.l^{-1})	12	8.0	12	16	3.1	0.0 – 1.0
7.	C.O.D (mg.l^{-1})	84	74	56	58	32	10 – 20
8.	$SO_4^=$ (mg.l^{-1})	215	310	345	410	280	200 – 400
9.	NO_3 (mg.l^{-1})	64	45	52	37	54	45
10.	MPN (Cells. 100 ml^{-1})	2.2	9.2	2.2	9.2	9.2	0.0

Source: MapCom (2010)

Note: WB = World Bank, Temp. = Temperature, ºC = degrees Celsius, pH – potential of hydronium, EC = Electrical Conductivity, µs.cm^{-1} = micro siemens per centimetre, mg.l^{-1} = milligram per liter, TSS = Total Suspende Solids, D.O. = Dissolved oxygen, B.O.D$_5$ = Biological Oxygen Demand of five day incubation time, C.O.D = Chemical Oxygen Demand, $SO_4^=$ = Sulfate, NO_3 = Nitrate, MPN = Most Probable Number of Fecal coliform bacteria.

Table A1.4 Physical, chemical and biological properties of groundwater and surface water system in the study area (MapCom, 2018)

Sampling sites		GW1	GW2	GW3	GW4	GW5	GW6	GW7	GW8	WHO Norms
Parameters	**Unit**									
Aggregate parameters										
Calcium Hardness	mmol/L	2.9	2.7	4.82	1.42	1.93	2.41	1.14	2.43	
Hardness	mmol/L	3.4	2.56	6.91	1.63	3.22	2.79	1.47	2.81	
Hardness as CaCO3	mg $CaCO_3$/L	324	256	691	163	322	279	147	281	500
Magnesium Hardness	mg $CaCO_3$/L	33.8	28.9	210	21.7	129	38.6	33.2	38.2	
Dissolved metals/major cations										
Aluminium	mg/L	0.016	0.014	0.020	0.011	0.013	0.015	0.010	0.015	
Antimony	mg/L	<0.010	<0.010	<0.010	<0.0 10	<0.0 10	<0.0 10	<0.010	<0.010	
Arsenic	mg/L	<0.0050	<0.0050	<0.0050	<0.0 050	<0.0 050	<0.0 050	<0.0050	<0.0050	0.001
Barium	mg/L	0.220	0.106	0.0684	0.0287	0.108	0.196	0.171	0.200	
Beryllium	mg/L	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	
Boron	mg/L	0.025	0.017	0.255	0.019	0.093	0.034	0.034	0.034	
Cadmium	mg/L	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	0.003
Calcium	mg/L	101	81.2	166	50.1	69.6	87.2	40.5	89.0	150
Chromium	mg/L	<0.0010	<0.0010	0.0011	<0.0010	<0.0010	<0.0010	<0.0010	0.0011	0.05
Cobalt	mg/L	<0.002 0	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	
Copper	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	0.0044	<0.0010	<0.0010	<0.0010	2
Iron	mg/L	<0.0020	<0.0020	0.0050	<0.0020	0.0996	<0.0020	<0.00050	<0.0020	0.3
Lead	mg/L	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.01
Lithium	mg/L	0.0069	0.0069	0.0297	0.0037	0.0306	0.0059	0.0054	0.0072	
Magnesium	mg/L	7.11	6.39	44.5	4.64	28	8.40	7.30	8.34	100
Manganese	mg/L	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.4
Molybdenum	mg/L	<0.002	<0.002	<0.002	<0.0	<0.0	<0.0	<0.00	<0.00	
Nickel	mg/L	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.07
Phosphorus	mg/L	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	
Potassium	mg/L	1.76	0.132	15.9	0.104	1.91	0.525	0.338	0.465	250
Selenium	mg/L	<0.010	<0.010	<0.000	<0.010	<0.010	<0.010	<0.010	<0.010	0.01
Silver	mg/L	<0.0010	<0.0010	<0.0010	<0.010	<0.010	<0.010	<0.0010	<0.0010	
Sodium	mg/L	8.28	7.59	64.4	6.74	90.1	12.3	12.3	12.2	200
Thallium	mg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	
Vanadium	mg/L	0.0015	<0.0010	<0.0010	<0.0010	0.0071	0.0021	0.0035	0.0019	
Zinc	mg/L	<0.0020	<0.0020	<0.0020	<0.010	0.0384	0.0218	0.0042	0.0231	3
Petroleum hydrocarbons										
C10 - C12 Fraction	µg/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	
C10 - C40 Fraction	µg/L	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0	
C12 - C16 Fraction	µg/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	
C16 - C35 Fraction	µg/L	<30.0	<30.0	<30.0	<30.0	<30.0	<30.0	<30.0	<30.0	
C35 - C40 Fraction	µg/L	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	
Physical parameters										
Turbidity	NTU	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	
Total metals/major cations										
Magnesium	mg/L	8.21	7.04	51	5.28	31.4	9.39	8.06	9.28	
Mercury	µg/L	0.047	<10.0	0.046	<10.0	<10.0	<10.0	<10.0	<10.0	
Potassium	mg/L	2.10	0.146	18.2	0.126	2.21	0.608	0.424	0.587	
Sodium	mg/L	9.63	8.49	75.2	7.66	100	13.6	13.7	13.6	
Other parameters										

pH	-	7.42	7.62	7.88	7.72	7.48	7.93	7.58	7.93	6.5-8.5
EC	µS.cm-^{1}	520	761	923	290	631	772	547	772	1000
Salinity	ppt	0.26	0.23	0.45	0.14	0.32	0.37	0.24	0.37	
TDS	ppt	338	494.6	599.9	188	410	501	355	501	500
Well Depth	m	Spring	Spring	55	-	2.5	6	Storage Tank	6	
Water Table Depth	m	Spring	Spring	6	-	20cm	2.5	Storage Tank	2.5	
Temperature	C^{o}	19.4	19.7	21.11	21.7	19.9	20.3	19.8	20.3	
DO	ppm	2.99	2.84	2.69	7.99	4.23	3.45	2.87	3.45	
BOD5	ppm	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	
COD	ppm	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	
Bacteriological analysis										
MPN	MPN/ml	160	5	28	14	1	240	1	92	<5
T.P.C	-	10^{3}	10^{3}	10^{3}	10^{3}	10^{3}	10^{3}	10^{3}	10^{3}	100
Non-metallic inorganic parameters										
Base neutralizing (Acidity) capacity pH 8.3	mmol/L	0.417	0.235	0.203	<0.150	<0.150	1.61	<0.150	<0.150	3
Base neutralizing (Acidity) capacity pH 4.5	mmol/L	<0.150	<0.150	<0.150	<0.150	<0.150	<0.150	<0.150	<0.150	
Acid neutralizing capacity (alkalinity) pH 4.5	mmol/L	5.17	3.66	5.67	3.11	1.06	4.27	2.48	4.21	3.00
Acid neutralizing capacity (alkalinity) pH 8.3	mmol/L	<0.150	<0.150	<0.150	<0.150	<0.150	<0.150	<0.150	<0.150	
Biochemical Oxygen Demand (BOD 5)	mg/L	<1.0	<1.0	<1.0	<1.0	1.6	<1.0	<1.0	<1.0	5
Chemical Oxygen Demand (COD-Cr)	mg/L	<5.0	<5.0	<5.0	<5.0	13	<5.0	<5.0	<5.0	
Sulphate as SO4 2-	mg/L	10.5	10.3	130	6.34	117	11.3	6.64	11.8	250
Nitrate	mg/L	17.8	19.7	98.7	29.9	282	20.6	19.6	20.8	50
Nitrates as N	mg/L	4.02	4.46	22.3	6.76	63.8	4.66	4.43	4.70	
Sulphate as SO4 2-	mg/L	46.9	70.8	388	17.5	242	73.9	34.0	77.2	250

Biodiversity

Table A1.5 Rare plant species identified by Nature Iraq (2017)

Scientific name	IUCN (2019) status	Habitat of occurrence	Countries of occurrence according to IUCN (2019)
Typha lugdunensis	Data Deficient	Wetlands (inland), artificial / aquatic & marine	Austria, France, Germany & Switzerland. However, it was probably introduced to Europe.
Equisetum arvense	Least Concern	Forest, wetlands (inland), grassland, artificial / aquatic & marine	>30 countries
Rubus caesius	Least Concern	Forest, grassland, shrubland, marine coastal / supratidal	>30 countries
Quercus macranthera	Not assessed		Iran, Lebanon-Syria, North Caucasus, Transcaucasus; Turkey
Linum velutinum	Not Assessed		Iraq (NE-Iraq)
Carlina kurdica	Not Assessed		Iraq (NE-Iraq), Syria (Jazira)
Pisum sativum	Least Concern	Artificial/Terrestrial, Shrubland	>30 countries
Paronychia kurdica	Not Assessed		Turkey, Iran, Iraq, Lebanon, Syria Armenia, Azerbaijan, Georgia
Dianthus basianicus	Not Assessed		Iran (W-Iran), Iraq (NW-Iraq)
Ornithogalum iraqense	Not Assessed		Northern Iraq

Table A1.6 Results of fauna species screening

Common name	Scientific name	IUCN (2019) status	Species range	Habitat type	Likelihood of species to use habitats in the study area	Likelihood of species occurring in project footprint – *assuming the site is fenced*
Bunni's Short-tailed Bandicoot Rat	*Nesokia bunni*	EN	Iraq, presence in Iran is uncertain	It is poorly known, but it appears to be a terrestrial species which prefer moist habitats, such as marshes and swamps. Endemic to the marshlands of south-eastern Iraq in the Tigris and Euphrates Valleys.	Unlikely due to restricted range	Unlikely due to restricted range however further analysis is required to validate this assumption.
Goitered gazelle	*Gazella subgutturosa*	Global VU; Mediterranean CR	Afghanistan, Azerbaijan, Bahrain, China, Iran, Iraq, Jordan, Kazakhstan, Kyrgyzstan, Mongolia; Oman, Pakistan, Saudi Arabia, Syrian Arab Republic, Tajikistan, Turkey, Turkmenistan, United Arab Emirates, Uzbekistan & Yemen	Inhabits a wide range of semi-desert and desert habitats	Unlikely, thought to be restricted to Chamcham al KBA & IBA but	Unlikely
Arabian Sand Gazelle	*Gazella marica*	VU	Iraq, Jordan, Kuwait; Oman, Qatar, Saudi Arabia, Syrian Arab Republic, United Arab Emirates & Yemen	Deserts, including sand dunes and areas of sand and gravel as well as coastal flats; it avoids steep and rocky areas.	Possible	Unlikely
leopard	*Panthera pardus*	VU; Mediterranean CR	>30 counties including Iraq	wide range of habitats including desert and semi-desert, mountainous habitats & rainforests.	Unlikely	Unlikely
marbled polecat	*Vormela peregusna*	Global VU; Europe VU; Mediterranea	Afghanistan; Armenia; Azerbaijan; Bulgaria; China; Egypt (Sinai); Georgia; Greece; Iran, Islamic Republic of; Iraq; Israel; Kazakhstan; Lebanon; Mongolia; Montenegro; North Macedonia; Pakistan; Romania; Russian Federation; Serbia; Syrian Arab Republic; Turkey;	Desert, semi-desert and steppe habitats	Possible	Possible assuming individuals can climb over the fence

Common name	Scientific name	IUCN (2019) status	Species range	Habitat type	Likelihood of species to use habitats in the study area	Likelihood of species occurring in project footprint – *assuming the site is fenced*
		n VU	Turkmenistan; Ukraine; Uzbekistan			
grey wolf	*Canis lupus*	LC	>30 counties including Iraq	Forest, desert, rocky areas (e.g. inland cliffs, mountain peaks), shrubland, grassland & wetlands (inland)	Possible	unlikely
brown bear	*Ursus arctos*	LC	Afghanistan; Albania; Armenia; Azerbaijan; Belarus; Bosnia and Herzegovina; Bulgaria; Canada; China; Croatia; Estonia; Finland; France; Georgia; India; Iran, Islamic Republic of; Iraq; Italy; Japan; Kazakhstan; Korea, Democratic People's Republic of; Latvia; Mongolia; Montenegro; Nepal; North Macedonia; Norway; Pakistan; Poland; Romania; Russian Federation; Serbia; Slovakia; Slovenia; Spain; Sweden; Tajikistan; Ukraine; United States; Uzbekistan	Desert, forest, wetlands (inland), grassland, & shrubland.	Unlikely	Unlikely
striped hyaena	*Hyaena Hyaena*	Global NT; Mediterranean VU	Afghanistan; Algeria; Armenia; Azerbaijan; Burkina Faso; Cameroon; Chad; Djibouti; Egypt; Ethiopia; Georgia; India; Iran, Islamic Republic of; Iraq; Israel; Jordan; Kenya; Lebanon; Libya; Mali; Mauritania; Morocco; Nepal; Niger; Nigeria; Oman; Pakistan; Saudi Arabia; Senegal; Syrian Arab Republic; Tajikistan; Tanzania, United Republic of; Tunisia; Turkey; Turkmenistan; Uganda; Uzbekistan; Western Sahara; Yemen	Wetlands (inland), savanna, shrubland, forest, grassland.	Possible	Unlikely
wild boar	*Sus scrofa*	LC	>30 counties including Iraq	Wide variety of temperate and tropical habitats including semi-desert to tropical	Possible	Unlikely

Common name	Scientific name	IUCN (2019) status	Species range	Habitat type	Likelihood of species to use habitats in the study area	Likelihood of species occurring in project footprint – *assuming the site is fenced*
				rain forests, temperate woodlands, grasslands, shrubland, often raiding agricultural land for food.		

Note: LC = IUCN listed Least Concern; NT = Near Threatened; VU = Vulnerable; EN = Endangered; CR = Critically Endangered

Table A1.7 Rare and threatened bird species with ranges that overlap the study area

Common name	Scientific name	IUCN (2019) status	Habitat of occurrence (IUCN, 2019)	Migratory status	Congregatory status
sociable lapwing	*Vanellus gregarius*	CR	Desert, wetlands (inland), grassland, artificial/terrestrial	Full migrant	Congregatory (and dispersive)
saker falcon	*Falco cherrug*	EN	Marine intertidal, wetlands (inland), grassland, shrubland, artificial/terrestrial	Full migrant	Congregatory (and dispersive)
Northern bald ibis	*Geronticus eremita*	EN	Marine coastal/supratidal, caves and subterranean habitats (non-aquatic), rocky areas (eg. inland cliffs, mountain peaks), wetlands (inland), grassland, shrubland, artificial/terrestrial – possibly extinct in Iraq (IUCN, 2019)	Full Migrant	Congregatory (and dispersive)
Egyptian vulture	*Neophron percnopterus*	EN	Rocky areas (e.g. inland cliffs, mountain peaks), wetlands (inland), grassland, shrubland, savanna, artificial/terrestrial	Full migrant	Congregatory (and dispersive)
white-headed duck	*Oxyura leucocephala*	EN	Wetlands (inland), artificial/aquatic & marine, marine coastal/supratidal	Full migrant	Congregatory (and dispersive)
steppe eagle	*Aquila nipalensis*	EN	Rocky areas (e.g. inland cliffs, mountain peaks), grassland, savanna	Full migrant	Congregatory (and dispersive)
great bustard	*Otis tarda*	VU	Grassland, artificial/terrestrial	Full migrant	Not congregatory
Marbled Teal	*Marmaronetta angustirostris*	VU	Wetlands (inland), marine coastal/supratidal, artificial/aquatic & marine	Full migrant	Congregatory (and dispersive)
Lesser White-fronted Goose	*Anser erythropus*	VU	Artificial/terrestrial, grassland, rocky areas (eg. inland cliffs, mountain peaks), shrubland, wetlands (inland)	Full migrant	Congregatory (and dispersive)
greater spotted eagle	*Clanga clanga*	VU	Forest, wetlands (inland), shrubland, artificial/aquatic & marine, grassland	Full migrant	Congregatory (and dispersive)
Asian houbara	*Chlamydotis macqueenii*	VU	Desert, grassland, artificial/terrestrial	Full migrant	Not congregatory
European turtle-dove	*Streptopelia turtur*	VU	Forest, artificial/terrestrial, shrubland	Full migrant	Not congregatory

Table A1.8 Avifauna species identified from previous surveys (Nature Iraq)

Scientific name	English name	IUCN (2019) status	Status
Ammoperdix griseogularis	See-see Partridge	LC	Resident
Milvus migrans	Black Kite	LC	Passage migrant
Neophron percnopterus	Egyptian Vulture	EN	Passage migrant
Circus cyaneus	Hen Harrier	LC	Passage migrant and winter visitor
Circus macrourus	Pallid Harrier	NT	Passage migrant and winter visitor
Falco cherrug	Saker Falcon	EN	Passage migrant
Accipiter nisus	Eurasian Sparrowhawk	LC	Passage migrant and winter visitor
Buteo buteo vulpinus	Steppe Buzzard	LC	Passage migrant and winter visitor
Buteo rufinus	Long-legged Buzzard	LC	Passage migrant
Aquila clanga	Greater Spotted Eagle	VU	Passage migrant
Aquila nipalensis	Steppe Eagle	CR	Passage migrant
Aquila heliaca	Eastern Imperial Eagle	VU	Passage migrant and winter visitor
Falco tinnunculus	Common Kestrel	LC	Passage migrant and winter visitor
Vanellus indicus	Red-wattled Lapwing	LC	Resident
Vanellus leucurus	White-tailed Lapwing	LC	Passage migrant
Columba livia	Rock Dove	LC	Resident
Streptopelia decaocto	Eurasian Collared Dove	LC	Resident
Stigmatopelia senegalensis	Laughing Dove	LC	Resident
Athene noctua	Little Owl	LC	Resident
Apus apus	Common Swift	LC	Passage migrant
Coracias garrulus	European Roller	LC	Passage migrant
Merops apiaster	European Bee-eater	LC	Passage migrant
Upupa epops	Eurasian Hoopoe	LC	Summer breeder and passage migrant
Lanius collurio	Red-backed shrike	LC	Passage migrant
Lanius minor	Lesser Grey Shrike	LC	Passage migrant
Lanius senator	Woodchat Shrike	LC	Passage migrant
Lanius nubicus	Masked Shrike	LC	Passage migrant

Pica pica	Eurasian Magpie	LC	Passage migrant
Corvus monedula	Western Jackdaw	LC	Passage migrant and winter visitor
Corvus frugilegus	Rook	LC	Passage migrant and winter visitor
Corvus corax	Northern Raven	LC	Resident
Melanocorypha calandra	Calandra Lark	LC	Resident and passage migrat
Ammomanes deserti	Desert Lark	LC	Resident and passage migrant
Galerida cristata	Crested Lark	LC	Resident
Alauda arvensis	Eurasian Skylark	LC	Passage migrant and winter visitor
Riparia riparia	Sand Martin	LC	Passage migrant
Hirundo rustica	Barn Swallow	LC	Passage migrant
Cecropis daurica	Red-rumped Swallow	LC	Passage migrant
Phylloscopus trochilus	Willow Warbler	LC	Passage migrant
Sitta neumayer	Western Rock Nuthatch	LC	Resident
Phylloscopus collybita	Common Chiffchaff	LC	Passage migrant
Sturnus vulgaris	Common Starling	LC	Passage migrant and winter visitor
Phoenicurus ochruros	Western Black Redstart	LC	Passage migrant
Phoenicurus phoenicurus	Common Redstart	LC	Passage migrant
Oenanthe isabellina	Isabelline Wheatear	LC	Passage migrant
Oenanthe oenanthe	Northern Wheatear	LC	Passage migrant
Oenanthe finschii	Finsch's Wheatear	LC	Passage migrant and possible breeder
Oenanthe melanoleuca	Eastern Black-eared Wheatear	LC	Possible Breeder
Oenanthe albonigra	Hume's Wheatear	LC	Resident breeder
Passer domesticus	House Sparrow	LC	Resident
Carpospiza brachydactyla	Pale Rockfinch	LC	Passage migrant and possible breeder
Motacilla flava	Yellow Wagtail	LC	Passage migrant
Motacilla cinerea	Grey Wagtail	LC	Passage migrant
Motacilla alba	White Wagtail	LC	Passage migrant
Anthus spinoletta	Water Pipit	LC	Passage migrant
Fringilla coelebs	Common Chaffinch	LC	Passage migrant

Carduelis carduelis	European Goldfinch	LC	Passage migrant
Emberiza melanocephala	Black-headed Bunting	LC	Passage migrant and possible breeder
Miliaria calandra	Corn Bunting	LC	Passage migrant

APPENDIX 2
KM250A PROJECT ESIA BASELINE SURVEY RESULTS (SOIL, WATER, AIR, LAND USE, TRAFFIC, ARCHAEOLOGY), LABORATORY CERTIFICATES AND PHOTOGRAPHS

SOIL

Table A2.1 Soil sampling location photographs

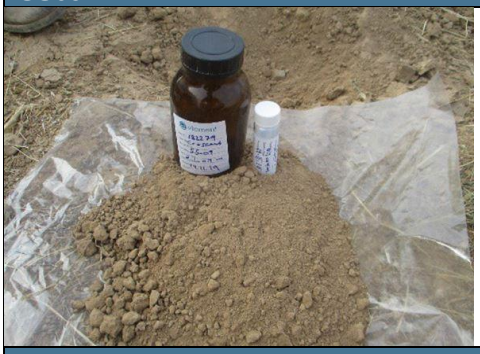
SS01
 
SS02
 
SS03
 
SS04
 
SS05

SS06

SS07

SS08

SS09

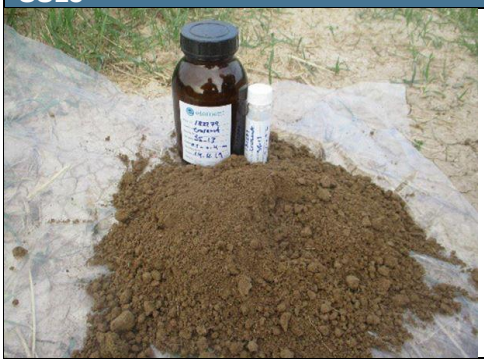


SS10

SS11

SS12

SS13



Soil sampling laboratory results:

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Analytical Report

Job Ref. No. : 79963
Report No : 111036
Date Reported : 25/12/2019

Client: RSK ENVIRONMENT LLC – IRAQ BRANCH
Al Majal Business Park
Basrah, Iraq
BASRAH, IRAQ
Attn: Jessica Hommelhoff
Project ID: 182279/ Soil
Project Name: Crescent
Project Location: Kormor
Tel. No: +964 782 784 6339

Approved by:

Saji SK
Asst. Laboratory Manager–Chemistry & Microbiology

002-LB-TEST

Sample ID	79963-1	79963-2	79963-3
Date Received	16/12/2019	16/12/2019	16/12/2019
Sampled By	Karrar Kamal	Karrar Kamal	Karrar Kamal
Sampling Date	14/11/2019	14/11/2019	14/11/2019
Sampling Time	Not Given	Not Given	Not Given
Sample Sub Matrix	Soil	Soil	Soil
Sampling Location	Not Given	Not Given	Not Given
Client Sample ID	SS01 / X-484346 - Y-3887945 / 0.1-0.4m	SS02 / X-483340 - Y-3887510 / 0.1-0.4m	SS03 / X-484181 - Y-3887266 / 0.1-0.4m

Analyte	Units	Results	Results	Results	Method Limit of Detection
Metals					
Cadmium (Cd)	mg/kg	<0.5	0.6	0.7	0.5
Arsenic (As)	mg/kg	4.1	3.6	3.0	1.0
Barium (Ba)	mg/kg	101	123	137	3.0
Copper (Cu)	mg/kg	19.0	21.1	20.0	3.0
Lead (Pb)	mg/kg	8.1	9.4	7.0	1.0
Nickel (Ni)	mg/kg	75.6	79.7	80.1	1.0
Selenium (Se)	mg/kg	<3.0	<3.0	<3.0	3.0
Zinc (Zn)	mg/kg	47.6	53.3	51.5	3.0
Chromium (VI)	mg/kg	<0.4	<0.4	<0.4	0.4
Mercury (Hg)	mg/kg	0.017	0.017	0.013	0.010
Hydrocarbons					
VPH C5-C10	mg/kg	<0.05	<0.05	<0.05	0.05
EPH C10-C40	mg/kg	53	<50	89	50

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Project Name: Crescent
Project Location: Kormor
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Approved by:

Saji SK
Asst. Laboratory Manager–Chemistry & Microbiology

002-LB-TEST

Sample ID	79963-4	79963-5	79963-6
Date Received	16/12/2019	16/12/2019	16/12/2019
Sampled By	Karrar Kamal	Karrar Kamal	Karrar Kamal
Sampling Date	14/11/2019	14/11/2019	14/11/2019
Sampling Time	Not Given	Not Given	Not Given
Sample Sub Matrix	Soil	Soil	Soil
Sampling Location	Not Given	Not Given	Not Given
Client Sample ID	SS04 / X-483599 - Y-3886433 / 0.1-0.4m	SS05 / X-484681 - Y-3886904 / 0.1-0.4m	SS06 / X-483669 - Y-3887283 / 0.1-0.4m

Analyte	Units	Results	Results	Results	Method Limit of Detection
Metals					
Cadmium (Cd)	mg/kg	<0.5	<0.5	<0.5	0.5
Arsenic (As)	mg/kg	2.7	3.4	4.9	1.0
Barium (Ba)	mg/kg	112	270	134	3.0
Copper (Cu)	mg/kg	17.9	21.7	20.5	3.0
Lead (Pb)	mg/kg	6.7	7.1	6.9	1.0
Nickel (Ni)	mg/kg	67.8	81.6	80.7	1.0
Selenium (Se)	mg/kg	<3.0	<3.0	<3.0	3.0
Zinc (Zn)	mg/kg	47.5	56.8	52.3	3.0
Chromium (VI)	mg/kg	<0.4	<0.4	<0.4	0.4
Mercury (Hg)	mg/kg	0.012	0.035	0.014	0.010
Hydrocarbons					
VPH C5-C10	mg/kg	<0.05	<0.05	<0.05	0.05
EPH C10-C40	mg/kg	<50	72	<50	50

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Project ID: 182279/ Soil
Project Name: Crescent
Project Location: Kormor
Tel. No: +964 782 784 6339

Approved by:

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Asst. Laboratory Manager–Chemistry & Microbiology

002-LB-TEST

Sample ID	79963-7	79963-8	79963-9
Date Received	16/12/2019	16/12/2019	16/12/2019
Sampled By	Karrar Kamal	Karrar Kamal	Karrar Kamal
Sampling Date	14/11/2019	14/11/2019	14/11/2019
Sampling Time	Not Given	Not Given	Not Given
Sample Sub Matrix	Soil	Soil	Soil
Sampling Location	Not Given	Not Given	Not Given
Client Sample ID	SS07 / X-483823 - Y-3887283 / 0.1-0.4m	SS08 / X-483923 - Y-3886816 / 0.1-0.4m	SS09 / X-484210- Y-3886672 / 0.1-0.4m

Analyte	Units	Results	Results	Results	Method Limit of Detection
Metals					
Cadmium (Cd)	mg/kg	<0.5	0.7	0.6	0.5
Arsenic (As)	mg/kg	3.9	3.7	4.1	1.0
Barium (Ba)	mg/kg	182	99.5	95.4	3.0
Copper (Cu)	mg/kg	19.4	17.6	17.1	3.0
Lead (Pb)	mg/kg	6.2	6.2	6.5	1.0
Nickel (Ni)	mg/kg	76.0	72.4	69.9	1.0
Selenium (Se)	mg/kg	<3.0	<3.0	<3.0	3.0
Zinc (Zn)	mg/kg	55.6	48.3	46.9	3.0
Chromium (VI)	mg/kg	<0.4	<0.4	<0.4	0.4
Mercury (Hg)	mg/kg	0.014	0.012	0.012	0.010
Hydrocarbons					
VPH C5-C10	mg/kg	<0.05	<0.05	<0.05	0.05
EPH C10-C40	mg/kg	65	<50	<50	50

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Analytical Report

Job Ref. No. : 79963
Report No : 111036
Date Reported : 25/12/2019

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Project ID: 182279/ Soil
Project Name: Crescent
Project Location: Kormor
Tel. No: +964 782 784 6339

Approved by:

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Asst. Laboratory Manager–Chemistry & Microbiology

002-LB-TEST

Sample ID	79963-10	79963-11	79963-12
Date Received	16/12/2019	16/12/2019	16/12/2019
Sampled By	Karrar Kamal	Karrar Kamal	Karrar Kamal
Sampling Date	14/11/2019	14/11/2019	14/11/2019
Sampling Time	Not Given	Not Given	Not Given
Sample Sub Matrix	Soil	Soil	Soil
Sampling Location	Not Given	Not Given	Not Given
Client Sample ID	SS10 / X-484246 - Y-3886585 / 0.1-0.4m	SS11 / X-484281 - Y-3887167 / 0.1-0.4m	SS12 / X-484060 - Y-3887549 / 0.1-0.4m

Analyte	Units	Results	Results	Results	Method Limit of Detection
Metals					
Cadmium (Cd)	mg/kg	<0.5	<0.5	0.6	0.5
Arsenic (As)	mg/kg	2.8	3.4	4.3	1.0
Barium (Ba)	mg/kg	91.0	98.6	93.8	3.0
Copper (Cu)	mg/kg	16.8	22.1	19.7	3.0
Lead (Pb)	mg/kg	6.4	7.6	7.9	1.0
Nickel (Ni)	mg/kg	67.9	84.7	74.8	1.0
Selenium (Se)	mg/kg	<3.0	<3.0	<3.0	3.0
Zinc (Zn)	mg/kg	46.9	57.4	53.8	3.0
Chromium (VI)	mg/kg	<0.4	<0.4	<0.4	0.4
Mercury (Hg)	mg/kg	0.013	0.020	0.015	0.010
Hydrocarbons					
VPH C5-C10	mg/kg	<0.05	<0.05	<0.05	0.05
EPH C10-C40	mg/kg	<50	<50	<50	50

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Analytical Report

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Report No : 111036
Date Reported : 25/12/2019

Client: RSK ENVIRONMENT LLC – IRAQ BRANCH
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Project Name: Crescent
Project Location: Kormor
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Approved by:

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002-LB-TEST

Sample ID	79963-13
Date Received	16/12/2019
Sampled By	Karrar Kamal
Sampling Date	14/11/2019
Sampling Time	Not Given
Sample Sub Matrix	Soil
Sampling Location	Not Given
Client Sample ID	SS13 / X-484346 - Y-3887945 / 0.1-0.4m

Analyte	Units	Results	Results	Results	Method Limit of Detection
Metals					
Cadmium (Cd)	mg/kg	<0.5			0.5
Arsenic (As)	mg/kg	3.4			1.0
Barium (Ba)	mg/kg	117			3.0
Copper (Cu)	mg/kg	19.7			3.0
Lead (Pb)	mg/kg	6.9			1.0
Nickel (Ni)	mg/kg	76.1			1.0
Selenium (Se)	mg/kg	<3.0			3.0
Zinc (Zn)	mg/kg	51.6			3.0
Chromium (VI)	mg/kg	<0.4			0.4
Mercury (Hg)	mg/kg	0.013			0.010
Hydrocarbons					
VPH C5-C10	mg/kg	<0.05			0.05
EPH C10-C40	mg/kg	<50			50

Method of Analysis

Method Name	Reference
Chromium (Hexavalent) [HACH 8023] Solids-DXB	HACH [8023]
EPH C10-C40 by GC-FID [EPA 8015B] SSS-DXB$	EPA [8015B]
Mercury by PSA [EPA 245.7] SSS-DXB$	EPA [245.7]
Metals ICP OES [APHA 3120 B] SSS-DXB$	APHA [3120 B]
VPH C5-C10 by GC-FID [EPA 8015B]-SSS-DXB$	EPA [8015B]

* Reference Method Modified

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Analytical Report

Job Ref. No. : 79963
Report No : 111036
Date Reported : 25/12/2019

Client:	RSK ENVIRONMENT LLC – IRAQ BRANCH Al Majal Business Park Basrah, Iraq BASRAH, IRAQ
Attn:	Jessica Hommelhoff
Project ID:	182279/ Soil
Project Name:	Crescent
Project Location:	Kormor
Tel. No:	+964 782 784 6339

Approved by:

Emirates International Accreditation Centre
002-LB-TEST

Saji SK
Asst. Laboratory Manager–Chemistry & Microbiology

Comments:

- Tested By : AAP, JCH, SKR
- Date Tested: 23/12/2019 to 24/12/2019

. Please note that if the sample has to be diluted due to the matrix, the reported Limit of Detection (LOD) value will increase from the method LOD.

. Any APHA methods stated herein are documented in-house procedures, referenced to 23rd edition.

. Test methods marked with $ are EIAC (formerly DAC) accredited.

WATER

Table A2.2 Water sampling location photographs

Paryawla – well
 
WW-2
 
WW-3
 
Khor Mor Gawra – spring
 
Taza Shar – spring


Shekh Hameed – spring


SP-2


SP-4


GW-5


Zhazh – spring	
	
Takhta Mina Saru – spring	
	
Ibrahim Ghulam – spring	
	

Water sampling chemical laboratory results:

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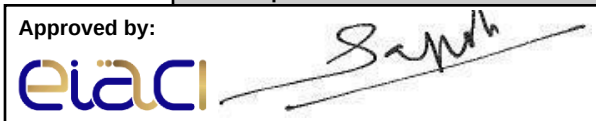
Analytical Report

Job Ref. No. : 79957
Report No : 111038
Date Reported : 25/12/2019

Client: RSK ENVIRONMENT LLC – IRAQ BRANCH
Al Majal Business Park
Basrah, Iraq
BASRAH, IRAQ
Attn: Jessica Hommelhoff
Project ID: 182279/Water
Project Name: Crescent
Project Location: Kormor
Tel. No: +964 782 784 6339

Approved by:



Saji SK
Asst. Laboratory Manager–Chemistry & Microbiology

002-LB-TEST

Sample ID	79957-1	79957-2	79957-3
Date Received	16/12/2019	16/12/2019	16/12/2019
Sampled By	Not Given	Not Given	Not Given
Sampling Date	11/11/2019	11/11/2019	11/11/2019
Sampling Time	Not Given	Not Given	Not Given
Sample Sub Matrix	Ground Water	Ground Water	Ground Water
Sampling Location	Not Given	Not Given	Not Given
Client Sample ID	Kormor Gawra-Spring / X-480842-Y-3886081	Taza Shaher -Spring / X-485378- Y-3882854	Sheikha Hammeed-Spring / X-486333-Y-3881433

Analyte	Units	Results	Results	Results	Method Limit of Detection
Inorganic Parameters					
pH Value @ 20°C	pH units	8.2	7.8	7.7	-
Total Dissolved Solids	mg/L	239	328	375	5
Turbidity	NTU	<0.1	1.8	2.8	0.1
Total Hardness	mg/L	191	370	370	1
Surfactants Anionic	mg/L	0.015	0.018	0.017	0.002
Anions					
Fluoride	mg/L	0.5	0.4	0.3	0.1
Nitrate	mg/L	0.66	0.49	1.02	0.04
Nitrite	mg/L	0.016	0.020	0.026	0.016
Sulphate	mg/L	23.0	33.0	42.0	5
Chloride	mg/L	7.0	9.5	11.0	2
Metals					
Aluminium (Al)	mg/L	<0.01	<0.01	<0.01	0.01
Chromium (VI)	mg/L	<0.05	<0.05	<0.05	0.05
Arsenic (As)	mg/L	<0.01	<0.01	<0.01	0.01
Barium (Ba)	mg/L	0.14	0.23	0.28	0.01
Cadmium (Cd)	mg/L	<0.001	<0.001	<0.001	0.001
Calcium (Ca)	mg/L	66.0	135	136	0.1
Copper (Cu)	mg/L	<0.01	<0.01	<0.01	0.01
Iron (Fe)	mg/L	<0.01	<0.01	<0.01	0.01
Lead (Pb)	mg/L	<0.01	<0.01	<0.01	0.01

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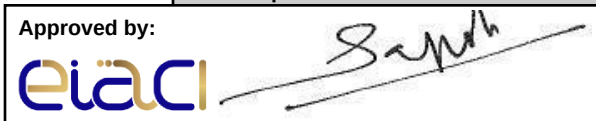
Analytical Report

Job Ref. No. : 79957
Report No : 111038
Date Reported : 25/12/2019

Client: RSK ENVIRONMENT LLC – IRAQ BRANCH
Al Majal Business Park
Basrah, Iraq
BASRAH, IRAQ
Attn: Jessica Hommelhoff
Project ID: 182279/Water
Project Name: Crescent
Project Location: Kormor
Tel. No: +964 782 784 6339

Approved by:



Saji SK
Asst. Laboratory Manager–Chemistry & Microbiology

002-LB-TEST

Sample ID	79957-1	79957-2	79957-3
Date Received	16/12/2019	16/12/2019	16/12/2019
Sampled By	Not Given	Not Given	Not Given
Sampling Date	11/11/2019	11/11/2019	11/11/2019
Sampling Time	Not Given	Not Given	Not Given
Sample Sub Matrix	Ground Water	Ground Water	Ground Water
Sampling Location	Not Given	Not Given	Not Given
Client Sample ID	Kormor Gawra-Spring / X-480842-Y-3886081	Taza Shaher -Spring / X-485378- Y-3882854	Sheikha Hammeed-Spring / X-486333-Y-3881433

Analyte	Units	Results	Results	Results	Method Limit of Detection
Metals - Continued					
Magnesium (Mg)	mg/L	6.4	7.9	7.2	0.1
Manganese (Mn)	mg/L	<0.01	<0.01	<0.01	0.01
Nickel (Ni)	mg/L	<0.01	<0.01	<0.01	0.01
Selenium (Se)	mg/L	<0.01	<0.01	<0.01	0.01
Sodium (Na)	mg/L	11.6	12.2	8.0	0.1
Zinc (Zn)	mg/L	<0.01	<0.01	<0.01	0.01
Mercury (Hg)	µg/L	<0.030	<0.030	<0.030	0.030
Hydrocarbons					
EPH C10-C40	µg/L	<50	129	<50	50
VPH C5-C10	µg/L	<7	<7	<7	7
PAH's					
Acenaphthene	µg/L	<0.01	<0.01	<0.01	0.01
Acenaphthylene	µg/L	<0.01	<0.01	<0.01	0.01
Anthracene	µg/L	<0.01	<0.01	<0.01	0.01
Benzo(a)anthracene	µg/L	<0.01	<0.01	<0.01	0.01
Benzo(a)pyrene	µg/L	<0.01	<0.01	<0.01	0.01
Benzo(b)fluoranthene	µg/L	<0.01	<0.01	<0.01	0.01
Benzo(g,h,i)perylene	µg/L	<0.01	<0.01	<0.01	0.01
Benzo(k)fluoranthene	µg/L	<0.01	<0.01	<0.01	0.01
Chrysene	µg/L	<0.01	<0.01	<0.01	0.01
Dibenzo(a,h)anthracene	µg/L	<0.01	<0.01	<0.01	0.01

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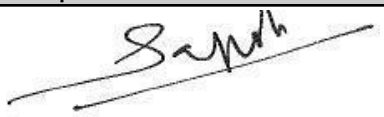
Analytical Report

Job Ref. No. : 79957
Report No : 111038
Date Reported : 25/12/2019

Client: RSK ENVIRONMENT LLC – IRAQ BRANCH
Al Majal Business Park
Basrah, Iraq
BASRAH, IRAQ
Attn: Jessica Hommelhoff
Project ID: 182279/Water
Project Name: Crescent
Project Location: Kormor
Tel. No: +964 782 784 6339

Approved by:



Saji SK
Asst. Laboratory Manager–Chemistry & Microbiology

002-LB-TEST

Sample ID	79957-1	79957-2	79957-3
Date Received	16/12/2019	16/12/2019	16/12/2019
Sampled By	Not Given	Not Given	Not Given
Sampling Date	11/11/2019	11/11/2019	11/11/2019
Sampling Time	Not Given	Not Given	Not Given
Sample Sub Matrix	Ground Water	Ground Water	Ground Water
Sampling Location	Not Given	Not Given	Not Given
Client Sample ID	Kormor Gawra-Spring / X-480842-Y-3886081	Taza Shaher -Spring / X-485378- Y-3882854	Sheikha Hammeed-Spring / X-486333-Y-3881433

Analyte	Units	Results	Results	Results	Method Limit of Detection
PAH's - Continued					
Fluoranthene	µg/L	<0.01	<0.01	<0.01	0.01
Fluorene	µg/L	<0.01	<0.01	<0.01	0.01
Indeno(1,2,3-c,d)pyrene	µg/L	<0.01	<0.01	<0.01	0.01
Naphthalene	µg/L	<0.02	<0.02	<0.02	0.02
Phenanthrene	µg/L	<0.01	<0.01	<0.01	0.01
Pyrene	µg/L	<0.01	<0.01	<0.01	0.01
Pesticides - Organochlorine					
BHC alpha	µg/L	<0.1	<0.1	<0.1	0.1
BHC beta	µg/L	<0.1	<0.1	<0.1	0.1
BHC delta	µg/L	<0.1	<0.1	<0.1	0.1
BHC gamma (Lindane)	µg/L	<0.1	<0.1	<0.1	0.1
Chlordane	µg/L	<0.1	<0.1	<0.1	0.1
DDD-p,p'	µg/L	<0.1	<0.1	<0.1	0.1
DDE-p,p'	µg/L	<0.1	<0.1	<0.1	0.1
DDT-p,p'	µg/L	<0.1	<0.1	<0.1	0.1
Endosulfan alpha	µg/L	<0.1	<0.1	<0.1	0.1
Endosulfan beta	µg/L	<0.1	<0.1	<0.1	0.1
Endosulfan sulphate	µg/L	<0.1	<0.1	<0.1	0.1
Endrin	µg/L	<0.1	<0.1	<0.1	0.1
Endrin aldehyde	µg/L	<0.1	<0.1	<0.1	0.1
Methoxychlor	µg/L	<0.1	<0.1	<0.1	0.1
Aldrin	µg/L	<0.03	<0.03	<0.03	0.03

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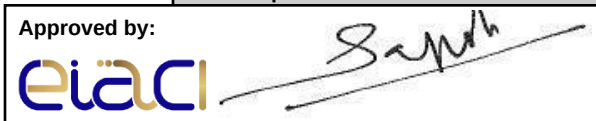
Analytical Report

Job Ref. No. : 79957
Report No : 111038
Date Reported : 25/12/2019

Client: RSK ENVIRONMENT LLC – IRAQ BRANCH
Al Majal Business Park
Basrah, Iraq
BASRAH, IRAQ
Attn: Jessica Hommelhoff
Project ID: 182279/Water
Project Name: Crescent
Project Location: Kormor
Tel. No: +964 782 784 6339

Approved by:



Saji SK
Asst. Laboratory Manager–Chemistry & Microbiology

002-LB-TEST

Sample ID	79957-1	79957-2	79957-3
Date Received	16/12/2019	16/12/2019	16/12/2019
Sampled By	Not Given	Not Given	Not Given
Sampling Date	11/11/2019	11/11/2019	11/11/2019
Sampling Time	Not Given	Not Given	Not Given
Sample Sub Matrix	Ground Water	Ground Water	Ground Water
Sampling Location	Not Given	Not Given	Not Given
Client Sample ID	Kormor Gawra-Spring / X-480842-Y-3886081	Taza Shaher -Spring / X-485378- Y-3882854	Sheikha Hammeed-Spring / X-486333-Y-3881433

Analyte	Units	Results	Results	Results	Method Limit of Detection
Pesticides - Organochlorine - Continued					
Dieldrin	µg/L	<0.03	<0.03	<0.03	0.03
Heptachlor	µg/L	<0.03	<0.03	<0.03	0.03
Heptachlor epoxide	µg/L	<0.03	<0.03	<0.03	0.03
Pesticides - Organophosphorous					
Chlorpyrifos	µg/L	<50	<50	<50	50
Dichlorvos	µg/L	<50	<50	<50	50
Dimethoate	µg/L	<50	<50	<50	50
Disulfoton	µg/L	<50	<50	<50	50
Fenchlorphos	µg/L	<50	<50	<50	50
Methyl Parathion	µg/L	<50	<50	<50	50
Parathion	µg/L	<50	<50	<50	50
Phorate	µg/L	<50	<50	<50	50
Famphur	µg/L	<50	<50	<50	50
Guthion	µg/L	<50	<50	<50	50
o,o,o-triethylphosphorothionate	µg/L	<50	<50	<50	50
Sulfotep	µg/L	<50	<50	<50	50
Thionazin	µg/L	<50	<50	<50	50
Tokuthion	µg/L	<50	<50	<50	50
Ethoprophos	µg/L	<50	<50	<50	50
Phenols					
Total Phenol	mg/L	<0.005	<0.005	<0.005	0.005

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Analytical Report

Job Ref. No. : 79957
Report No : 111038
Date Reported : 25/12/2019

Client: RSK ENVIRONMENT LLC – IRAQ BRANCH
Al Majal Business Park
Basrah, Iraq
BASRAH, IRAQ
Attn: Jessica Hommelhoff
Project ID: 182279/Water
Project Name: Crescent
Project Location: Kormor
Tel. No: +964 782 784 6339

Approved by:

Saji SK
Asst. Laboratory Manager–Chemistry & Microbiology

002-LB-TEST

Sample ID	79957-4	79957-5	79957-6
Date Received	16/12/2019	16/12/2019	16/12/2019
Sampled By	Not Given	Not Given	Not Given
Sampling Date	11/11/2019	11/11/2019	11/11/2019
Sampling Time	Not Given	Not Given	Not Given
Sample Sub Matrix	Ground Water	Ground Water	Ground Water
Sampling Location	Not Given	Not Given	Not Given
Client Sample ID	SP-2 / X-486130- Y-3881866	SP-4 / X-489330- Y-3877453	GW-5 / X-487354- Y-3887512

Analyte	Units	Results	Results	Results	Method Limit of Detection
Inorganic Parameters					
pH Value @ 20°C	pH units	7.9	7.9	7.9	-
Total Dissolved Solids	mg/L	341	228	444	5
Turbidity	NTU	0.7	0.3	4.3	0.1
Total Hardness	mg/L	185	178	218	1
Surfactants Anionic	mg/L	0.017	0.018	0.017	0.002
Anions					
Fluoride	mg/L	0.3	0.3	0.6	0.1
Nitrate	mg/L	0.58	1.24	1.86	0.04
Nitrite	mg/L	0.020	<0.016	0.259	0.016
Sulphate	mg/L	61.0	12.0	66.0	5
Chloride	mg/L	10.0	8.5	24.5	2
Metals					
Aluminium (Al)	mg/L	<0.01	<0.01	<0.01	0.01
Chromium (VI)	mg/L	<0.05	<0.05	<0.05	0.05
Arsenic (As)	mg/L	<0.01	<0.01	<0.01	0.01
Barium (Ba)	mg/L	0.13	0.04	0.09	0.01
Cadmium (Cd)	mg/L	<0.001	<0.001	<0.001	0.001
Calcium (Ca)	mg/L	62.6	62.9	51.2	0.1
Copper (Cu)	mg/L	<0.01	<0.01	<0.01	0.01
Iron (Fe)	mg/L	<0.01	<0.01	<0.01	0.01
Lead (Pb)	mg/L	<0.01	<0.01	<0.01	0.01
Magnesium (Mg)	mg/L	7.0	5.1	22.0	0.1

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Analytical Report

Job Ref. No. : 79957
Report No : 111038
Date Reported : 25/12/2019

Client: RSK ENVIRONMENT LLC – IRAQ BRANCH
Al Majal Business Park
Basrah, Iraq
BASRAH, IRAQ
Attn: Jessica Hommelhoff
Project ID: 182279/Water
Project Name: Crescent
Project Location: Kormor
Tel. No: +964 782 784 6339

Approved by:

Saji SK
Asst. Laboratory Manager–Chemistry & Microbiology

002-LB-TEST

Sample ID	79957-4	79957-5	79957-6
Date Received	16/12/2019	16/12/2019	16/12/2019
Sampled By	Not Given	Not Given	Not Given
Sampling Date	11/11/2019	11/11/2019	11/11/2019
Sampling Time	Not Given	Not Given	Not Given
Sample Sub Matrix	Ground Water	Ground Water	Ground Water
Sampling Location	Not Given	Not Given	Not Given
Client Sample ID	SP-2 / X-486130- Y-3881866	SP-4 / X-489330- Y-3877453	GW-5 / X-487354- Y-3887512

Analyte	Units	Results	Results	Results	Method Limit of Detection
Metals - Continued					
Manganese (Mn)	mg/L	<0.01	<0.01	<0.01	0.01
Nickel (Ni)	mg/L	<0.01	<0.01	<0.01	0.01
Selenium (Se)	mg/L	<0.01	<0.01	<0.01	0.01
Sodium (Na)	mg/L	6.6	7.0	60.9	0.1
Zinc (Zn)	mg/L	<0.01	<0.01	<0.01	0.01
Mercury (Hg)	µg/L	<0.030	<0.030	<0.030	0.030
Hydrocarbons					
EPH C10-C40	µg/L	<50	<50	<50	50
VPH C5-C10	µg/L	<7	<7	<7	7
PAH's					
Acenaphthene	µg/L	<0.01	<0.01	<0.01	0.01
Acenaphthylene	µg/L	<0.01	<0.01	<0.01	0.01
Anthracene	µg/L	<0.01	<0.01	<0.01	0.01
Benzo(a)anthracene	µg/L	<0.01	<0.01	<0.01	0.01
Benzo(a)pyrene	µg/L	<0.01	<0.01	<0.01	0.01
Benzo(b)fluoranthene	µg/L	<0.01	<0.01	<0.01	0.01
Benzo(g,h,i)perylene	µg/L	<0.01	<0.01	<0.01	0.01
Benzo(k)fluoranthene	µg/L	<0.01	<0.01	<0.01	0.01
Chrysene	µg/L	<0.01	<0.01	<0.01	0.01
Dibenzo(a,h)anthracene	µg/L	<0.01	<0.01	<0.01	0.01
Fluoranthene	µg/L	<0.01	<0.01	<0.01	0.01
Fluorene	µg/L	<0.01	<0.01	<0.01	0.01

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Analytical Report

Job Ref. No. : 79957
Report No : 111038
Date Reported : 25/12/2019

Client: RSK ENVIRONMENT LLC – IRAQ BRANCH
Al Majal Business Park
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Attn: Jessica Hommelhoff
Project ID: 182279/Water
Project Name: Crescent
Project Location: Kormor
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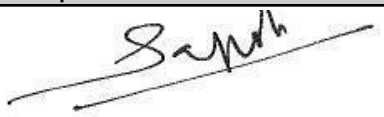
Approved by:



Saji SK
Asst. Laboratory Manager–Chemistry & Microbiology

002-LB-TEST

Sample ID	79957-4	79957-5	79957-6
Date Received	16/12/2019	16/12/2019	16/12/2019
Sampled By	Not Given	Not Given	Not Given
Sampling Date	11/11/2019	11/11/2019	11/11/2019
Sampling Time	Not Given	Not Given	Not Given
Sample Sub Matrix	Ground Water	Ground Water	Ground Water
Sampling Location	Not Given	Not Given	Not Given
Client Sample ID	SP-2 / X-486130- Y-3881866	SP-4 / X-489330- Y-3877453	GW-5 / X-487354- Y-3887512

Analyte	Units	Results	Results	Results	Method Limit of Detection
PAH's - Continued					
Indeno(1,2,3-c,d)pyrene	µg/L	<0.01	<0.01	<0.01	0.01
Naphthalene	µg/L	<0.02	0.04	<0.02	0.02
Phenanthrene	µg/L	<0.01	<0.01	<0.01	0.01
Pyrene	µg/L	<0.01	<0.01	<0.01	0.01
Pesticides - Organochlorine					
BHC alpha	µg/L	<0.1	<0.1	<0.1	0.1
BHC beta	µg/L	<0.1	<0.1	<0.1	0.1
BHC delta	µg/L	<0.1	<0.1	<0.1	0.1
BHC gamma (Lindane)	µg/L	<0.1	<0.1	<0.1	0.1
Chlordane	µg/L	<0.1	<0.1	<0.1	0.1
DDD-p,p'	µg/L	<0.1	<0.1	<0.1	0.1
DDE-p,p'	µg/L	<0.1	<0.1	<0.1	0.1
DDT-p,p'	µg/L	<0.1	<0.1	<0.1	0.1
Endosulfan alpha	µg/L	<0.1	<0.1	<0.1	0.1
Endosulfan beta	µg/L	<0.1	<0.1	<0.1	0.1
Endosulfan sulphate	µg/L	<0.1	<0.1	<0.1	0.1
Endrin	µg/L	<0.1	<0.1	<0.1	0.1
Endrin aldehyde	µg/L	<0.1	<0.1	<0.1	0.1
Methoxychlor	µg/L	<0.1	<0.1	<0.1	0.1
Aldrin	µg/L	<0.03	<0.03	<0.03	0.03
Dieldrin	µg/L	<0.03	<0.03	<0.03	0.03
Heptachlor	µg/L	<0.03	<0.03	<0.03	0.03

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Project Name: Crescent
Project Location: Kormor
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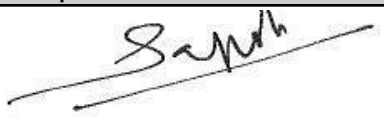

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002-LB-TEST

Sample ID	79957-4	79957-5	79957-6
Date Received	16/12/2019	16/12/2019	16/12/2019
Sampled By	Not Given	Not Given	Not Given
Sampling Date	11/11/2019	11/11/2019	11/11/2019
Sampling Time	Not Given	Not Given	Not Given
Sample Sub Matrix	Ground Water	Ground Water	Ground Water
Sampling Location	Not Given	Not Given	Not Given
Client Sample ID	SP-2 / X-486130- Y-3881866	SP-4 / X-489330- Y-3877453	GW-5 / X-487354- Y-3887512

Analyte	Units	Results	Results	Results	Method Limit of Detection
Pesticides - Organochlorine - Continued					
Heptachlor epoxide	µg/L	<0.03	<0.03	<0.03	0.03
Pesticides - Organophosphorous					
Chlorpyrifos	µg/L	<50	<50	<50	50
Dichlorvos	µg/L	<50	<50	<50	50
Dimethoate	µg/L	<50	<50	<50	50
Disulfoton	µg/L	<50	<50	<50	50
Fenchlorphos	µg/L	<50	<50	<50	50
Methyl Parathion	µg/L	<50	<50	<50	50
Parathion	µg/L	<50	<50	<50	50
Phorate	µg/L	<50	<50	<50	50
Famphur	µg/L	<50	<50	<50	50
Guthion	µg/L	<50	<50	<50	50
o,o,o-triethylphosphorothionate	µg/L	<50	<50	<50	50
Sulfotep	µg/L	<50	<50	<50	50
Thionazin	µg/L	<50	<50	<50	50
Tokuthion	µg/L	<50	<50	<50	50
Ethoprophos	µg/L	<50	<50	<50	50
Phenols					
Total Phenol	mg/L	<0.005	<0.005	<0.005	0.005

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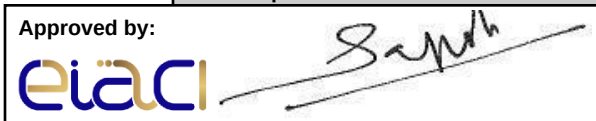
Job Ref. No. : 79957
Report No : 111038
Date Reported : 25/12/2019

Client: RSK ENVIRONMENT LLC – IRAQ BRANCH
Al Majal Business Park
Basrah, Iraq
BASRAH, IRAQ
Attn: Jessica Hommelhoff
Project ID: 182279/Water
Project Name: Crescent
Project Location: Kormor
Tel. No: +964 782 784 6339

Approved by:



Saji SK
Asst. Laboratory Manager–Chemistry & Microbiology

002-LB-TEST

Sample ID	79957-7	79957-8	79957-9
Date Received	16/12/2019	16/12/2019	16/12/2019
Sampled By	Not Given	Not Given	Not Given
Sampling Date	11/11/2019	12/11/2019	12/11/2019
Sampling Time	Not Given	Not Given	Not Given
Sample Sub Matrix	Ground Water	Ground Water	Ground Water
Sampling Location	Not Given	Not Given	Not Given
Client Sample ID	SP-3	Zhazh-Spring / X-478101- Y-3889592	Takhta mina -Spring / X-484711- Y-387719

Analyte	Units	Results	Results	Results	Method Limit of Detection
Inorganic Parameters					
pH Value @ 20°C	pH units	8.0	7.9	7.7	-
Total Dissolved Solids	mg/L	337	1450	306	5
Turbidity	NTU	0.7	4.7	0.9	0.1
Total Hardness	mg/L	262	677	210	1
Surfactants Anionic	mg/L	0.016	0.017	0.015	0.002
Anions					
Fluoride	mg/L	0.2	0.7	0.4	0.1
Nitrate	mg/L	0.66	0.89	1.99	0.04
Nitrite	mg/L	0.016	0.168	0.016	0.016
Sulphate	mg/L	50.0	437	13.0	5
Chloride	mg/L	9.5	334	10.5	2
Metals					
Aluminium (Al)	mg/L	<0.01	<0.01	<0.01	0.01
Chromium (VI)	mg/L	<0.05	<0.05	<0.05	0.05
Arsenic (As)	mg/L	<0.01	<0.01	<0.01	0.01
Barium (Ba)	mg/L	0.13	0.05	0.27	0.01
Cadmium (Cd)	mg/L	<0.001	<0.001	<0.001	0.001
Calcium (Ca)	mg/L	93.4	180	64.4	0.1
Copper (Cu)	mg/L	<0.01	<0.01	<0.01	0.01
Iron (Fe)	mg/L	<0.01	<0.01	<0.01	0.01
Lead (Pb)	mg/L	<0.01	<0.01	<0.01	0.01

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Analytical Report

Job Ref. No. : 79957
Report No : 111038
Date Reported : 25/12/2019

Client: RSK ENVIRONMENT LLC – IRAQ BRANCH
Al Majal Business Park
Basrah, Iraq
BASRAH, IRAQ
Attn: Jessica Hommelhoff
Project ID: 182279/Water
Project Name: Crescent
Project Location: Kormor
Tel. No: +964 782 784 6339

Approved by:

Saji SK
Asst. Laboratory Manager–Chemistry & Microbiology

002-LB-TEST

Sample ID	79957-7	79957-8	79957-9
Date Received	16/12/2019	16/12/2019	16/12/2019
Sampled By	Not Given	Not Given	Not Given
Sampling Date	11/11/2019	12/11/2019	12/11/2019
Sampling Time	Not Given	Not Given	Not Given
Sample Sub Matrix	Ground Water	Ground Water	Ground Water
Sampling Location	Not Given	Not Given	Not Given
Client Sample ID	SP-3	Zhazh-Spring / X-478101- Y-3889592	Takhta mina -Spring / X-484711- Y-387719

Analyte	Units	Results	Results	Results	Method Limit of Detection
Metals - Continued					
Magnesium (Mg)	mg/L	7.1	55.1	11.9	0.1
Manganese (Mn)	mg/L	<0.01	<0.01	<0.01	0.01
Nickel (Ni)	mg/L	<0.01	<0.01	<0.01	0.01
Selenium (Se)	mg/L	<0.01	<0.01	<0.01	0.01
Sodium (Na)	mg/L	6.6	186	16.2	0.1
Zinc (Zn)	mg/L	<0.01	<0.01	<0.01	0.01
Mercury (Hg)	µg/L	<0.030	<0.030	<0.030	0.030
Hydrocarbons					
EPH C10-C40	µg/L	<50	<50	<50	50
VPH C5-C10	µg/L	<7	<7	<7	7
PAH's					
Acenaphthene	µg/L	<0.01	<0.01	<0.01	0.01
Acenaphthylene	µg/L	<0.01	<0.01	<0.01	0.01
Anthracene	µg/L	<0.01	<0.01	<0.01	0.01
Benzo(a)anthracene	µg/L	<0.01	<0.01	<0.01	0.01
Benzo(a)pyrene	µg/L	<0.01	<0.01	<0.01	0.01
Benzo(b)fluoranthene	µg/L	<0.01	<0.01	<0.01	0.01
Benzo(g,h,i)perylene	µg/L	<0.01	<0.01	<0.01	0.01
Benzo(k)fluoranthene	µg/L	<0.01	<0.01	<0.01	0.01
Chrysene	µg/L	<0.01	<0.01	<0.01	0.01
Dibenzo(a,h)anthracene	µg/L	<0.01	<0.01	<0.01	0.01

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Analytical Report

Job Ref. No. : 79957
Report No : 111038
Date Reported : 25/12/2019

Client: RSK ENVIRONMENT LLC – IRAQ BRANCH
Al Majal Business Park
Basrah, Iraq
BASRAH, IRAQ
Attn: Jessica Hommelhoff
Project ID: 182279/Water
Project Name: Crescent
Project Location: Kormor
Tel. No: +964 782 784 6339

Approved by:

Saji SK
Asst. Laboratory Manager–Chemistry & Microbiology

002-LB-TEST

Sample ID	79957-7	79957-8	79957-9
Date Received	16/12/2019	16/12/2019	16/12/2019
Sampled By	Not Given	Not Given	Not Given
Sampling Date	11/11/2019	12/11/2019	12/11/2019
Sampling Time	Not Given	Not Given	Not Given
Sample Sub Matrix	Ground Water	Ground Water	Ground Water
Sampling Location	Not Given	Not Given	Not Given
Client Sample ID	SP-3	Zhazh-Spring / X-478101- Y-3889592	Takhta mina -Spring / X-484711- Y-387719

Analyte	Units	Results	Results	Results	Method Limit of Detection
PAH's - Continued					
Fluoranthene	µg/L	<0.01	<0.01	<0.01	0.01
Fluorene	µg/L	<0.01	<0.01	<0.01	0.01
Indeno(1,2,3-c,d)pyrene	µg/L	<0.01	<0.01	<0.01	0.01
Naphthalene	µg/L	<0.02	<0.02	<0.02	0.02
Phenanthrene	µg/L	<0.01	<0.01	<0.01	0.01
Pyrene	µg/L	<0.01	<0.01	<0.01	0.01
Pesticides - Organochlorine					
BHC alpha	µg/L	<0.1	<0.1	<0.1	0.1
BHC beta	µg/L	<0.1	<0.1	<0.1	0.1
BHC delta	µg/L	<0.1	<0.1	<0.1	0.1
BHC gamma (Lindane)	µg/L	<0.1	<0.1	<0.1	0.1
Chlordane	µg/L	<0.1	<0.1	<0.1	0.1
DDD-p,p'	µg/L	<0.1	<0.1	<0.1	0.1
DDE-p,p'	µg/L	<0.1	<0.1	<0.1	0.1
DDT-p,p'	µg/L	<0.1	<0.1	<0.1	0.1
Endosulfan alpha	µg/L	<0.1	<0.1	<0.1	0.1
Endosulfan beta	µg/L	<0.1	<0.1	<0.1	0.1
Endosulfan sulphate	µg/L	<0.1	<0.1	<0.1	0.1
Endrin	µg/L	<0.1	<0.1	<0.1	0.1
Endrin aldehyde	µg/L	<0.1	<0.1	<0.1	0.1
Methoxychlor	µg/L	<0.1	<0.1	<0.1	0.1
Aldrin	µg/L	<0.03	<0.03	<0.03	0.03

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Analytical Report

Job Ref. No. : 79957
Report No : 111038
Date Reported : 25/12/2019

Client: RSK ENVIRONMENT LLC – IRAQ BRANCH
Al Majal Business Park
Basrah, Iraq
BASRAH, IRAQ
Attn: Jessica Hommelhoff
Project ID: 182279/Water
Project Name: Crescent
Project Location: Kormor
Tel. No: +964 782 784 6339

Approved by:

Saji SK
Asst. Laboratory Manager–Chemistry & Microbiology

002-LB-TEST

Sample ID	79957-7	79957-8	79957-9
Date Received	16/12/2019	16/12/2019	16/12/2019
Sampled By	Not Given	Not Given	Not Given
Sampling Date	11/11/2019	12/11/2019	12/11/2019
Sampling Time	Not Given	Not Given	Not Given
Sample Sub Matrix	Ground Water	Ground Water	Ground Water
Sampling Location	Not Given	Not Given	Not Given
Client Sample ID	SP-3	Zhazh-Spring / X-478101- Y-3889592	Takhta mina -Spring / X-484711- Y-387719

Analyte	Units	Results	Results	Results	Method Limit of Detection
Pesticides - Organochlorine - Continued					
Dieldrin	µg/L	<0.03	<0.03	<0.03	0.03
Heptachlor	µg/L	<0.03	<0.03	<0.03	0.03
Heptachlor epoxide	µg/L	<0.03	<0.03	<0.03	0.03
Pesticides - Organophosphorous					
Chlorpyrifos	µg/L	<50	<50	<50	50
Dichlorvos	µg/L	<50	<50	<50	50
Dimethoate	µg/L	<50	<50	<50	50
Disulfoton	µg/L	<50	<50	<50	50
Fenchlorphos	µg/L	<50	<50	<50	50
Methyl Parathion	µg/L	<50	<50	<50	50
Parathion	µg/L	<50	<50	<50	50
Phorate	µg/L	<50	<50	<50	50
Famphur	µg/L	<50	<50	<50	50
Guthion	µg/L	<50	<50	<50	50
o,o,o-triethylphosphorothionate	µg/L	<50	<50	<50	50
Sulfotep	µg/L	<50	<50	<50	50
Thionazin	µg/L	<50	<50	<50	50
Tokuthion	µg/L	<50	<50	<50	50
Ethoprophos	µg/L	<50	<50	<50	50
Phenols					
Total Phenol	mg/L	<0.005	<0.005	<0.005	0.005

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Analytical Report

Job Ref. No. : 79957
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Date Reported : 25/12/2019

Client: RSK ENVIRONMENT LLC – IRAQ BRANCH
Al Majal Business Park
Basrah, Iraq
BASRAH, IRAQ
Attn: Jessica Hommelhoff
Project ID: 182279/Water
Project Name: Crescent
Project Location: Kormor
Tel. No: +964 782 784 6339

Approved by:

Saji SK
Asst. Laboratory Manager–Chemistry & Microbiology

002-LB-TEST

Sample ID	79957-10	79957-11	79957-12
Date Received	16/12/2019	16/12/2019	16/12/2019
Sampled By	Not Given	Not Given	Not Given
Sampling Date	12/11/2019	13/11/2019	13/11/2019
Sampling Time	Not Given	Not Given	Not Given
Sample Sub Matrix	Ground Water	Ground Water	Ground Water
Sampling Location	Not Given	Not Given	Not Given
Client Sample ID	Ibrahim Ghulam-Spring / X-492210-Y-3887439	Paryawala Well / X-476313- Y-3892673 / 5.26m	WW-2 / X-481888-Y-3885416

Analyte	Units	Results	Results	Results	Method Limit of Detection
Inorganic Parameters					
pH Value @ 20°C	pH units	8.2	8.3	8.1	-
Total Dissolved Solids	mg/L	398	600	215	5
Turbidity	NTU	0.4	<0.1	<0.1	0.1
Total Hardness	mg/L	147	60.0	140	1
Surfactants Anionic	mg/L	0.017	0.016	0.015	0.002
Anions					
Fluoride	mg/L	0.9	1.0	0.5	0.1
Nitrate	mg/L	0.66	2.17	0.40	0.04
Nitrite	mg/L	0.016	0.023	0.020	0.016
Sulphate	mg/L	97.0	192	33.0	5
Chloride	mg/L	20.5	50.0	7.5	2
Metals					
Aluminium (Al)	mg/L	<0.01	<0.01	<0.01	0.01
Chromium (VI)	mg/L	<0.05	<0.05	<0.05	0.05
Arsenic (As)	mg/L	<0.01	<0.01	<0.01	0.01
Barium (Ba)	mg/L	0.05	0.02	0.16	0.01
Cadmium (Cd)	mg/L	<0.001	<0.001	<0.001	0.001
Calcium (Ca)	mg/L	29.1	14.0	43.0	0.1
Copper (Cu)	mg/L	<0.01	<0.01	<0.01	0.01
Iron (Fe)	mg/L	<0.01	<0.01	<0.01	0.01
Lead (Pb)	mg/L	<0.01	<0.01	<0.01	0.01

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Analytical Report

Job Ref. No. : 79957
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Client: RSK ENVIRONMENT LLC – IRAQ BRANCH
Al Majal Business Park
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BASRAH, IRAQ
Attn: Jessica Hommelhoff
Project ID: 182279/Water
Project Name: Crescent
Project Location: Kormor
Tel. No: +964 782 784 6339

Approved by:

Saji SK
Asst. Laboratory Manager–Chemistry & Microbiology

002-LB-TEST

Sample ID	79957-10	79957-11	79957-12
Date Received	16/12/2019	16/12/2019	16/12/2019
Sampled By	Not Given	Not Given	Not Given
Sampling Date	12/11/2019	13/11/2019	13/11/2019
Sampling Time	Not Given	Not Given	Not Given
Sample Sub Matrix	Ground Water	Ground Water	Ground Water
Sampling Location	Not Given	Not Given	Not Given
Client Sample ID	Ibrahim Ghulam-Spring / X-492210-Y-3887439	Paryawala Well / X-476313- Y-3892673 / 5.26m	WW-2 / X-481888-Y-3885416

Analyte	Units	Results	Results	Results	Method Limit of Detection
Metals - Continued					
Magnesium (Mg)	mg/L	18.5	6.5	7.8	0.1
Manganese (Mn)	mg/L	<0.01	<0.01	<0.01	0.01
Nickel (Ni)	mg/L	<0.01	<0.01	<0.01	0.01
Selenium (Se)	mg/L	<0.01	<0.01	<0.01	0.01
Sodium (Na)	mg/L	76.7	165	13.2	0.1
Zinc (Zn)	mg/L	<0.01	<0.01	<0.01	0.01
Mercury (Hg)	µg/L	<0.030	<0.030	<0.030	0.030
Hydrocarbons					
EPH C10-C40	µg/L	<50	<50	<50	50
VPH C5-C10	µg/L	<7	<7	<7	7
PAH's					
Acenaphthene	µg/L	<0.01	<0.01	<0.01	0.01
Acenaphthylene	µg/L	<0.01	<0.01	<0.01	0.01
Anthracene	µg/L	<0.01	<0.01	<0.01	0.01
Benzo(a)anthracene	µg/L	<0.01	<0.01	<0.01	0.01
Benzo(a)pyrene	µg/L	<0.01	<0.01	<0.01	0.01
Benzo(b)fluoranthene	µg/L	<0.01	<0.01	<0.01	0.01
Benzo(g,h,i)perylene	µg/L	<0.01	<0.01	<0.01	0.01
Benzo(k)fluoranthene	µg/L	<0.01	<0.01	<0.01	0.01
Chrysene	µg/L	<0.01	<0.01	<0.01	0.01
Dibenzo(a,h)anthracene	µg/L	<0.01	<0.01	<0.01	0.01

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Client: RSK ENVIRONMENT LLC – IRAQ BRANCH
Al Majal Business Park
Basrah, Iraq
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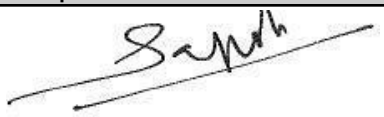
Attn: Jessica Hommelhoff
Project ID: 182279/Water
Project Name: Crescent
Project Location: Kormor
Tel. No: +964 782 784 6339

Approved by:



Saji SK
Asst. Laboratory Manager–Chemistry & Microbiology

002-LB-TEST

Sample ID	79957-10	79957-11	79957-12
Date Received	16/12/2019	16/12/2019	16/12/2019
Sampled By	Not Given	Not Given	Not Given
Sampling Date	12/11/2019	13/11/2019	13/11/2019
Sampling Time	Not Given	Not Given	Not Given
Sample Sub Matrix	Ground Water	Ground Water	Ground Water
Sampling Location	Not Given	Not Given	Not Given
Client Sample ID	Ibrahim Ghulam-Spring / X-492210-Y-3887439	Paryawala Well / X-476313- Y-3892673 / 5.26m	WW-2 / X-481888-Y-3885416

Analyte	Units	Results	Results	Results	Method Limit of Detection
PAH's - Continued					
Fluoranthene	µg/L	<0.01	<0.01	<0.01	0.01
Fluorene	µg/L	<0.01	<0.01	<0.01	0.01
Indeno(1,2,3-c,d)pyrene	µg/L	<0.01	<0.01	<0.01	0.01
Naphthalene	µg/L	<0.02	<0.02	<0.02	0.02
Phenanthrene	µg/L	<0.01	<0.01	<0.01	0.01
Pyrene	µg/L	<0.01	<0.01	<0.01	0.01
Pesticides - Organochlorine					
BHC alpha	µg/L	<0.1	<0.1	<0.1	0.1
BHC beta	µg/L	<0.1	<0.1	<0.1	0.1
BHC delta	µg/L	<0.1	<0.1	<0.1	0.1
BHC gamma (Lindane)	µg/L	<0.1	<0.1	<0.1	0.1
Chlordane	µg/L	<0.1	<0.1	<0.1	0.1
DDD-p,p'	µg/L	<0.1	<0.1	<0.1	0.1
DDE-p,p'	µg/L	<0.1	<0.1	<0.1	0.1
DDT-p,p'	µg/L	<0.1	<0.1	<0.1	0.1
Endosulfan alpha	µg/L	<0.1	<0.1	<0.1	0.1
Endosulfan beta	µg/L	<0.1	<0.1	<0.1	0.1
Endosulfan sulphate	µg/L	<0.1	<0.1	<0.1	0.1
Endrin	µg/L	<0.1	<0.1	<0.1	0.1
Endrin aldehyde	µg/L	<0.1	<0.1	<0.1	0.1
Methoxychlor	µg/L	<0.1	<0.1	<0.1	0.1
Aldrin	µg/L	<0.03	<0.03	<0.03	0.03

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Analytical Report

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Client: RSK ENVIRONMENT LLC – IRAQ BRANCH
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Attn: Jessica Hommelhoff
Project ID: 182279/Water
Project Name: Crescent
Project Location: Kormor
Tel. No: +964 782 784 6339

Approved by:

Saji SK
Asst. Laboratory Manager–Chemistry & Microbiology

002-LB-TEST

Sample ID	79957-10	79957-11	79957-12
Date Received	16/12/2019	16/12/2019	16/12/2019
Sampled By	Not Given	Not Given	Not Given
Sampling Date	12/11/2019	13/11/2019	13/11/2019
Sampling Time	Not Given	Not Given	Not Given
Sample Sub Matrix	Ground Water	Ground Water	Ground Water
Sampling Location	Not Given	Not Given	Not Given
Client Sample ID	Ibrahim Ghulam-Spring / X-492210-Y-3887439	Paryawala Well / X-476313- Y-3892673 / 5.26m	WW-2 / X-481888-Y-3885416

Analyte	Units	Results	Results	Results	Method Limit of Detection
Pesticides - Organochlorine - Continued					
Dieldrin	µg/L	<0.03	<0.03	<0.03	0.03
Heptachlor	µg/L	<0.03	<0.03	<0.03	0.03
Heptachlor epoxide	µg/L	<0.03	<0.03	<0.03	0.03
Pesticides - Organophosphorous					
Chlorpyrifos	µg/L	<50	<50	<50	50
Dichlorvos	µg/L	<50	<50	<50	50
Dimethoate	µg/L	<50	<50	<50	50
Disulfoton	µg/L	<50	<50	<50	50
Fenchlorphos	µg/L	<50	<50	<50	50
Methyl Parathion	µg/L	<50	<50	<50	50
Parathion	µg/L	<50	<50	<50	50
Phorate	µg/L	<50	<50	<50	50
Famphur	µg/L	<50	<50	<50	50
Guthion	µg/L	<50	<50	<50	50
o,o,o-triethylphosphorothionate	µg/L	<50	<50	<50	50
Sulfotep	µg/L	<50	<50	<50	50
Thionazin	µg/L	<50	<50	<50	50
Tokuthion	µg/L	<50	<50	<50	50
Ethoprophos	µg/L	<50	<50	<50	50
Phenols					
Total Phenol	mg/L	<0.005	<0.005	<0.005	0.005

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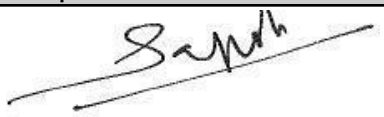
Analytical Report

Job Ref. No. : 79957
Report No : 111038
Date Reported : 25/12/2019

Client: RSK ENVIRONMENT LLC – IRAQ BRANCH
Al Majal Business Park
Basrah, Iraq
BASRAH, IRAQ
Attn: Jessica Hommelhoff
Project ID: 182279/Water
Project Name: Crescent
Project Location: Kormor
Tel. No: +964 782 784 6339

Approved by:



Saji SK
Asst. Laboratory Manager–Chemistry & Microbiology

002-LB-TEST

Sample ID	79957-13	79957-14
Date Received	16/12/2019	16/12/2019
Sampled By	Not Given	Not Given
Sampling Date	13/11/2019	13/11/2019
Sampling Time	Not Given	Not Given
Sample Sub Matrix	Ground Water	Ground Water
Sampling Location	Not Given	Not Given
Client Sample ID	WW-3 / X-482156-Y-3884612	WW-6

Analyte	Units	Results	Results	Results	Method Limit of Detection
Inorganic Parameters					
pH Value @ 20°C	pH units	8.1	7.9		-
Total Dissolved Solids	mg/L	203	215		5
Turbidity	NTU	<0.1	0.7		0.1
Total Hardness	mg/L	134	141		1
Surfactants Anionic	mg/L	0.016	0.017		0.002
Anions					
Fluoride	mg/L	0.4	0.6		0.1
Nitrate	mg/L	0.71	0.18		0.04
Nitrite	mg/L	<0.016	0.020		0.016
Sulphate	mg/L	24.0	36.0		5
Chloride	mg/L	7.0	8.0		2
Metals					
Aluminium (Al)	mg/L	<0.01	<0.01		0.01
Chromium (VI)	mg/L	<0.05	<0.05		0.05
Arsenic (As)	mg/L	<0.01	<0.01		0.01
Barium (Ba)	mg/L	0.21	0.14		0.01
Cadmium (Cd)	mg/L	<0.001	<0.001		0.001
Calcium (Ca)	mg/L	42.0	43.0		0.1
Copper (Cu)	mg/L	<0.01	<0.01		0.01
Iron (Fe)	mg/L	<0.01	<0.01		0.01
Lead (Pb)	mg/L	<0.01	<0.01		0.01
Magnesium (Mg)	mg/L	7.1	8.3		0.1

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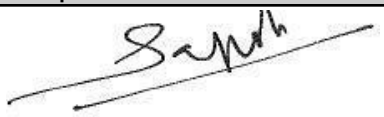
Analytical Report

Job Ref. No. : 79957
Report No : 111038
Date Reported : 25/12/2019

Client: RSK ENVIRONMENT LLC – IRAQ BRANCH
Al Majal Business Park
Basrah, Iraq
BASRAH, IRAQ
Attn: Jessica Hommelhoff
Project ID: 182279/Water
Project Name: Crescent
Project Location: Kormor
Tel. No: +964 782 784 6339

Approved by:



Saji SK
Asst. Laboratory Manager–Chemistry & Microbiology

002-LB-TEST

Sample ID	79957-13	79957-14
Date Received	16/12/2019	16/12/2019
Sampled By	Not Given	Not Given
Sampling Date	13/11/2019	13/11/2019
Sampling Time	Not Given	Not Given
Sample Sub Matrix	Ground Water	Ground Water
Sampling Location	Not Given	Not Given
Client Sample ID	WW-3 / X-482156-Y-3884612	WW-6

Analyte	Units	Results	Results	Results	Method Limit of Detection
Metals - Continued					
Manganese (Mn)	mg/L	<0.01	<0.01		0.01
Nickel (Ni)	mg/L	<0.01	<0.01		0.01
Selenium (Se)	mg/L	<0.01	<0.01		0.01
Sodium (Na)	mg/L	12.2	14.4		0.1
Zinc (Zn)	mg/L	<0.01	<0.01		0.01
Mercury (Hg)	µg/L	<0.030	<0.030		0.030
Hydrocarbons					
EPH C10-C40	µg/L	<50	<50		50
VPH C5-C10	µg/L	<7	<7		7
PAH's					
Acenaphthene	µg/L	<0.01	<0.01		0.01
Acenaphthylene	µg/L	<0.01	<0.01		0.01
Anthracene	µg/L	<0.01	<0.01		0.01
Benzo(a)anthracene	µg/L	<0.01	<0.01		0.01
Benzo(a)pyrene	µg/L	<0.01	<0.01		0.01
Benzo(b)fluoranthene	µg/L	<0.01	<0.01		0.01
Benzo(g,h,i)perylene	µg/L	<0.01	<0.01		0.01
Benzo(k)fluoranthene	µg/L	<0.01	<0.01		0.01
Chrysene	µg/L	<0.01	<0.01		0.01
Dibenzo(a,h)anthracene	µg/L	<0.01	<0.01		0.01
Fluoranthene	µg/L	<0.01	<0.01		0.01
Fluorene	µg/L	<0.01	<0.01		0.01

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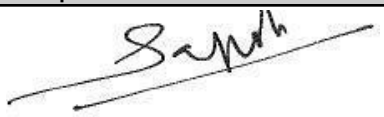
Analytical Report

Job Ref. No. : 79957
Report No : 111038
Date Reported : 25/12/2019

Client: RSK ENVIRONMENT LLC – IRAQ BRANCH
Al Majal Business Park
Basrah, Iraq
BASRAH, IRAQ
Attn: Jessica Hommelhoff
Project ID: 182279/Water
Project Name: Crescent
Project Location: Kormor
Tel. No: +964 782 784 6339

Approved by:



Saji SK
Asst. Laboratory Manager–Chemistry & Microbiology

002-LB-TEST

Sample ID	79957-13	79957-14
Date Received	16/12/2019	16/12/2019
Sampled By	Not Given	Not Given
Sampling Date	13/11/2019	13/11/2019
Sampling Time	Not Given	Not Given
Sample Sub Matrix	Ground Water	Ground Water
Sampling Location	Not Given	Not Given
Client Sample ID	WW-3 / X-482156-Y-3884612	WW-6

Analyte	Units	Results	Results	Results	Method Limit of Detection
PAH's - Continued					
Indeno(1,2,3-c,d)pyrene	µg/L	<0.01	<0.01		0.01
Naphthalene	µg/L	<0.02	<0.02		0.02
Phenanthrene	µg/L	<0.01	<0.01		0.01
Pyrene	µg/L	<0.01	<0.01		0.01
Pesticides - Organochlorine					
BHC alpha	µg/L	<0.1	<0.1		0.1
BHC beta	µg/L	<0.1	<0.1		0.1
BHC delta	µg/L	<0.1	<0.1		0.1
BHC gamma (Lindane)	µg/L	<0.1	<0.1		0.1
Chlordane	µg/L	<0.1	<0.1		0.1
DDD-p,p'	µg/L	<0.1	<0.1		0.1
DDE-p,p'	µg/L	<0.1	<0.1		0.1
DDT-p,p'	µg/L	<0.1	<0.1		0.1
Endosulfan alpha	µg/L	<0.1	<0.1		0.1
Endosulfan beta	µg/L	<0.1	<0.1		0.1
Endosulfan sulphate	µg/L	<0.1	<0.1		0.1
Endrin	µg/L	<0.1	<0.1		0.1
Endrin aldehyde	µg/L	<0.1	<0.1		0.1
Methoxychlor	µg/L	<0.1	<0.1		0.1
Aldrin	µg/L	<0.03	<0.03		0.03
Dieldrin	µg/L	<0.03	<0.03		0.03
Heptachlor	µg/L	<0.03	<0.03		0.03

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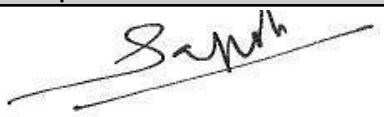
Analytical Report

Job Ref. No. : 79957
Report No : 111038
Date Reported : 25/12/2019

Client: RSK ENVIRONMENT LLC – IRAQ BRANCH
Al Majal Business Park
Basrah, Iraq
BASRAH, IRAQ
Attn: Jessica Hommelhoff
Project ID: 182279/Water
Project Name: Crescent
Project Location: Kormor
Tel. No: +964 782 784 6339

Approved by:



Saji SK
Asst. Laboratory Manager–Chemistry & Microbiology

002-LB-TEST

Sample ID	79957-13	79957-14
Date Received	16/12/2019	16/12/2019
Sampled By	Not Given	Not Given
Sampling Date	13/11/2019	13/11/2019
Sampling Time	Not Given	Not Given
Sample Sub Matrix	Ground Water	Ground Water
Sampling Location	Not Given	Not Given
Client Sample ID	WW-3 / X-482156-Y-3884612	WW-6

Analyte	Units	Results	Results	Results	Method Limit of Detection
Pesticides - Organochlorine - Continued					
Heptachlor epoxide	µg/L	<0.03	<0.03		0.03
Pesticides - Organophosphorous					
Chlorpyrifos	µg/L	<50	<50		50
Dichlorvos	µg/L	<50	<50		50
Dimethoate	µg/L	<50	<50		50
Disulfoton	µg/L	<50	<50		50
Fenchlorphos	µg/L	<50	<50		50
Methyl Parathion	µg/L	<50	<50		50
Parathion	µg/L	<50	<50		50
Phorate	µg/L	<50	<50		50
Famphur	µg/L	<50	<50		50
Guthion	µg/L	<50	<50		50
o,o,o-triethylphosphorothionate	µg/L	<50	<50		50
Sulfotep	µg/L	<50	<50		50
Thionazin	µg/L	<50	<50		50
Tokuthion	µg/L	<50	<50		50
Ethoprophos	µg/L	<50	<50		50
Phenols					
Total Phenol	mg/L	<0.005	<0.005		0.005

Method of Analysis

Method Name	Reference
Chloride [APHA 4500 Cl- B]-DXB	APHA [4500 Cl- B]

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Analytical Report

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Client: RSK ENVIRONMENT LLC – IRAQ BRANCH
Al Majal Business Park
Basrah, Iraq
BASRAH, IRAQ
Attn: Jessica Hommelhoff
Project ID: 182279/Water
Project Name: Crescent
Project Location: Kormor
Tel. No: +964 782 784 6339

Approved by:

Emirates International Accreditation Centre
002-LB-TEST

Saji SK
Asst. Laboratory Manager–Chemistry & Microbiology

Method of Analysis

Method Name	Reference
Chromium (Hexavalent) [HACH 8023] Water-DXB	HACH [8023]
EPH C10-C40 by GC-FID [EPA 8015B] Water-DXB$	EPA [8015B]
Fluoride [HACH 8029]-DXB	HACH [8029]
Hardness (Total) [APHA 2340 B]-DXB	APHA [2340 B]
Mercury by PSA [EPA 245.7] P&E-DXB$	EPA [245.7]
Metals ICP OES [APHA 3120 B] P-DXB$	APHA [3120 B]
Nitrate [HACH 8039]-DXB	HACH [8039]
Nitrite [HACH 8507]-DXB	HACH [8507]
Organochlorine Pesticides in Water [EPA 8081 A]-DXB$	EPA [8081 A]
Organophosphorous Pesticides in water [EPA 8270 D]-DXB	EPA [8270 D]
PAH in Water [EPA 8270 D]-DXB$	US EPA [8270 D]
pH [APHA 4500 H+ B]Water-DXB$	APHA [4500 H+ B]
Phenol (Total) [HACH 8047]-DXB	HACH [8047]
Solids (Total Dissolved) [APHA 2540 C]Water-DXB$	APHA [2540 C]
Sulphate [APHA 4500 SO42- C]-DXB	APHA [4500 SO42- C]
Surfactants Anionic [HACH 8028]-DXB	HACH [8028]
Turbidity [APHA 2130 B]-DXB	APHA [2130 B]
VPH C5-C10 by GC-FID [EPA 8015B]-Water-DXB$	EPA [8015B]

* Reference Method Modified

Comments:

· Tested By : AAP, JCH, SKR, SMO
· Date Tested: 19/12/2019 to 24/12/2019

. Please note that if the sample has to be diluted due to the matrix, the reported Limit of Detection (LOD) value will increase from the method LOD.

. Any APHA methods stated herein are documented in-house procedures, referenced to 23rd edition.

. Test methods marked with $ are EIAC (formerly DAC) accredited.

. Please note that the metals results reported above are dissolved metals.

. Please see the table below detailing the surrogate recovery of Naphthalene-D8* for the samples shown. The normal acceptable recovery range is 70-130%, however, the values shown are slightly below this for some of the samples due to the sample matrix effect. The recovery of the counterpart analytes may therefore also be slightly reduced. All other surrogate compounds had acceptable recovery.

Surrogate Compounds	Sample ID											
	79957/1	79957/2	79957/4	79957/5	79957/6	79957/7	79957/8	79957/9	79957/10	79957/12	79957/13	79957/14
Naphthalene-D8*	72	75	65	74	72	70	70	71	73	75	66	66

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Analytical Report

Job Ref. No.	:	79957
Report No	:	111038
Date Reported	:	25/12/2019

Client:	RSK ENVIRONMENT LLC – IRAQ BRANCH Al Majal Business Park Basrah, Iraq BASRAH, IRAQ
Attn:	Jessica Hommelhoff
Project ID:	182279/Water
Project Name:	Crescent
Project Location:	Kormor
Tel. No:	+964 782 784 6339

Approved by:

مركز الإمارات العالمي للاعتماد
Emirates International Accreditation Centre
002-LB-TEST

Saji SK
Asst. Laboratory Manager–Chemistry & Microbiology

Water sampling bacterial laboratory results:

Al Majal Business Park
Berjessah, Az Zubayr, Basra

FINAL ANALYTICAL TEST REPORT

Laboratory Job Number: 19/10710
Issue Number: 1 **Date:** 16 November, 2019

Client:
RSK Environment IIc, Iraq
PO Box 45103 Abu Dhabi
902 Silver Wave Tower
Suite 1202
Mina Road
Abu Dhabi
United Arab Emirates

Project Manager: Jessica Hommelhoff
Project Name: Crescent
Project Ref: 182279
Order No: N/A
Date Samples Received: 12/11/19
Date Instructions Received: 12/11/19
Date Analysis Completed: 16/11/19

Prepared by:

Farhan Shaher Luhaib
Senior Technician

Approved by:

Hayder Naseer
Laboratory Supervisor

Laboratory Job Number: 19/10710

Client Project Name: Crescent

Client Project Ref: 182279

Lab Sample ID	19/10710/1	19/10710/2	19/10710/3	19/10710/4	19/10710/5	19/10710/6	19/10710/7	Units	Limit of Detection	Method ref
Client Sample No	Kormor Gawra-Spring	Taza Shaher-Spring	Sheikh Hameed-Spring	SP-2	SP-4	GW-5	SP-3			
Client Sample ID	480842-388608 1	485378-388285 4	486333-388143 3	486130-388186 6	489330-387745 3	487354-388751 2				
Depth to Top										
Depth To Bottom										
Date Sampled	11-Nov-19	11-Nov-19	11-Nov-19	11-Nov-19	11-Nov-19	11-Nov-19	11-Nov-19			
Sample Type	Water - W	Water - W	Water - W	Water - W	Water - W	Water - W	Water - W			
Ecoli$_A$	No Growth	No Growth	No Growth	No Growth	No Growth	No Growth	No Growth			Test kit
Coliforms (total)$_A$	1000	100000	100	100	100	100000	1000	cfu/ml		Test kit

REPORT NOTES

Notes - Soil analysis
All results are reported as dry weight.
Natural stones >10mm are removed or excluded from the sample prior to analysis and reported results corrected to a whole sample basis.

Notes - General

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Samples submitted by others. Sampling is outside of our control.

Subscript "A" indicates analysis performed on the sample as received. "D" indicates analysis performed on the dried sample, crushed to pass a 2mm sieve, unless asbestos is found to be present in which case all analysis is performed on the sample as received.
For samples that are oil all analysis is performed on the as received sample and this supercedes any “D” subscript.
For samples that are aggregate, stones, concrete or any similar matrices all analysis is performed on the dried and crushed sample.

Uncertainty has been calculated for all procedures and summary data is available upon request.
All calibrations performed by the laboratory are traceable to NIST standards.

IS indicates Insufficient sample for analysis.
NDP indicates No Determination Possible.
NAD indicates No Asbestos Detected.
Superscript * indicates that all analysis for that sample was performed by a subcontract laboratory.
Superscript # indicates method accredited to ISO 17025.
Analytical results reflect the quality of the sample at the time of analysis only. Opinions and interpretations expressed are outside the scope of our accreditation.

Please contact us if you need any further information.

Al Majal Business Park
Berjessah, Az Zubayr, Basra

FINAL ANALYTICAL TEST REPORT

Laboratory Job Number: 19/10723
Issue Number: 1 **Date:** 16 November, 2019

Client:
RSK Environment IIc, Iraq
PO Box 45103 Abu Dhabi
902 Silver Wave Tower
Suite 1202
Mina Road
Abu Dhabi
United Arab Emirates

Project Manager: Jessica Hommelhoff
Project Name: Crescent
Project Ref: 182279
Order No: N/A
Date Samples Received: 13/11/19
Date Instructions Received: 13/11/19
Date Analysis Completed: 16/11/19

Prepared by:

Farhan Shaher Luhaib
Senior Technician

Approved by:

Hayder Naseer
Laboratory Supervisor

Laboratory Job Number: 19/10723

Client Project Name: Crescent

Client Project Ref: 182279

Lab Sample ID	19/10723/1	19/10723/2	19/10723/3					Units	Limit of Detection	Method ref
Client Sample No	Zhazh-Spring	Takhta mina-Spring	Ibrahim Ghulam-Spri n							
Client Sample ID	478101-38895 92	484711-38771 9	492210-38874 39							
Depth to Top										
Depth To Bottom										
Date Sampled	12-Nov-19	12-Nov-19	12-Nov-19							
Sample Type	Water - W	Water - W	Water - W							
Ecoli$_A$	No Growth	No Growth	No Growth							Test kit
Coliforms (total)$_A$	10000	100000	10000					cfu/ml		Test kit

REPORT NOTES

Notes - Soil analysis
All results are reported as dry weight.
Natural stones >10mm are removed or excluded from the sample prior to analysis and reported results corrected to a whole sample basis.

Notes - General

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Al Majal Business Park
Berjessah, Az Zubayr, Basra

FINAL ANALYTICAL TEST REPORT

Laboratory Job Number: 19/10883
Issue Number: 1 **Date:** 16 November, 2019

Client:
RSK Environment IIc, Iraq
PO Box 45103 Abu Dhabi
902 Silver Wave Tower
Suite 1202
Mina Road
Abu Dhabi
United Arab Emirates

Project Manager: Jessica Hommelhoff
Project Name: Crescent
Project Ref: 182279
Order No: N/A
Date Samples Received: 14/11/19
Date Instructions Received: 14/11/19
Date Analysis Completed: 16/11/19

Prepared by:

Farhan Shaher Luhaib
Senior Technician

Approved by:

Hayder Naseer
Laboratory Supervisor

Laboratory Job Number: 19/10883

Client Project Name: Crescent

Client Project Ref: 182279

Lab Sample ID	19/10883/1	19/10883/2	19/10883/3	19/10883/4				Units	Limit of Detection	Method ref
Client Sample No	Paryawla well	WW-2	WW-3	WW-6						
Client Sample ID	476313-3892673	481888-3885416	482156-3884612							
Depth to Top	5.26									
Depth To Bottom										
Date Sampled	13-Nov-19	13-Nov-19	13-Nov-19	13-Nov-19						
Sample Type	Water - W	Water - W	Water - W	Water - W						
Ecoli$_A$	No Growth	No Growth	No Growth	No Growth						Test kit
Coliforms (total)$_A$	10	10	10	100				cfu/ml		Test kit

REPORT NOTES

Notes - Soil analysis
All results are reported as dry weight.
Natural stones >10mm are removed or excluded from the sample prior to analysis and reported results corrected to a whole sample basis.

Notes - General

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Please contact us if you need any further information.

AIR

Air quality laboratory results:

gradko environmental
(A division of Gradko International Ltd.)
St. Martins House, 77 Wales Street Winchester, Hampshire SO23 0RH
tel.: 01962 860331 fax: 01962 841339 e-mail:diffusion@gradko.co.uk

2187

LABORATORY ANALYSIS REPORT

HYDROGEN SULPHIDE IN DIFFUSION TUBES BY U.V.SPECTROPHOTOMETRY

REPORT NUMBER N07476R

BOOKING IN REFERENCE N07476
DESPATCH NOTE 73775
CUSTOMER RSK Environment Llc (UAE) Attn: Andreea Stroe
PO Box 46112
Al Ghaith Tower, Suite 1202
Hamdan Bin Mohamed St.
Abu Dhabi

United Arab Emirates

DATE SAMPLES RECEIVED 10/10/2019

JOB NUMBER

Location	Sample Number	Exposure Data Date On*	Date Off*	Time* (hr.)	µg H_2S on tube	µg H_2S - Blank	µg/m^3 *	ppb *
Kormar Gamara Village	1431399	22/08/2019	23/09/2019	764.67	0.08	0.04	0.08	0.06
Kormar Bichuck Village	1431394	20/08/2019	23/09/2019	815.50	<0.04	<0.01	<0.01	<0.01
Taza Shahaw Village	1431395	20/08/2019	23/09/2019	814.83	<0.04	<0.01	<0.01	<0.01
Aweya Jalal Village	1431397	21/08/2019	23/09/2019	790.33	0.06	0.02	0.04	0.02
Shikhhsmeed Village	1431396	21/08/2019	23/09/2019	792.75	0.05	0.01	0.01	0.01
Mamsik Village	1431401	24/08/2019	23/09/2019	726.33	<0.04	<0.01	<0.01	<0.01
Qadev Qarm Village	1431398	22/08/2019	23/09/2019	774.58	0.05	0.02	0.03	0.02
MP8	1431400	23/08/2019	23/09/2019	746.00	<0.04	<0.01	<0.01	<0.01
Field Blank	1431402				0.04			
Laboratory Blank					0.02			

Results reported as <0.044µg on tube are below the reporting limit.
Tubes have exceeded shelf-life. Results may be compromised.

Overall M.U. ±18.6% **Limit of Detection** 0.044µg on tube

Analysed on CARY 60
Analyst Name Sam Minns **Report Checked By** Andrew Poole

Date of Analysis 15/10/2019 **Date of Report** 22/10/2019

Analysis carried out in accordance with documented in-house Laboratory Method GLM5

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2187

LABORATORY ANALYSIS REPORT

Report Number	**N07442R**
Customer	**RSK Environment LLC (UAE)** **PO Box 46112** **Al Ghaith Tower, Suite 1202** **Hamdan Bin Mohamed St.** **Abu Dhabi, UAE**
Booking In Reference	**T1299**
Despatch Note Number	**73775**
Date Samples Received	**10/10/2019**
Diffusion Tube Type	**Tenax**

Quantitative Analysis of BTEX
Identification and estimation of ng on tube in accordance with ISO16000-6
Estimation of Total VOC (C_6 to C_{16}) on Tenax Diffusion Tubes in accordance with ISO16000-6

Tube Number	**GRA02624**
Gradko Lab Reference	**04N1310**
Exposure Time (mins)*	**45880**
Sample ID	**Kormor Gawra Village**

BTEX	**ng on tube**	**ppb in air***	**µgm^{-3}***
Benzene	5.6	0.2	0.5
Toluene	6.6	0.1	0.5
Ethylbenzene	<5.0	<0.1	<0.3
m/p-Xylene	<5.0	<0.1	<0.3
o-Xylene	<5.0	<0.1	<0.3

Top 5 VOC	**Estimated ng on tube**	**ppb in air***	**µgm^{-3}***
Benzoic acid	617	6.7	33
2,6-Diphenyl-p-benzoquinone	338	3.7	38
Acetophenone**	79	0.9	4.1
Phenylmaleic anhydride	67	0.7	5.1
Benzaldehyde**	61	0.7	2.8

	Estimated ng on tube	**ppb in air***	**µgm^{-3}***
Total VOC (C_6 to C_{16})	1097	12.0	74.4

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LABORATORY ANALYSIS REPORT

Tube Number	**001685**
Gradko Lab Reference	**04N1311**
Exposure Time (mins)*	**48930**
Sample ID	**Kormor Bichuk Village**

BTEX	**ng on tube**	**ppb in air***	**µgm^{-3}***
Benzene	5.0	0.1	0.5
Toluene	<5.0	<0.1	<0.4
Ethylbenzene	<5.0	<0.1	<0.3
m/p-Xylene	<5.0	<0.1	<0.3
o-Xylene	<5.0	<0.1	<0.3

Top 5 VOC	**Estimated ng on tube**	**ppb in air***	**µgm^{-3}***
Benzoic acid	924	9.4	46
2,6-Diphenyl-p-benzoquinone	339	3.5	36
Acetophenone**	112	1.1	5.5
Phenylmaleic anhydride	98	1.0	7.0
Benzaldehyde**	79	0.8	3.4

	Estimated ng on tube	**ppb in air***	**µgm^{-3}***
Total VOC (C_6 to C_{16})	1804	18.4	117

Tube Number	**GRA09924**
Gradko Lab Reference	**04N1312**
Exposure Time (mins)*	**48890**
Sample ID	**Taza Shahar Village**

BTEX	**ng on tube**	**ppb in air***	**µgm^{-3}***
Benzene	5.6	0.2	0.5
Toluene	<5.0	<0.1	<0.4
Ethylbenzene	<5.0	<0.1	<0.3
m/p-Xylene	<5.0	<0.1	<0.3
o-Xylene	<5.0	<0.1	<0.3

Top 5 VOC	**Estimated ng on tube**	**ppb in air***	**µgm^{-3}***
Benzoic acid	1204	12	60
2,6-Diphenyl-p-benzoquinone	296	3.0	31
2-Phenacyl-quinoxaline	193	2.0	20
Acetophenone**	139	1.4	6.8
Phenylmaleic anhydride	134	1.4	9.5

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LABORATORY ANALYSIS REPORT

	Estimated ng on tube	ppb in air*	µgm^{-3}*
Total VOC (C_6 to C_{16})	2042	20.9	133

Tube Number	**GRA10201**
Gradko Lab Reference	**04N1313**
Exposure Time (mins)*	**47420**
Sample ID	**Awey el Talal Village**

BTEX	ng on tube	ppb in air*	µgm^{-3}*
Benzene	5.5	0.2	0.5
Toluene	<5.0	<0.1	<0.4
Ethylbenzene	<5.0	<0.1	<0.3
m/p-Xylene	<5.0	<0.1	<0.3
o-Xylene	<5.0	<0.1	<0.3

Top 5 VOC	Estimated ng on tube	ppb in air*	µgm^{-3}*
Benzoic acid	963	10.2	49.6
2,6-Diphenyl-p-benzoquinone	281	3.0	31
2-Phenacyl-quinoxaline	158	1.7	17
Acetophenone**	118	1.2	6.0
Phenylmaleic anhydride	102	1.1	7.5

	Estimated ng on tube	ppb in air*	µgm^{-3}*
Total VOC (C_6 to C_{16})	1706	18.0	114

Tube Number	**GRA08280**
Gradko Lab Reference	**04N1314**
Exposure Time (mins)*	**47565**
Sample ID	**Shehik Hanced Village**

BTEX	ng on tube	ppb in air*	µgm^{-3}*
Benzene	6.0	0.2	0.6
Toluene	6.2	0.1	0.5
Ethylbenzene	<5.0	<0.1	<0.3
m/p-Xylene	5.1	0.1	0.3
o-Xylene	<5.0	<0.1	<0.3

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LABORATORY ANALYSIS REPORT

Top 5 VOC	Estimated ng on tube	ppb in air*	µgm^{-3}*
Benzoic acid	1019	11	52
2,6-Diphenyl-p-benzoquinone	239	2.5	26
Acetophenone**	112	1.2	5.7
Phenylmaleic anhydride	108	1.1	7.9
Benzaldehyde**	82	0.9	3.7

	Estimated ng on tube	ppb in air*	µgm^{-3}*
Total VOC (C_6 to C_{16})	1801	18.9	120

Tube Number	**GRA09570**
Gradko Lab Reference	**04N1315**
Exposure Time (mins)*	**43580**
Sample ID	**Mamsik Village**

BTEX	ng on tube	ppb in air*	µgm^{-3}*
Benzene	5.4	0.2	0.6
Toluene	12.2	0.3	1.0
Ethylbenzene	<5.0	<0.1	<0.3
m/p-Xylene	10.2	0.2	0.7
o-Xylene	<5.0	<0.1	<0.3

Top 5 VOC	Estimated ng on tube	ppb in air*	µgm^{-3}*
Benzoic acid	678	7.8	38
2,6-Diphenyl-p-benzoquinone	212	2.4	25
Nonanal**	128	1.5	8.3
Acetophenone**	89	1.0	4.9
Phenylmaleic anhydride	70	0.8	5.6

	Estimated ng on tube	ppb in air*	µgm^{-3}*
Total VOC (C_6 to C_{16})	1579	18.1	113

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LABORATORY ANALYSIS REPORT

Tube Number	**GRA04440**
Gradko Lab Reference	**04N1316**
Exposure Time (mins)*	**46475**
Sample ID	**Qader Karam Village**

BTEX	**ng on tube**	**ppb in air***	**µgm^{-3}***
Benzene	<5.0	<0.2	<0.5
Toluene	<5.0	<0.1	<0.4
Ethylbenzene	<5.0	<0.1	<0.3
m/p-Xylene	<5.0	<0.1	<0.3
o-Xylene	<5.0	<0.1	<0.3

Top 5 VOC	**Estimated ng on tube**	**ppb in air***	**µgm^{-3}***
Benzoic acid	614	6.6	32
2,6-Diphenyl-p-benzoquinone	222	2.4	25
Acetophenone**	92	1.0	4.7
Benzaldehyde**	56	0.6	2.5
Phenylmaleic anhydride	53	0.6	4.0

	Estimated ng on tube	**ppb in air***	**µgm^{-3}***
Total VOC (C_6 to C_{16})	1094	11.8	73.6

Tube Number	**GRA10309**
Gradko Lab Reference	**04N1317**
Exposure Time (mins)*	**44760**
Sample ID	**MP8**

BTEX	**ng on tube**	**ppb in air***	**µgm^{-3}***
Benzene	6.8	0.2	0.7
Toluene	11.1	0.2	0.9
Ethylbenzene	<5.0	<0.1	<0.3
m/p-Xylene	7.2	0.1	0.5
o-Xylene	<5.0	<0.1	<0.3

Top 5 VOC	**Estimated ng on tube**	**ppb in air***	**µgm^{-3}***
Benzoic acid	458	5.1	25
2,6-Diphenyl-p-benzoquinone	422	4.7	49
Acetophenone**	80	0.9	4.3
Benzaldehyde**	63	0.7	3.0
Phenylmaleic anhydride	57	0.6	4.4

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LABORATORY ANALYSIS REPORT

	Estimated ng on tube	ppb in air*	µgm^{-3}*
Total VOC (C_6 to C_{16})	1462	16.3	101

Tube Number	**GRA06147**
Gradko Lab Reference	**04N1318**
Exposure Time (mins)*	**49440**
Sample ID	**Field Blank**

BTEX	ng on tube	ppb in air*	µgm^{-3}*
Benzene	<5.0	<0.1	<0.5
Toluene	<5.0	<0.1	<0.4
Ethylbenzene	<5.0	<0.1	<0.3
m/p-Xylene	<5.0	<0.1	<0.3
o-Xylene	<5.0	<0.1	<0.3

Top 5 VOC	Estimated ng on tube	ppb in air*	µgm^{-3}*
Phthalic acid, isoporpyl propyl ester	6	0.1	0.6

1 Compound detected

	Estimated ng on tube
Total VOC (C_6 to C_{16})	<5

Results are not Blank corrected.
Overall MU ±17.8% for quantitative analysis of BTEX compounds.
Estimated results as ng on tube are calculated by reference to toluene in accordance with ISO 16000-6
Results for Total VOC as µgm^{-3} are calculated by reference to alkane molecular weights.

Results greater than 1000ng (excluding Total VOC results) are outside of our UKAS accredited calibration range.

Results reported as <5ng on tube are below the reporting limit.
Reporting limits for BTEX 5ng
Estimated results reported as <5ng on tube are below the reporting limit for the non-specific standard toluene.

2,6-Diphenyl-p-benzoquinone is not present in mass spectrum libraries. It has been tentatively identified by comparison of the mass spectrum and retention times of the standard 2,5-Diphenyl-p-benzoquinone.
2,6-Diphenyl-p-benzoquinone may be an artifact due to degradation of Tenax by nitrogen dioxide.

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LABORATORY ANALYSIS REPORT

Compounds shown in italics are tentatively identified due to quality match of less than 85%

****Compounds may be an artifact due to reaction of ozone with the Tenax sorbent.**

Uptake Rates:
Benzene 0.70 ng.ppm^{-1}.min^{-1}.
Toluene 1.03 ng.ppm^{-1}.min^{-1}.
Ethylbenzene 1.46 ng.ppm^{-1}.min^{-1}.
m/p Xylene 1.46 ng.ppm^{-1}.min^{-1}.
o-Xylene 1.46 ng.ppm^{-1}.min^{-1}.
All other compounds: 2.00 ng.ppm^{-1}.min^{-1}.

Analysts Name	**Katya Paldamova**	**Date of Analysis**	**21/10/2019**
Report Checked By	**Mariella Angelova**	**Date of Report**	**31/10/2019**

Analysis has been carried out in accordance with in-house method GLM 13

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LABORATORY ANALYSIS REPORT

DETERMINATION OF SULPHUR DIOXIDE IN DIFFUSION TUBES BY ION CHROMATOGRAPHY

REPORT NUMBER N07593R

BOOKING IN REFERENCE No N07593

DESPATCH NOTE No 73775

CUSTOMER RSK Environment Llc (UAE) Attn: Andreea Stroe
PO Box 46112
Al Ghaith Tower, Suite 1202
Hamdan Bin Mohamed St.
Abu Dhabi

United Arab Emirates

DATE SAMPLES RECEIVED 10/10/2019

JOB NUMBER

Location	Sample Number	Date Exposed*	Date Finished*	Exposure Hours*	SO_4^{2-} µg/ml	µgSO_4^{2-} - Blank	SO_2 µg/m^3*	SO_2 ppb*
Kormar Gamara Village	1431383	22/08/2019	23/09/2019	764.67	0.82	0.73	11.66	4.37
Kormar Bichuck Village	1431374	20/08/2019	23/09/2019	815.50	1.77	1.69	25.25	9.47
Taza Shaher Village	1431375	20/08/2019	23/09/2019	814.83	1.55	1.46	21.87	8.20
Aweya Jalal Village	1431377	21/08/2019	23/09/2019	790.33	1.61	1.53	23.54	8.83
Shikh Hameed Village	1431376	21/08/2019	23/09/2019	792.75	1.30	1.21	18.64	6.99
Mamsik Village	1431381	24/08/2019	23/09/2019	726.33	0.85	0.77	12.92	4.84
Qadev Karam Village	1431378	22/08/2019	23/09/2019	774.58	1.08	1.00	15.69	5.88
MP8	1431380	23/08/2019	23/09/2019	746.00	1.02	0.94	15.37	5.76
Field Blank	1431382				0.08			
Laboratory Blank					0.03			

Comment: Results are blank subtracted

Overall M.U. ±9.6% **Reporting Limit** 0.09µg SO_4^{2-}

Analysed on Dionex ICS1100 ICU11

Analyst Name Sam Minns **Report Checked By** Andrew Poole

Date of Analysis 25/10/2019 **Date of Report** 29/10/2019

Analysis has been carried out in accordance with in-house method GLM1

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LABORATORY ANALYSIS REPORT

DETERMINATION OF OZONE IN DIFFUSION TUBES BY ION CHROMATOGRAPHY

REPORT NUMBER N07595R

BOOKING IN REFERENCE No N07595

DESPATCH NOTE No 73775

CUSTOMER RSK Environment Llc (UAE) Attn: Andreea Stroe
PO Box 46112
Al Ghaith Tower, Suite 1202
Hamdan Bin Mohamed St.
Abu Dhabi

United Arab Emirates

DATE SAMPLES RECEIVED 10/10/2019

JOB NUMBER

Location	Sample Number	Date Exposed*	Date Finished*	Exposure Hours*	NO_3^- µg/ml	µg/ml NO_3^- - Blank	O_3 µg/m^3*	O_3 ppb*
Kormar Gamara Village	1431389	22/08/2019	23/09/2019	764.67	0.92	0.90	68.10	34.05
Kormar Bichuck Village	1431384	20/08/2019	23/09/2019	815.50	1.43	1.41	99.90	49.95
Taza Shahaw Village	1431385	20/08/2019	23/09/2019	814.83	1.68	1.67	118.27	59.13
Aweya Jalal Village	1431387	21/08/2019	23/09/2019	790.33	1.47	1.46	106.61	53.31
Shikh Hameed Village	1431386	21/08/2019	23/09/2019	792.75	1.11	1.09	79.55	39.77
Mamsik Village	1431391	24/08/2019	23/09/2019	726.33	1.59	1.58	125.42	62.71
Qadev Karam Village	1431388	22/08/2019	23/09/2019	774.58	1.16	1.15	85.54	42.77
MP8	1431390	23/08/2019	23/09/2019	746.00	1.55	1.54	119.23	59.62
Field Blank	1431392				0.02			
Laboratory Blank					0.01			

Comment: Results are blank subtracted

Overall M.U. ±10.2% **Reporting Limit** 0.049µg/ml NO_3^-

Analysed on Dionex ICS1100 ICU10

Analyst Name Sam Minns **Report Checked By** Andrew Poole

Date of Analysis 25/10/2019 **Date of Report** 29/10/2019

Analysis has been carried out in accordance with in-house method GLM 2

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LAND USE

During the land use survey, the following features were identified:

Table A2.3 Summary of land use features

Feature	Locations	Considerations
Residential buildings	Ali Mustafa, Khor Mor Gawra, Shekh Hameed	Dust, noise, vibration from passing vehicles, maintaining full access, community road safety.
Agricultural buildings	Ali Mustafa, Khor Mor Gawra	Dust, noise, vibration from passing vehicles, maintaining full access, community road safety, animal welfare.
Commercial buildings	One location identified along route (see coordinates in subsequent table)	Dust, noise, vibration from passing vehicles, maintaining full access, community road safety.
Land use types	Along entire transportation routes	Maintaining full access, presence of grazing animals, occasional road crossings by animals, dust, noise, vibration from passing vehicles, community road safety.
Public buildings - schools	Khor Mor Gawra, Shekh Hameed	Proximity to road side, community road safety.
Infrastructure	Mamisik, Qadir Karim, Shekh Hameed	Protection of local infrastructure.
Places of worship	Awaye Jalal, Shekh Hameed	Timing of religious celebrations and ceremonies.
Graveyards	Four locations identified along the route (see coordinates in subsequent table)	Maintaining full access, awareness of funeral processions.
Water points	Various locations (including Mamisik, Taza Shar, Shekh Hameed)	Seasonal use by livestock rearers, pollution.
Security features	Junction of Qadir Karim and Kirkuk roads	Security terms and conditions.

These features are further elaborated upon in the following table:

Table A2.4 Details of land use features

Coordinates	Feature	Location / Considerations	Photograph
35.125149 44.787287	Public building - school	Khor Mor Gawra Primary School **Considerations:** Community road safety, traffic management and school schedule awareness.	
35.078286 44.854561	Public building - school	Shekh Hameed Primary School **Considerations:** Community road safety, traffic management and school schedule awareness.	
35.108735 44.820016	Place of worship - mosque	Awaye Jalal **Considerations:** Place of local significance and worship. Schedule of local religious activities to manage traffic and access.	

35.07888 44.854116	Place of worship - mosque	Shekh Hameed **Considerations:** Place of local significance and worship. Schedule of local religious activities to manage traffic and access.	
35.21463 44.780444	Residential buildings - cluster of houses	Access to one house is approximately 100 metres from the road side **Considerations:** Maintaining full access, dust, noise, vibration from passing vehicles, community road safety.	

35.20112 44.790301	Residential buildings - cluster of houses	Ali Mustafa **Considerations:** Maintaining full access, dust, noise, vibration from passing vehicles, community road safety.	 

35.20112 44.790301	Residential buildings, other - cluster of houses, access road	Ali Mustafa and access road to Bariula **Considerations:** Maintaining full access, dust, noise, vibration from passing vehicles, community road safety, deterioration of road conditions, overhead power lines crossing the road.	 
35.199504 44.793867	Residential buildings, agricultural buildings - cluster of houses and animal shelter	Ali Mustafa **Considerations:** Maintaining full access, dust, noise, vibration from passing vehicles, community and road safety, animal welfare.	

35.131106 44.861126	Residential buildings – abandoned houses	Abandoned properties on either side of the road on route to Mamisik	 

35.080837 44.852539	Residential buildings – housing units	Shekh Hameed **Considerations:** Maintaining full access, dust, noise, vibration from passing vehicles, community road safety, deterioration of road conditions, overhead power lines crossing the road.	 
35.202144 44.811118	Other – access road to residential building	**Considerations:** Maintaining full access.	

35.213547 44.850751	Residential buildings, graveyards – house under construction, graveyard	**Considerations:** Maintaining full access, dust, noise, vibration from passing vehicles, community road safety, awareness of funeral processions.	 
35.214946 44.856572	Residential buildings - cluster of houses	Aliawa **Considerations:** Maintaining full access, dust, noise, vibration from passing vehicles, community road safety.	

35.212057 44.875358	Residential buildings – housing units	**Considerations:** Maintaining full access, dust, noise, vibration from passing vehicles, community and road safety, deterioration of road conditions.	 

35.205744 44.879739	Residential buildings - housing units	Houses located on both sides of road. **Considerations:** Maintaining full access, dust, noise, vibration from passing vehicles, community and road safety, deterioration of road conditions.	
35.204555 44.879489	Residential buildings, graveyards – housing unit, graveyard	Old property and graveyard **Considerations:** Maintaining full access, dust, noise, vibration from passing vehicles, community road safety, deterioration of road conditions, awareness of funeral processions.	
35.198026 44.876224	Residential building – housing unit	House located on side of road **Considerations:** Maintaining full access, dust, noise, vibration from passing vehicles, community road safety, deterioration of road conditions.	

35.125034 44.789886	Residential buildings – cluster of houses	Khor Mor Gawra **Considerations:** Maintaining full access, dust, noise, vibration from passing vehicles, community road safety, deterioration of road conditions.	
35.114111 44.810818	Other – abandoned structures	Shekh Hameed	

35.110507 44.816425	Residential buildings – housing units	Awaye Jalal **Considerations:** Maintaining full access, dust, noise, vibration from passing vehicles, community and road safety, deterioration of road conditions, overhead electricity lines.	
35.091496 44.842766	Residential buildings – housing units	Taza Shar **Considerations:** Maintaining full access, dust, noise, vibration from passing vehicles, community and road safety, deterioration of road conditions, overhead electricity lines.	

35.212755 44.828577	Agricultural buildings, water point – animal shelters, water point	Animal shelter located near to dry water path **Considerations:** Maintaining full access, dust, noise, vibration from passing vehicles, community road safety, animal welfare, pollution.	
35.176166 44.856105	Agricultural buildings – animal shelters	Animals shelter for goats, sheep and ducks **Considerations:** Maintaining full access, dust, noise, vibration from passing vehicles, community road safety, animal welfare.	
35.124447 44.792151	Agricultural buildings – animal shelters	Khor Mor Gawra **Considerations:** Maintaining full access, dust, noise, vibration from passing vehicles, community road safety, animal welfare.	

35.10837 44.820715	Agricultural buildings – animal shelters	Close to Taza Shar **Considerations:** Maintaining full access, dust, noise, vibration from passing vehicles, community road safety, animal welfare.	
35.157516 44.830778	Commercial buildings – collection of small shops	**Considerations:** Dust, noise, vibration from passing vehicles, maintaining full access, community road safety.	

35.203436 44.879185	Agricultural buildings – animal shelters	**Considerations:** Maintaining full access, dust, noise, vibration from passing vehicles, community road safety, animal welfare.	

35.156096 44.832457	Land use – grazing land	Grazing land on route to Mamisik **Considerations:** Presence of grazing animals, occasional road crossings by animals.	 

35.212282 44.783494	Land use – grazing land	Grazing land on either sides of the road **Considerations:** Presence of grazing animals, occasional road crossings by animals.	 

35.117486 44.806755	Land use – agricultural land	Land used for wheat farming on route to Shekh Hameed **Considerations:** Maintaining full access, dust, noise, vibration from passing vehicles, community road safety.	

35.075073 44.857162	Land use – agricultural land	Land used for wheat farming on route to Shekh Hameed **Considerations:** Maintaining full access, dust, noise, vibration from passing vehicles, community road safety.	 

35.206295 44.788023	Land use – grazing land	Grazing land on either sides of the road **Considerations:** Presence of grazing animals, occasional road crossings by animals.	 

35.14863 44.844631	Land use – agricultural land	Land used for wheat farming **Considerations:** Maintaining full access.	 

35.148732 44.845396	Land use, water point – agricultural land, dry water path	Land used for wheat farming and dry water path on route to Mamisik **Considerations:** Maintaining full access, dust, noise, vibration from passing vehicles, community road safety, pollution.	 

35.143204 44.854907	Land use – grazing land	**Considerations:** Presence of grazing animals, occasional road crossings by animals.	 
35.141508 44.857615	Land use – agricultural land	Land used for wheat farming **Considerations:** Maintaining full access.	

35.12771 44.859544	Land use – agricultural land	Land used for wheat farming on route to Mamisik **Considerations:** Maintaining full access.	
35.117857 44.865078	Land use – agricultural land	Land used for wheat farming on route to Mamisik **Considerations:** Maintaining full access.	
35.104041 44.827317	Land use – agricultural land	Land used for wheat farming **Considerations:** Maintaining full access.	

35.097517 44.835701	Land use – agricultural land	Land used for wheat farming **Considerations:** Maintaining full access.	 

35.20112 44.790301	Graveyard	Graveyard located opposite Ali Mustafa **Considerations:** Maintaining full access, dust, noise, vibration from passing vehicles, community road safety, deterioration in road conditions, awareness of funeral processions.	
35.124582 44.791646	Graveyard	**Considerations:** Maintaining full access, dust, noise, vibration from passing vehicles, community road safety, deterioration in road conditions, awareness of funeral processions.	

35.083803 44.850719	Graveyard	Graveyard on route to Shekh Hameed **Considerations:** Maintaining full access, dust, noise, vibration from passing vehicles, community road safety, deterioration in road conditions, awareness of funeral processions.	 
35.210752 44.784875	Other - access road to agricultural land	**Considerations:** Maintaining full access.	

35.086511 44.847453	Land use – agricultural land	**Considerations:** Maintaining full access.	 

35.201549 44.804078	Land use, place of worship – grazing land and mosque	**Considerations:** Presence of grazing animals, occasional road crossings by animals. Place of local significance and worship, schedule of local religious activities to manage traffic and access.	 

44.817747 433.84024	Land use – grazing land	**Considerations:** Presence of grazing animals, occasional road crossings by animals.	 

35.212061 44.841182	Land use – grazing land (and access road to grazing land)	**Considerations:** Presence of grazing animals, occasional road crossings by animals, maintaining access.	

35.193643 44.872109	Land use – agricultural and grazing land	**Considerations:** Maintaining full access, dust, noise, vibration from passing vehicles, community road safety, animal welfare.	 

35.166975 44.842947	Land use – grazing land	**Considerations:** Presence of grazing animals, occasional road crossings by animals.	 

35.158012 44.826355	Land use – grazing land	**Considerations:** Presence of grazing animals, occasional road crossings by animals.	 
35.132835 44.820536	Land use – grazing land	**Considerations:** Presence of grazing animals, occasional road crossings by animals.	

35.123721 44.794543	Land use – grazing land	**Considerations:** Presence of grazing animals, occasional road crossings by animals.	 
35.13687 44.861373	Water source, infrastructure – dry water path and bridge	On route to Mamisik **Considerations:** seasonal water use by livestock rearers, protection of local infrastructure.	

35.092737 44.841349	Water source – dry water path	On route to Taza Shar **Considerations:** seasonal water use by livestock rearers.	

35.087597 44.724987	Water point, land use – dry water path, grazing land	**Considerations:** seasonal water use by livestock rearers, presence of grazing animals. occasional road crossings by animals.	

35.155575 44.833112	Water point – dry water path	On route to Mamisik **Considerations:** seasonal water use by livestock rearers.	
35.084317 44.7117	Land use – grazing land	**Considerations:** Presence of grazing animals, occasional road crossings by animals.	

35.125689 44.813932	Land use, other – grazing land, access road	**Considerations:** Presence of grazing animals, occasional road crossings by animals, maintaining access, deterioration of road conditions.	 

35.1229 44.783429	Land use – agricultural land	**Considerations:** Maintaining full access.	

35.213117 44.831321	Water source, infrastructure – dry water path and bridge	**Considerations:** seasonal water use by livestock rearers, protection of local infrastructure.	 

35.214463 44.854687	Water source, infrastructure – dry water path and bridge	**Considerations:** seasonal water use by livestock rearers, protection of local infrastructure.	 

35.174043 44.852911	Water source – dry water path	**Considerations:** seasonal water use by livestock rearers.	 

35.163321 44.837084	Water source – dry water path	**Considerations:** seasonal water use by livestock rearers.	
35.124356 44.785665	Water source – dry water path	**Considerations:** seasonal water use by livestock rearers.	 

35.214993 44.779476	Security feature – military checkpoint	Junction of Qadir Karim and Kirkuk roads **Considerations:** security terms and conditions, traffic and congestion.	
35.207747 44.880145	Security feature, other – military checkpoint, access road	Checkpoint and access road to Qadir Karim **Considerations:** security terms and conditions, traffic and congestion.	

35.105456 44.82487	Security feature, water point - military checkpoint, water path	**Considerations:** security terms and conditions, traffic and congestion.	

35.200722 44.878919	Security feature – military checkpoint	Qadir Karim **Considerations:** security terms and conditions, traffic and congestion.	 

35.203436 44.879185	Water point, infrastructure – river, bridge	River crossing on route to existing facility at Qadir Karim **Considerations:** seasonal use by livestock rearers, protection of local infrastructure.	
35.150811 44.836649	Infrastructure - bridge	On route to Mamisik **Considerations:** protection of local infrastructure	

35.150045 44.838452	Infrastructure, land use - bridge, grazing land	On route to Mamisik **Considerations:** protection of local infrastructure, presence of grazing animals, occasional road crossings by animals.	 

35.095857 44.837719	Infrastructure, water point – bridge, dry water path	On route to Shekh Hameed **Considerations:** protection of local infrastructure, seasonal use by livestock rearers	
35.191113 44.871295	Water point, land use river, grazing land	**Considerations:** Presence of grazing animals, occasional road crossings by animals, seasonal use by livestock rearers, pollution.	

35.181023 44.864196	Security feature - police camp (OFPF)	**Considerations:** security terms and conditions.	
35.172402 44.850395	Security feature - police base (OFPF)	**Considerations:** security terms and conditions.	

35.15272 44.821091	Security feature - former checkpoint	**Considerations:** security terms and conditions.	

35.125156 44.811679	Security feature – security tower	**Considerations:** security terms and conditions.	 

35.122324 44.800199	Security feature - military base	**Considerations:** security terms and conditions.	 

35.120763 44.802169	Security feature - military base	On route to Shekh Hameed **Considerations:** security terms and conditions.	
35.12338 44.861878	Security feature - military camp	On route to Mamisik **Considerations:** security terms and conditions.	

35.09226 44.766788	Security feature - military base	**Considerations:** security terms and conditions.	
35.088912 44.755051	Land use – grazing land	**Considerations:** Presence of grazing animals, occasional road crossings by animals.	

35.121915 44.800313	Other – former concrete patch plant	Khor Mor Bichuk	

TRAFFIC

Figure A2.1 Percentage of vehicle types (location one)

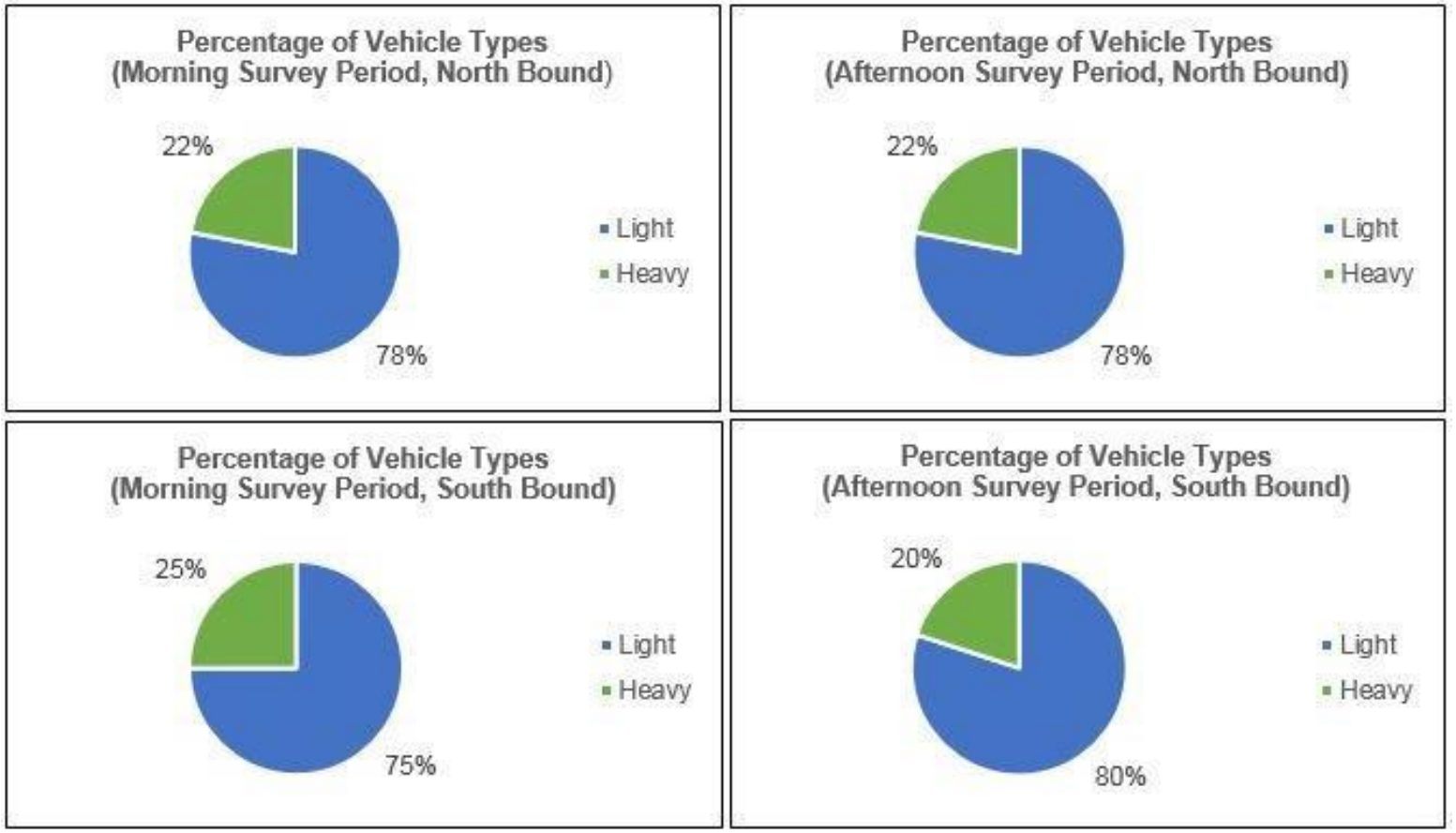


Figure A2.2 Percentage of vehicle types (location two)

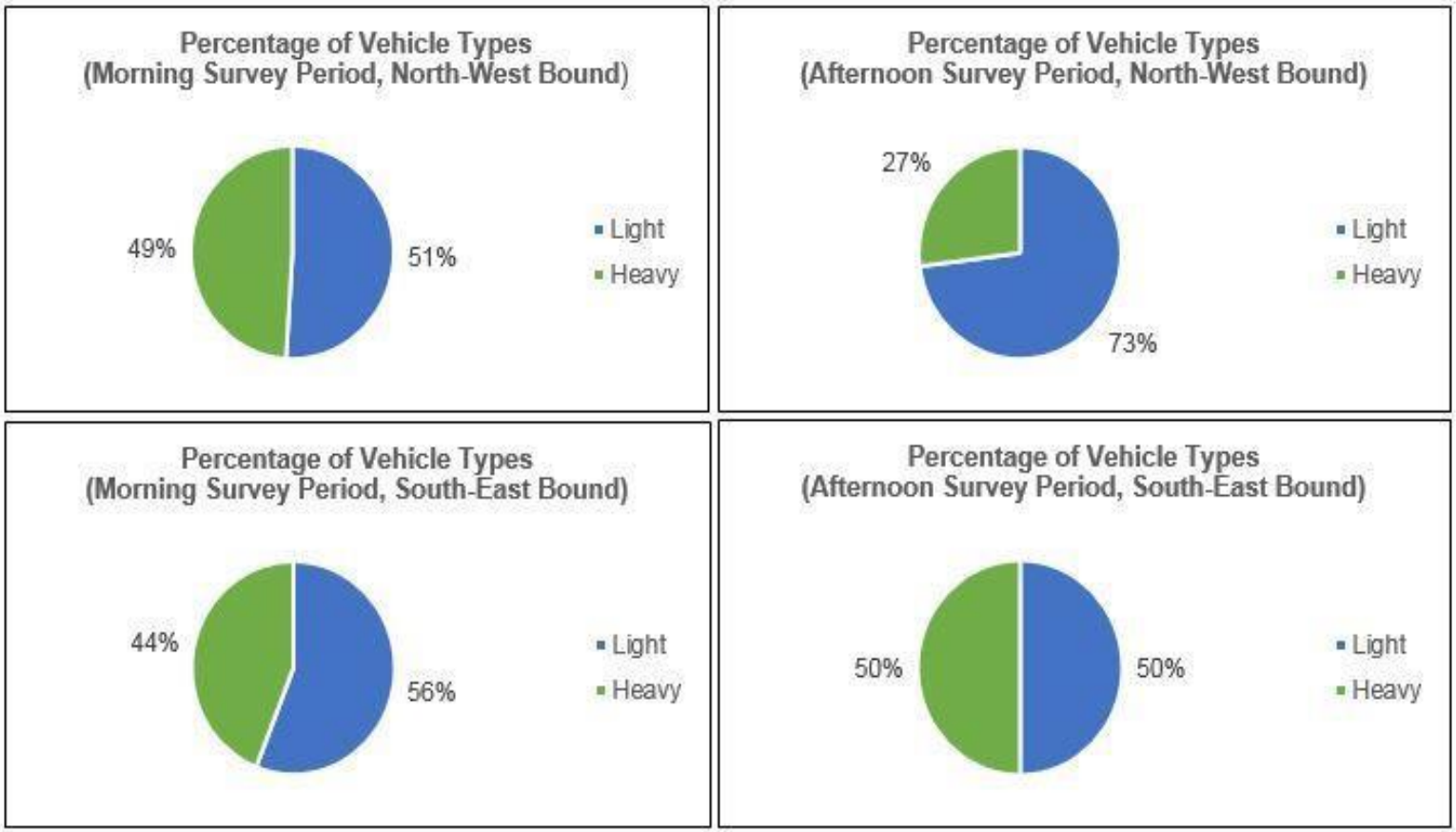


Figure A2.3 Percentage of vehicle types (location three)

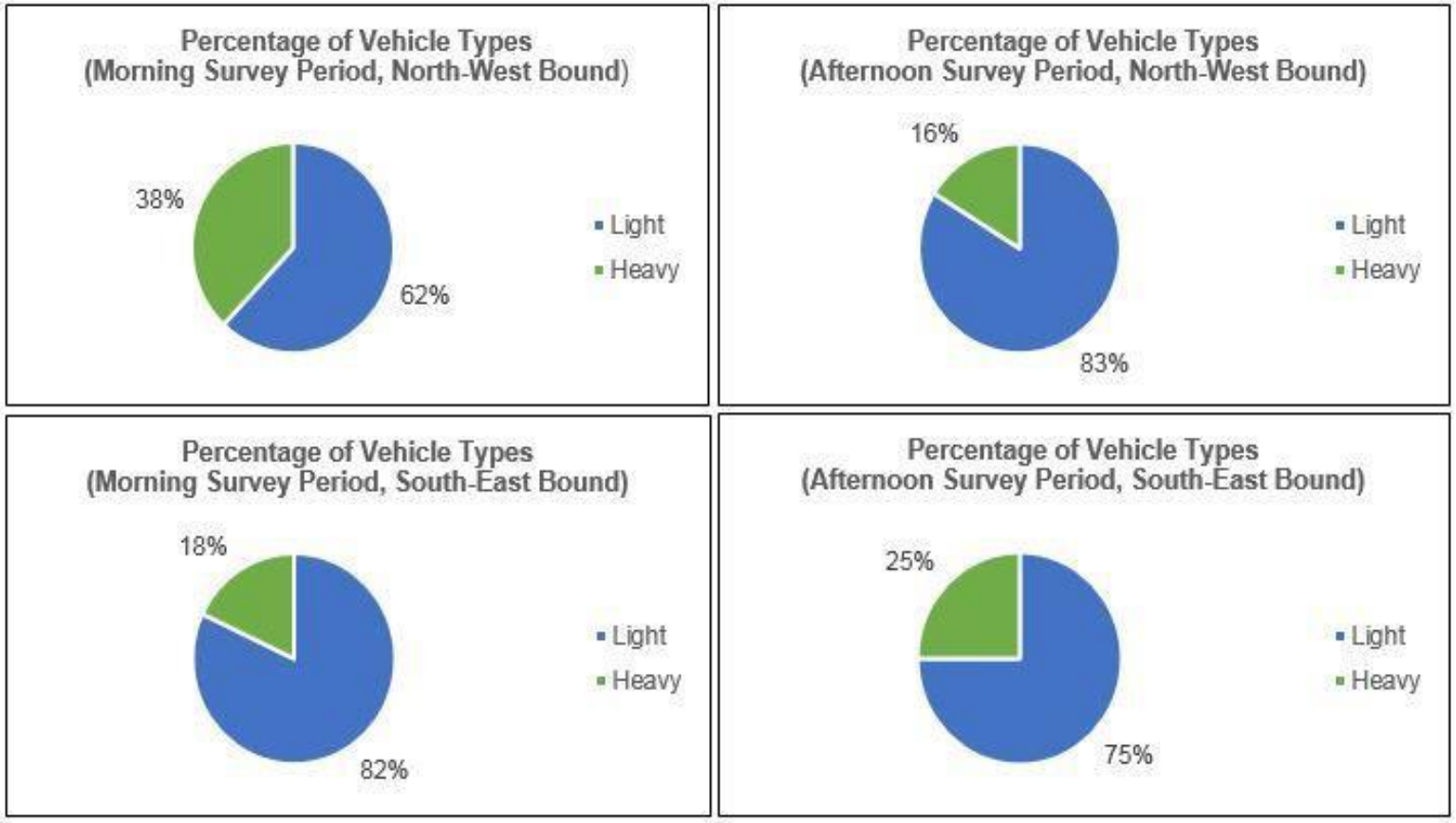


Figure A2.4 Percentage of vehicle types (location four)

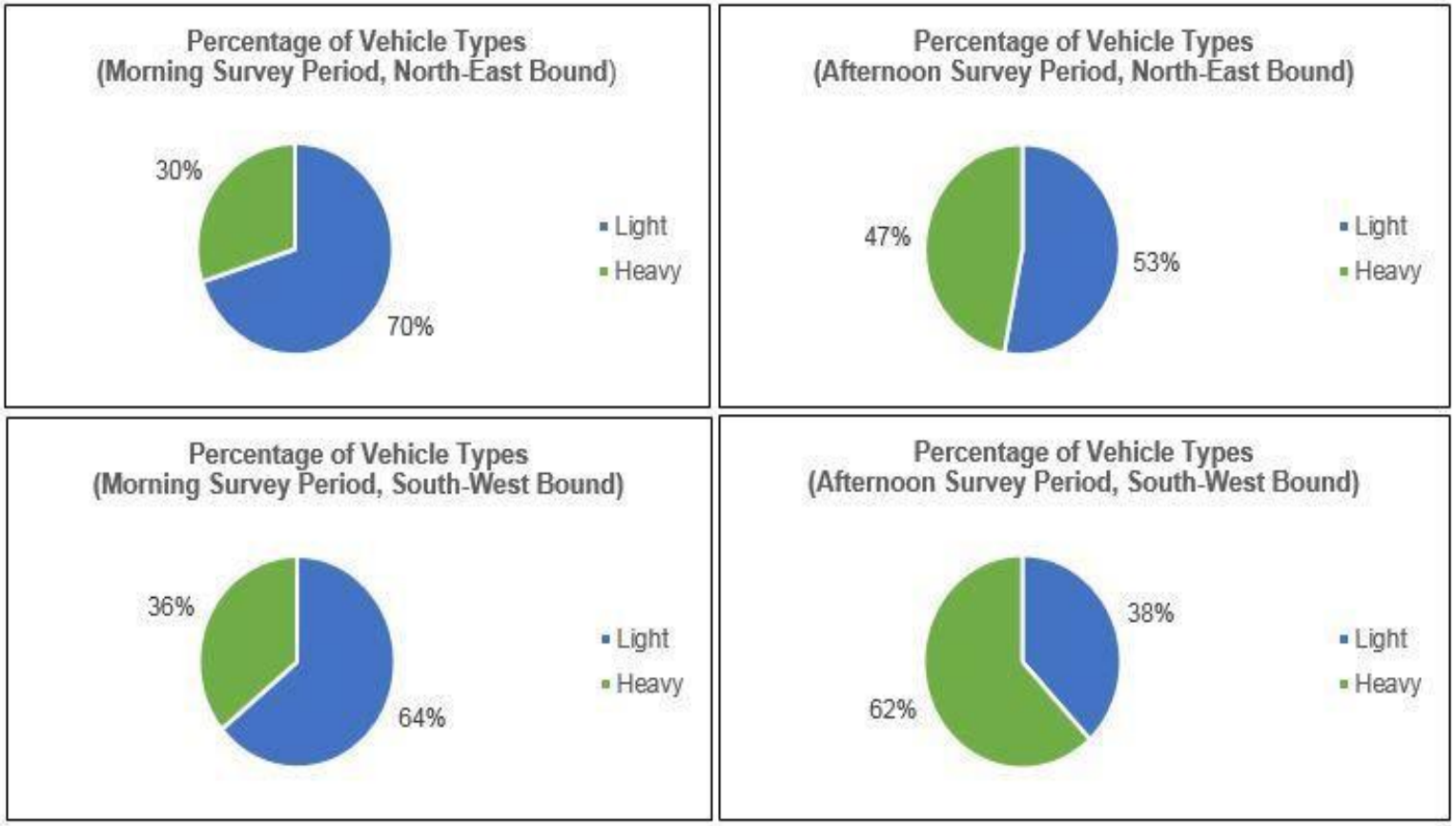


Figure A2.5 Percentage of vehicle types (location five)

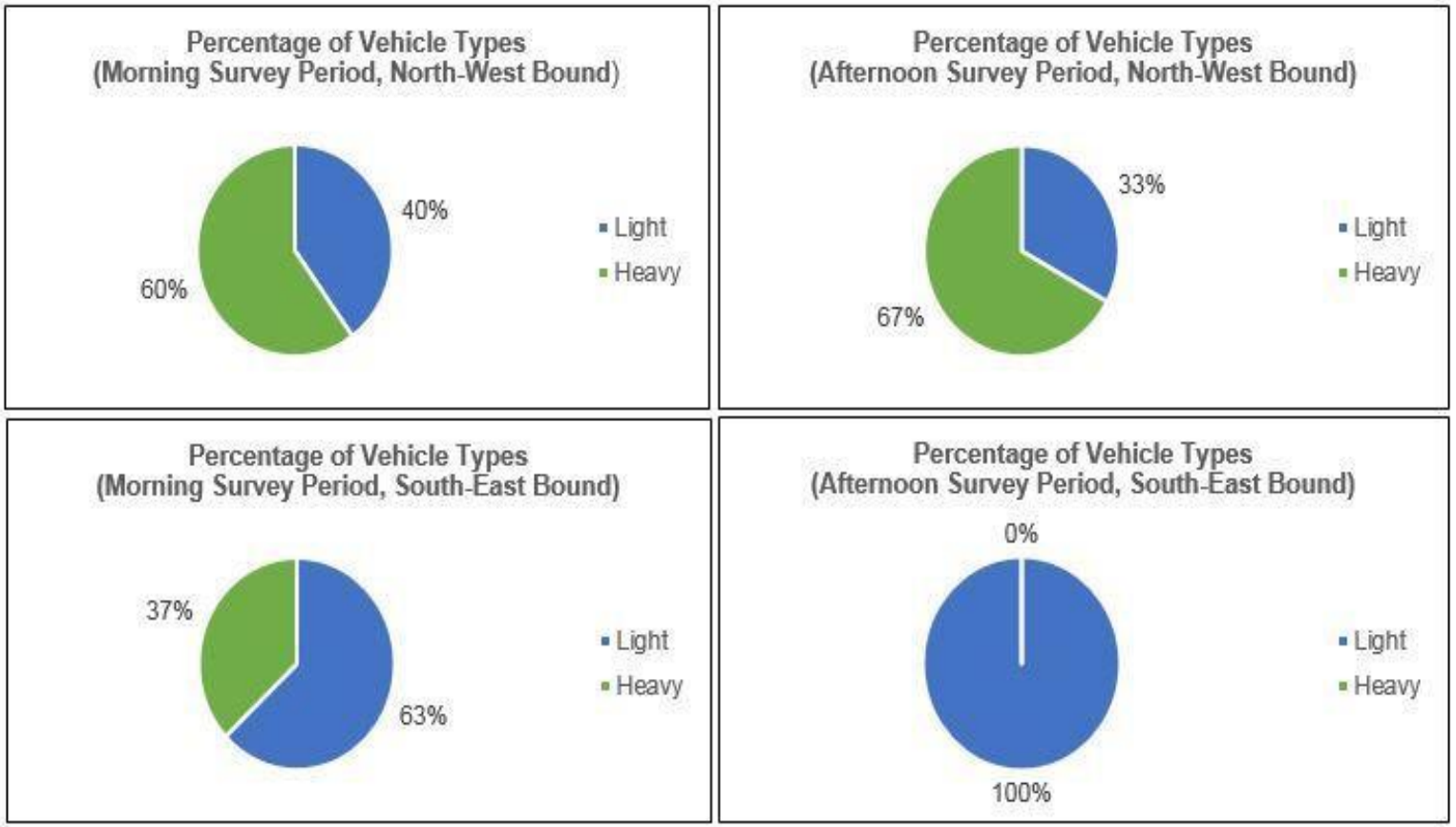
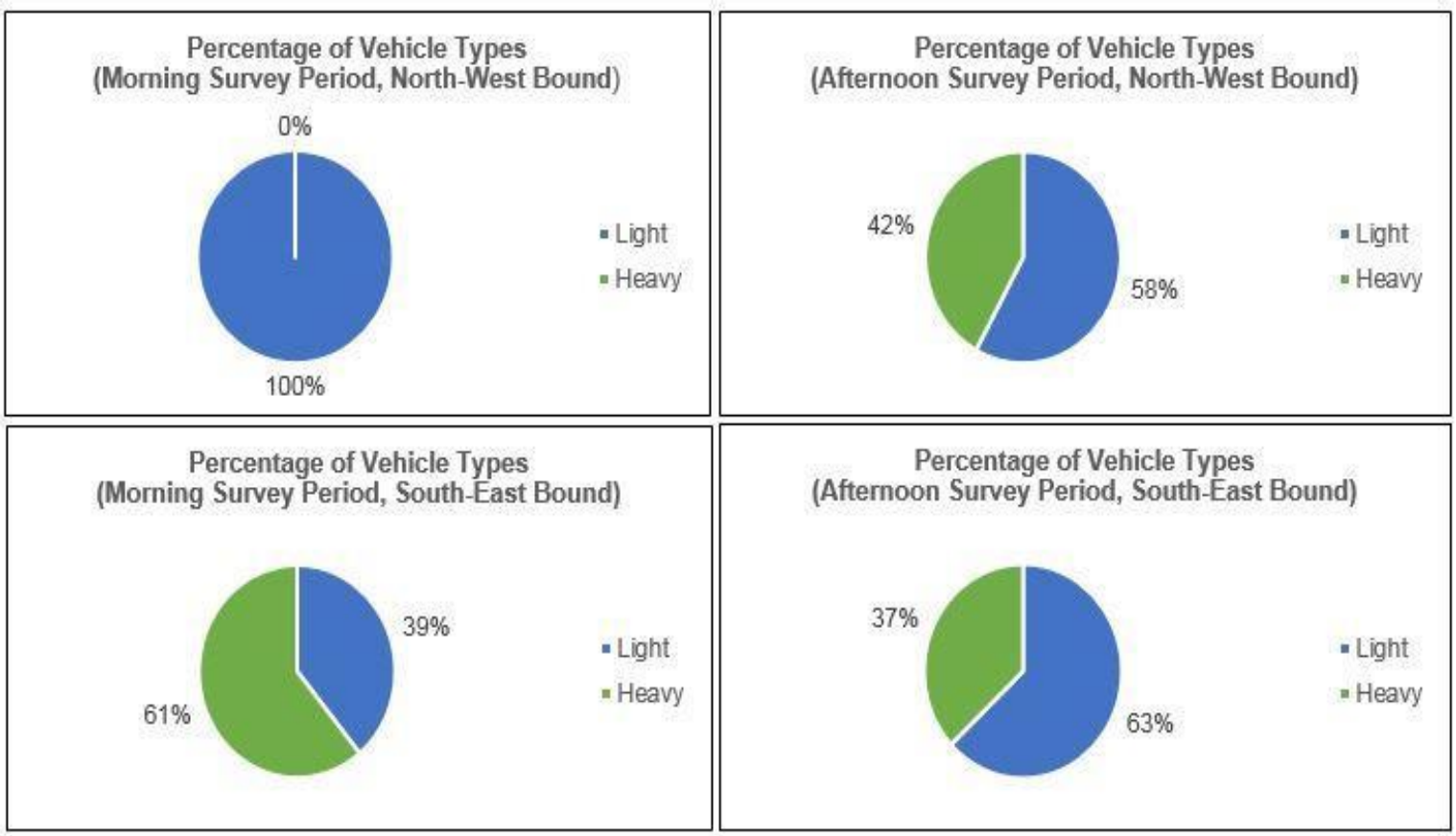


Figure A2.6 Percentage of vehicle types (location six)



ARCHAEOLOGY

ARCHAEOLOGICAL SITE FORM

1. Site Modern Name (local name): Sarcham Tepe

2. Site Ancient Name: _____

3. Governorate: Sulaymaniyah

4. District: Chemchemal **Sub-district:** Qadir Karim

5. GPS Coordinates: 44.839762, 35.126667

6. Location Description:

Sarcham Tepe is located near the archaeology investigation site of the flowline (i.e. FL-Arch.7). The site's area is a hill with rectangle shape, its dimensions are 20x30 metres. The height to the site is approximately five metres higher than the surrounding flat area. The nearest PAC is Khor Mor Gawra, which is located to the north-west of this site. There is an unpaved road connecting to the site. There are wheat and barley farms nearby. There are signs of grazing in the area around the site. The site (the hill) is not protected by fence or security guards.

Historic Temporal Period(s):

☐ Sumerian (Early Dynastic), Akkadian and New Sumerian periods (3rd Dynastic of Ur) 3000-2000 BC

☐ Old Babylonian period (including Isin-Larsa period) 2025-1595 BC

☐ Medium Babylonian period (Kassite Dynastic) 1595 -1162 BC

☐ New Babylonian Period (including Land sea Dynastic, Chaldean Dynastic) 1124-539 BC

☐ Achaemenid period 539-331 BC

☐ Seleucid period 331-126 BC

☐ Parthian period 126 BC-227 AD

☐ Sassanid period 226-637 AD

☐ Islamic periods 637-1258 AD

☐ Ottoman period 1500-1918 AD

Has the site been excavated? ☐ Yes ☐ No

Has the site been looted? ☐ Yes ☐ No

Is the site threatened? ☐ Yes ☐ No

Figure A2.7 Sarcham Tepe viewpoint one

Figure A2.8 Sarcham Tepe viewpoint two

Figure A2.9 Sarcham Tepe viewpoint three

APPENDIX 3
PROJECT STANDARDS

Soil standards

Table A3.1: Summary of soil quality standards (mg/kg)

Metals	Australian ecological investigation levels	Australian health investigation levels				Dutch intervention value	Selected Project standard
		A	B	C	D		
Arsenic (total)	20	100	400	200	500	-	**20**
Beryllium	-	20	80	40	100	-	**20**
Cadmium	3	20	80	40	100	-	**3**
Chromium (III)	400	12%	48%	24%	60%	-	**400/12%**
Chromium (VI)	1	100	400	200	500	-	**1**
Cobalt	50	100	400	200	500	-	**50**
Copper	100	1000	4000	2000	5000	-	**100**
Lead	600	300	1200	600	1500	530	**300**
Manganese	500	1500	6000	3000	7500	-	**500**
Methyl Mercury	-	10	40	20	50	-	**10**
Mercury (inorganic)	1	15	60	30	75	-	**1**
Nickel	60	600	2400	600	3000	-	**60**
Zinc	200	7000	28000	14000	35000	720	**200**
Organics							
Aldrin + Dieldrin	-	10	40	20	50	-	**10**
Chlordane	0.5	50	200	100	250	-	**0.5**
DDT+DDD+DDE	1	200	800	400	1000	-	**1**
Heptachlor	0.5	10	40	20	50	-	**0.5**
Polycyclic aromatic Hydrocarbons (PAHs)	-	20	80	40	100	-	**20**
Benzo(a)pyrene	1	1	4	2	5	-	**1**
Phenol	-	8500	34000	17000	42500	-	**8500**
PCBs (Total)	1	10	40	20	50	-	**1**
Petroleum Hydrocarbon Components (constituents): >C16 – C35 Aromatics	-	90	360	180	450	5000 for C10-C40 (mineral oil)	**90**
>C16-C35 Aliphatics	-	5600	22400	11200	28000	-	**5600**
>C35 Aliphatics	-	56000	224000	112000	280000	-	**56000**

Metals	Australian ecological investigation levels	Australian health investigation levels				Dutch intervention value	Selected Project standard
		A	B	C	D		
Other							
Boron	-	3000	12000	6000	15000	-	**3000**
Cyanides (Complexed)	50	500	2000	1000	2500	-	**50**
Cyanides (free)	10	250	1000	500	1250	-	**10**

Water standards

Table A3.2: Summary of Iraqi water quality standards and wastewater discharge standards

Parameters	Limits for receiving water body (mg/L)				Discharge limits (mg/L)		Selected Project standard
	A-1: Rivers and their tributaries and branches	A-2: Streams, brooks and canals and their original and secondary branches	A-3: Lakes, basins and others of water compounds	A-4: Springs, wells and groundwater	B-1: Remaining waters discharged to the water source	B-2: Remaining waters discharged to the public sewages	
Colour	Normal	Normal	Normal	Normal	-	-	**Normal**
Temperature	-	-	-	-	35°C	45°C	**-**
Suspended Materials	-	-	-	-	60	750	
Hydrogen Ion Concentration (pH)	6.5 to 8.5	8.5	8.5		6 to 9.5	6 to 9.5	**6.5 to 8.5**
Dissolved Oxygen	More than 5	More than 5	More than 5		-	-	**More than 5**
BOD_5	5	5	3		40	1,000	**5**
COD ($Cr_2 O_7$ method)	-	-	-	-	100	-	**-**
Cyanide	0.02	0.02	0.02	0.02	0.05	0.5	**0.02**
Fluorine	0.2 or more according to what exist naturally in the source				5.0	10	**0.2**
Free Chlorine	Trace	Trace	Trace	Trace	Trace	100	**Trace**

Parameters	Limits for receiving water body (mg/L)				Discharge limits (mg/L)		Selected Project standard
	A-1: Rivers and their tributaries and branches	A-2: Streams, brooks and canals and their original and secondary branches	A-3: Lakes, basins and others of water compounds	A-4: Springs, wells and groundwater	B-1: Remaining waters discharged to the water source	B-2: Remaining waters discharged to the public sewages	
Chlorides	200	200	200	200	If the ratio of the quantity of waters discharged to the quantity of the water source is 1:1,000 or less, then it is allowed to increase the concentration in the source by 1% of the normal concentration in the source before discharging. If the ratio of the quantity of the discharged waters to the quantity of the sources waters is more than 1:1,000, then the concentration of chlorides in the discharged waters must not exceed 600 mg/L. If the concentration of fluorides in the source waters is less than 200 mg/L, then each case is considered separately by the side responsible for applying the regulation.		**200**
	Or more according to what is normal in the source.						
Phenol	0.005	0.005	0.005	0.005	0.01- 0.05	5 - 10	**0.005**
Sulphates	200	200	200	200	If the ratio of the quantity of the discharged waters to the quantity of the source waters 1:1,000 or less, then it is allowed to discharge waters to the source in concentration and quantities leading to the increase in the concentration of sulphates in the source by 1% of the normal concentration in the source before discharge. If the ratio of the quantity of the discharged		**200**
	Or more according to what is normal to the source.						

Parameters	Limits for receiving water body (mg/L)				Discharge limits (mg/L)		Selected Project standard
	A-1: Rivers and their tributaries and branches	A-2: Streams, brooks and canals and their original and secondary branches	A-3: Lakes, basins and others of water compounds	A-4: Springs, wells and groundwater	B-1: Remaining waters discharged to the water source	B-2: Remaining waters discharged to the public sewages	
					waters to the quantity of the source waters is more than 1:1,000, then the concentration of sulphates in the discharged waters must not exceed 400 mg/L. If the concentration of sulphates in the source waters is less than 200 mg/L, then each case is considered separately by the party responsible for applying the regulations.		
Nitrates	15	15	15	50	50	-	**15**
Phosphates	0.4	0.4	0.1	0.4	3	-	**0.04**
Ammonium	1	1	1	-	-	-	**1**
DDT insecticides	0	0	0	0	0	-	**0**
Lead	0.05	0.05	0.05	0.05	0.1	0.1	**0.05**
Arsenic	0.05	0.05	0.05	0.05	0.05	0.05	**0.05**
Copper	0.05	0.05	0.05	0.01	0.2	-	**0.05**
Nickel	0.1	0.1	0.1	0.1	0.2	0.1	**0.1**
Selenium	0.1	0.1	0.1	0.1	0.05	-	**0.1**
Mercury	0.001	0.001	0.001	0.001	0.005	0.001	**0.001**
Cadmium	0.005	0.005	0.005	0.005	0.01	0.01	**0.005**
Zinc	0.5	0.5	0.5	0.1	2	0.1	**0.5**

Parameters	Limits for receiving water body (mg/L)				Discharge limits (mg/L)		Selected Project standard
	A-1: Rivers and their tributaries and branches	**A-2: Streams, brooks and canals and their original and secondary branches**	**A-3: Lakes, basins and others of water compounds**	**A-4: Springs, wells and groundwater**	**B-1: Remaining waters discharged to the water source**	**B-2: Remaining waters discharged to the public sewages**	
Chromium	0.05	0.05	0.05	0.05	0.1	0.1	**0.05**
Aluminium	0.1	0.1	0.5	-	5	20	**0.1**
Barium	1	1	1	1	4	0.1	**1**
Boron	1	1	1	1	1	1	**1**
Cobalt	0.05	0.05	0.05	0.05	0.5	0.5	**0.05**
Iron	0.3	0.3	0.3	0.5	2	15	**0.3**
Manganese	0.1	0.1	0.1	0.1	0.5	-	**0.2**
Silver	0.01	0.01	0.01	0.01	0.05	0.1	**0.02**
Total Hydrocarbons and their Derivatives	-	-	-	-	It is allowed to discharge the total of hydrocarbon materials to the water sources A-1 and A-2 according to the concentrations and limitations shown in the table, provided that these concentrations are measured before being mixed with the waters of the water source and it is not possible to discharge any hydrocarbon materials to the water sources A-3 and A-4. First: 10 mg/L and according to the following limitations. The ratio of the quantity of the discharged waters to the quantity of the water source is not less than 1:1,000.		**-**
		Total hydrocarbons and their derivatives	-	-			

Parameters	Limits for receiving water body (mg/L)				Discharge limits (mg/L)		Selected Project standard
	A-1: Rivers and their tributaries and branches	A-2: Streams, brooks and canals and their original and secondary branches	A-3: Lakes, basins and others of water compounds	A-4: Springs, wells and groundwater	B-1: Remaining waters discharged to the water source	B-2: Remaining waters discharged to the public sewages	
					The condition of the river should be in continuous flow. Second: 5 mg/L according to the following limitations. The ratio of the quantity of discharged waters to the quantity of the source waters is not less than 1: 500 or less. The condition of the river should be in continuous flow. Third: 3 mg/L and according to the following limitations. The ratio of the quantity of discharged waters to the quantity of source waters is not less than 1: 300. The condition of the river should be in continuous flow.		
Sulphides	-	-	-	-	-	3	-
Ammonia	-	-	-	-	-	10	-
Ammonia gas	-	-	-	-	-	6	-
Sulphur Dioxide	-	-	-	-	-	7	-
Petroleum Alcohol	-	-	-	-		Not permitted	-

Parameters	Limits for receiving water body (mg/L)				Discharge limits (mg/L)		Selected Project standard
	A-1: Rivers and their tributaries and branches	A-2: Streams, brooks and canals and their original and secondary branches	A-3: Lakes, basins and others of water compounds	A-4: Springs, wells and groundwater	B-1: Remaining waters discharged to the water source	B-2: Remaining waters discharged to the public sewages	
Calcium Carbide	-	-	-	-	-	Not permitted	-
Organic Solvents	-	-	-	-	-	Not permitted	-
Benzene	-	-	-	-	-	0.5	-
Chlorobenzene	-	-	-	-	-	0.1	-
TNT	-	-	-	-	-	0.5	-
Bromine	-	-	-	-	-	1-3	-

Table A3.3: Drinking water standards (Iraqi Standard Specification number 417 of 2001)

Characteristic	Maximum allowable limit (mg/L)
Natural characteristics	
Colour	10 units
Turbidity (NTU)	5 units
Taste	Accepted
Smell	Accepted
pH value	6.5 – 8.5
Chemical characteristics	
Arsenic	0.01
Cadmium	0.003
Chrome	0.05
Cyanide	0.02
Fluoride	1.0
Lead	0.01
Mercury	0.001
Nitrate	50
Nitrite	3
Selenium	0.01
Aluminium	0.2
Chloride	250
Copper	1.0
Total hardness (as $CaCO_3$)	500
Iron	0.3
Manganese	0.1
Sodium	200
TDS	1,000
Sulphate	250
Zinc	3.0
Calcium	50
Magnesium	50
Barium	0.7
Nickel	0.02
Dissolved hydrocarbons	0.01
Carbon-chloroform extracted	0.3
Industrial detergents	0.3
Phenolic compounds	0.002

Characteristic	Maximum allowable limit (mg/L)
Biological characteristics	
Coliform (100 ml after 24hr at 35°C)	<1.1
E. Coli (100 ml after 24hr at 44°C)	<1.1
Escherichia coli (250 ml after 24hr at 35°C)	Zero
Plate count (1 ml after 24hr at 35°C)	Zero
Pesticides	
Organic chloro (chlorinated)	0.07
Organic phosphorus	0.000005
Multi chloro-diphenolic	0.001
Radiation	
Total Alfa radiation	0.1
Total Beta radiation	1

Noise standards

Table A3.4: Maximum noise level limits

Receptor	Time period	One Hour L_{Aeq} (dBA)			
		KRG	GoI	IFC	Selected Project standard
Residential	07:00 – 18:00	50-60	55	55	**50-60**
	18:00 – 22:00	45-55			**45-55**
	22:00 – 07:00	40-50	45	45	**40-50**
Commercial	07:00 – 18:00	55-65	70	70	**55-65**
	18:00 – 22:00	55-60			**55-60**
	22:00 – 07:00	45-55	70	70	**45-55**
Industrial	07:00 – 18:00	60-70	70	70	**60-70**
	18:00 – 22:00	55-65			**55-65**
	22:00 – 07:00	50-60	70	70	**50-60**

NOTE: IFC guideline values are for noise levels measured out of doors. Daytime and night time periods are defined as 07:00-22:00 and 22:00-07:00 respectively in the IFC guideline. The stricter time period comes from KRG legislation and shall therefore be adopted by the Project.

Table A3.5: Acceptable noise level limits for construction activities

Receptor	Time period	One Hour L_{Aeq} (dBA)			
		KRG	GoI	IFC	Selected Project standard
Residential	07:00 – 19:00	75	55	55	**55**
	19:00 – 07:00	60	45	45	**45**
Commercial	07:00 – 19:00	80	70	70	**70**
	19:00 – 07:00	65	70	70	**65**
Industrial	07:00 – 19:00	85	70	70	**70**
	19:00 – 07:00	70	70	70	**70**

NOTE: IFC guideline values are for noise levels measured out of doors· Daytime and night time periods are defined as 07:00-22:00 and 22:00-07:00 respectively in the IFC guideline. The stricter time period comes from KRG legislation and shall therefore be adopted by the Project.

Air quality standards

Table A3.6 Ambient air quality standards

Parameter	Averaging period	Unit	KRG	GoI/IMO	IFC	Selected Project standard
Sulphur Dioxide (SO2)	1 year	µg/m³	20 – 60	47 (0.018 ppm)		**20 – 47**
	24 hours	µg/m³	125 – 150	105 (0.04 ppm)	20	**20**[2]
	3 hours	µg/m³	350			**262**[3]
	1 hour	µg/m³		262 (0.1 ppm)		**262 (0.1 ppm)**
	10 minutes	µg/m³			500	**500**
Carbon Monoxide (CO)	8 hours	ppm	10	9-10		**9-10**
	1 hour	ppm	30	35		**30**
Nitrous Dioxide (NO2)	1 year	µg/m³	100	75 (0.04 ppm)	40	**40**[2]
	24 hours	µg/m³	150	94 (0.05 ppm)		**94**
	1 hour	µg/m³	200 – 400		200	**200**
Suspended particles (such as black smoke)	1 year	µg/m³	60			**60**
	24 hours	µg/m³	100 – 150			**100 – 150**
Total suspended particles	1 year	µg/m³	90	150		**90**
	24 hours	µg/m³	230	350		**230**
Particulate Matter (PM10)	1 year	µg/m³	50		20	**20**[2]
	24 hours	µg/m³	150	150	50	**50**[2]
Particulate Matter (PM2.5)	1 year	µg/m³	15	15	10	**10**[2]
	24 hours	µg/m³	35	35	25	**25**[2]
Falling dust (residential zone)	30 days	t/km²/month		10		**10**
Falling dust (industrial zone)	30 days	t/km²/month		20		**20**
Hydrocarbons	3 hours	ppm		0.24		**0.24**
Benzene	1 year	mg/m³		0.003		**0.003**

[1] Where necessary, the values as per the standard are specified with relevant units in brackets. Units were converted between ppm and µg/m³ at 25°C and pressure of 1 atm.

[2] In this case, the legislated standard is significantly less stringent than those provided by the IFC. As outlined in the IFC's Performance Standard 3 (Resources Efficiency and Pollution Prevention), the EPC contractor will need to evaluate whether the legislated standards are appropriate in view of specific project circumstances and provide a full and detailed justification for any proposed derogations through the Project's environmental and social risks and impacts identification and assessment process.

[3] The GoI/IMO ambient air quality standard for SO2 at an averaging period of 1 hour is stricter than the KRG's standard at an averaging period of 3 hours. It is standard practice for ambient air quality standards to be less strict at shorter averaging periods. Therefore, the GoI/IMO standard for SO2 at an averaging period of 1 hour is set as the Project standard for both 1 hour and 3 hours.

Table A3.7 Maximum allowable emissions limits of air pollutants emitted from stationary sources

Parameter	Sources	Maximum allowable emission limits (mg/Nm^3)[1]			
		KRG	GoI	IFC	Selected Project standard
Visible emissions	Combustion sources		250		**250**
Opacity	All sources		20%		**20%**
Carbon Monoxide (CO)	All sources		500	100	**100**[4]
Nitrogen Oxide (NOx)	All sources	Varies depending on combustion source		150	**150**
Sulphur Dioxide (SO2)	All sources		500	75	**75**[4]
Total Suspended Particles (TSP)	Combustion sources		250		**250**
Benzene	All sources		5		**5**
Mercury and its compound (Hg)	All sources		0.5		**0.5**
Hydrogen Sulphide (H2S)	All sources		5		**5**
Total Volatile Organic Compounds (VOC)	All sources		20	100	**20**
Particulate Matter (PM10)	All sources			10	**10**

[1] All units are in milligram per normal cubic metres (mg/Nm^3) where normal cubic meters are measured at 25^{o}C and 1 atm.

[2] Relevant combustion sources as defined by Law no. 27, 2009 include incinerators and boilers.

[3] The limit of "visible emissions" does not apply to emissions of water vapour and a reasonable period for cold start-up, shutdown or emergency operation.

[4] In this case, the legislated standard is significantly less stringent than those provided by the IFC. As outlined in the IFC's Performance Standard 3 (Resources Efficiency and Pollution Prevention), the EPC contractor will need to evaluate whether the legislated standards are appropriate in view of specific project circumstances and provide a full and detailed justification for any proposed derogations through the Project's environmental and social risks and impacts identification and assessment process.

Table A3.8 Maximum allowable emissions limits of air pollutants emitted from hydrocarbon fuel combustion sources

Parameter	Combustion/ technology fuel type	Maximum allowable emission limits (mg/Nm^3)[1]		
		GoI	IFC[4]	Selected Project standard
Visible emissions[3]	A II	250		**250**
Carbon Monoxide (CO)	A II	500		**500**
Nitrogen Oxide (NOx)	Engine – spark ignition gas fuels	350	183 (200)[2]	**183[8]**
	Engine – duel fuel gas fuels	350	366 (400)[2]	**350**
	Engine liquid fuels	500		**500**
	Turbine gas fuels	70	47 (25 ppm)[3,6]	**47[8]**
Sulphur Dioxide (SO2)	A II	500		**500**
	Engine liquid fuels	500	Use of 1.5% or less sulphur fuel[9]	**500** Use of 1.5% or less sulphur fuel[9]
Total Suspended Particles (TSP)	All fuels	250		**250**
	Engine liquid fuels	250		**250**
Particulate Matter	Engine liquid fuels		45.8 (50)[2,7]	**45.8[7,8]**
Excess O[2]	Engines and		15%	**15%**

Parameter	Combustion/ technology	Maximum allowable emission limits (mg/Nm^3)[1]		
content (dry gas)	turbines all fuels			

[1] All units are in milligram per normal cubic metres (mg/Nm^3) where normal cubic meters are measured at 25^{o}C and 1 atm.

[2] The units used by the IFC are in Nm^3 at 1 atm, 0°C which are shown in brackets. This has been converted to ensure a consistent basis for Nm^3 at 25^{o}C and 1 atm.

[3] The units used by the IFC are in ppm. Units were converted between ppm and mg/Nm^3 at 25^{o}C and pressure of 1 atm.

[4] IFC guidelines only apply to small combustion facilities which operate more than 500 hours per year with an annual capacity utilisation factor of more than 30%.

[5] The NO_X guidelines for liquid engines in the IFC vary with bore size diameter.

[6] This IFC guideline applies to natural gas turbines which have a heat input of 15 – 30 MW on a heat basis.

[7] This IFC guideline can be increased to 92 mg/Nm^3 if it can be justified by project specific considerations.

[8] In this case, the legislated standard is significantly less stringent than those provided by the IFC. As outlined in the IFC's Performance Standard 3 (Resources Efficiency and Pollution Prevention), the EPC contractor will need to evaluate whether the legislated standards are appropriate in view of specific project circumstances and provide a full and detailed justification for any proposed derogations through the Project's environmental and social risks and impacts identification and assessment process.

APPENDIX 4
KM250A PROJECT ESIA
BIODIVERSITY SURVEY RESULTS

Table A4.1 List of vascular plant species for baseline botanical survey (2019)

Scientific name	IUCN (2019) status	Habitat of occurrence	Countries of occurrence according to IUCN (2019)
Centaurea solstitialis	Not assessed	Grasslands, disturbed areas (i.e. roadsides, abandoned fields & waste land) and cropland.	Native to It is native to Armenia, Azerbaijan, Georgia, Iran, Iraq, Lebanon, Syria, Tajikistan, Turkey, Turkmenistan, Ukraine, Algeria, Tunisia, Albania, Bulgaria, France, Greece, Italy, Spain and former Yugoslavia. This species is classed as an exotic / invasive species in several counties including but not limited to Australia, Argentina, Chile & USA (CAB International, 2019).
Zoegea leptaurea	Not assessed		Saudi Arabia, Syria, Lebanon & Turkey
Anchusa italica	Not assessed		>39 countries including Iraq (NE-Iraq, NW-Iraq & SE-Iraq)
Onosma sericeum	Not assessed		Turkey, Iran, Iraq (NE-Iraq, NW-Iraq), Lebanon, Syria Armenia & Georgia
Capsella bursa-pastoris	Least Concern	Artificial / terrestrial, grassland	> 39 countries
Eruca vesicaria	Least Concern	Marine intertidal, artificial/terrestrial, wetlands (inland), rocky areas (e.g. inland cliffs, mountain peaks) & grassland	Bulgaria, Croatia, France, Greece, Italy, Malta, Moldova, Portugal, Romania, Spain, Turkey & Ukraine
Lomelosia leucactis (synonym *Scabiosa leucactis*)	Not assessed		Iraq (NW-Iraq)
Lomelosia calocephala (synonym *Scabiosa calocephala*)	Not assessed		Turkey, Iran (N-Iran), Iraq (NW-Iraq), Lebanon & Syria
Ankyropetalum gypsophiloides (synonym *Gypsophila gypsophiloides*)	Not assessed		Turkey, Iran (S-Iran, W-Iran), Iraq (NE-Iraq, NW-Iraq), Israel, Kuwait, Lebanon, Sinai peninsula & Syria
Dianthus crinitus	Not assessed		Turkey, Aegean Islands, N.W. Africa, Caucasia, Turkestan, Iran

Scientific name	IUCN (2019) status	Habitat of occurrence	Countries of occurrence according to IUCN (2019)
			Pakistan (eFlora.org, Date unknown).
Chrozophora tinctoria	Least Concern	Wetlands (inland), artificial/aquatic & marine	Afghanistan, Albania, Algeria, Bulgaria; Cyprus, Egypt; France, Greece, Iran, Italy, Kazakhstan, Lebanon, Libya, Morocco, Pakistan, Palestine, Portugal, Qatar, Romania; Saudi Arabia; Slovenia, Spain, Tunisia, Turkey, Turkmenistan, Ukraine & Yemen
Hypericum lysimachioides	Not assessed		Turkey, Iran & Iraq (NE-Iraq)
Phlomis bruguieri	Not assessed		Iran, Iraq, Lebanon-Syria & Turkey
Gagea reticulata (synonym *Gagea tenuifolia*)	Not assessed		Afghanistan, Algeria, Bulgaria, Egypt; Greece, Iran, Iraq, Kazakhstan, Kriti, Kuwait, Lebanon-Syria, Libya, North Caucasus, Pakistan, Palestine, Romania, Saudi Arabia, Sinai, South European Russi & Tadzhikistan Transcaucasus; Turkey; Turkmenistan; Ukraine; Uzbekistan; West Himalaya
Aegilops umbellulata	Least Concern	Artificial / terrestrial, grassland, marine coastal/supratidal, other & forest	Armenia, Azerbaijan, Cyprus, Greece, Iran, Iraq, Lebanon, Serbia, Syrian Arab Republic, Turkey & Turkmenistan
Aegilops speltoides	Least Concern	Artificial / terrestrial, forest & grassland	Bulgaria, Greece, Iran, Iraq, Israel, Jordan; Lebanon, Palestine, Syrian & Turkey
Avena sterilis subsp. *ludoviciana*	Least Concern	Artificial / terrestrial, rocky areas (e.g. inland cliffs, mountain peaks) & grassland	>30 countries including Iraq
Hordeum bulbosum	Least Concern	Grassland, shrubland, artificial / terrestrial	28 countries including Iraq
Hordeum murinum subsp. *glaucum*	Not assessed		>30 countries including Iraq
Phragmites australis	Not assessed	Forest, wetlands (inland), artificial / aquatic & marine	>70 countries including Iraq

Table A4.2 Species of avifauna recorded within the baseline survey area (2019)

Common name	Scientific name	IUCN (2019) status	Habitat of occurrence (IUCN, 2019)	Migratory Status	Congregatory Status
masked shrike	*Lanius nubicus*	LC	Forest, shrubland, savanna	Full migrant	Not congregatory
crested lark	*Galerida cristata*	LC	Marine Intertidal, Grassland, Shrubland, Artificial/Terrestrial, Artificial/Aquatic & Marine, Savanna	Full migrant	Not congregatory
house sparrow	*Passer domesticus*	LC	Forest, Rocky areas (eg. inland cliffs, mountain peaks), Wetlands (inland), Grassland, Artificial/Terrestrial, Artificial/Aquatic & Marine, Shrubland	Not a migrant	Not congregatory
common wood-pigeon	*Columba palumbus*	LC	Shrubland, Artificial/Terrestrial, Forest	Full migrant	Not congregatory
Isabelline wheatear	*Oenanthe isabellina*	LC	Marine Intertidal, Desert, Artificial/Terrestrial, Shrubland, Grassland, Rocky areas (eg. inland cliffs, mountain peaks)	Full migrant	Not congregatory
whinchat	*Saxicola rubetra*	LC	Artificial/Terrestrial, Shrubland, Grassland, Forest	Full migrant	Not congregatory
laughing dove	*Streptopelia senegalensis*	LC	Grassland, Artificial/Terrestrial, Savanna	Full migrant	Not congregatory
Hume's Wheatear	*Oenanthe albonigra*	LC	Shrubland, Rocky areas (eg. inland cliffs, mountain peaks).	Not a migrant	Not congregatory
common raven	*Corvus corax*	LC	Forest, Rocky areas (eg. inland cliffs, mountain peaks), Grassland, Shrubland, Artificial/Terrestrial	Not a migrant	Not congregatory
Eurasian magpie	*Pica pica*	LC	Forest, Rocky areas (eg. inland cliffs, mountain peaks), Grassland, Shrubland, Artificial/Terrestrial	Not a migrant	Not congregatory
Eastern rock nuthatch	*Sitta tephronota*	LC	Rocky areas (e.g. inland cliffs, mountain peaks), Wetlands (inland), Shrubland	Altitudinal migrant	Not congregatory
Eurasian kestrel	*Falco tinnunculus*	LC	Artificial/Terrestrial, Shrubland, Forest, Grassland	Full migrant	Congregatory (and dispersive)

black francolin	*Francolinus francolinus*	LC	Grassland, Artificial/Terrestrial, Shrubland	Not a migrant	Not congregatory
red-wattled lapwing	*Vanellus indicus*	Globally LC; VU in Europe	Forest, Wetlands (inland), Grassland, Artificial/Terrestrial	Not a migrant	Congregatory (and dispersive)
Iraq babbler	*Turdoides altirostris*	LC; NT in Europe	Wetlands (inland), Artificial/Terrestrial, Artificial/Aquatic & Marine	Not a migrant	Not congregatory
white-throated kingfisher	*Halcyon smyrnensis*	LC; VU in Europe	Marine Intertidal, Forest, Artificial/Terrestrial, Artificial/Aquatic & Marine, Wetlands (inland)	Not a migrant	Not congregatory
black kite	*Milvus migrans*	LC	Marine Coastal/Supratidal, Artificial/Terrestrial, Forest, Shrubland, Desert, Grassland, Marine Intertidal, Wetlands (inland), Savanna	Full migrant	Congregatory (and dispersive)
graceful prinia	*Prinia gracilis*	LC	Forest, Shrubland, Savanna, Artificial/Terrestrial	Not a migrant	Not congregatory
corn bunting	*Emberiza calandra*	LC	Grassland, Artificial/Terrestrial	Full migrant	Not congregatory
rufous-tailed scrub-robin	*Cercotrichas galactotes*	LC	Artificial/Terrestrial, Wetlands (inland), Grassland, Forest, Shrubland, Savanna	Full migrant	Not congregatory
hen harrier	*Circus cyaneus*	LC; NT in Europe	Artificial/Terrestrial, Wetlands (inland), Shrubland, Grassland, Forest	Full migrant	Congregatory (and dispersive)
see-see partridge	*Ammoperdix griseogularis*	LC	Desert, Rocky areas (eg. inland cliffs, mountain peaks), Shrubland	Not a migrant	Not congregatory
Spanish sparrow	*Passer hispaniolensis*	LC	Forest, Artificial/Terrestrial, Shrubland, Grassland	Full migrant	Congregatory (and dispersive)
Eurasian eagle-owl	*Bubo bubo*	LC	Caves and Subterranean Habitats (non-aquatic), Forest, Grassland, Shrubland, Artificial/Terrestrial	Not a migrant	Not congregatory
Eurasian collared-dove	*Streptopelia decaocto*	LC	Artificial/Terrestrial, Shrubland	Not a migrant	Not congregatory
cattle egret	*Bubulcus ibis*	LC	Forest, Wetlands	Full	Congregatory

			(inland), Grassland, Artificial/Terrestrial	migrant	(and dispersive)
Menetries's warbler	*Sylvia mystacea*	LC	Marine Intertidal, Desert, Shrubland, Savanna, Artificial/Terrestrial	Full migrant	Not congregatory
white wagtail	*Motacilla alba*	LC	Marine Intertidal, Artificial/Terrestrial, Grassland, Wetlands (inland), Desert	Full migrant	Not congregatory

APPENDIX 5
STAKEHOLDER ENGAGEMENT MATERIALS

PowerPoint Presentation

Khor Mor 250 Expansion Project

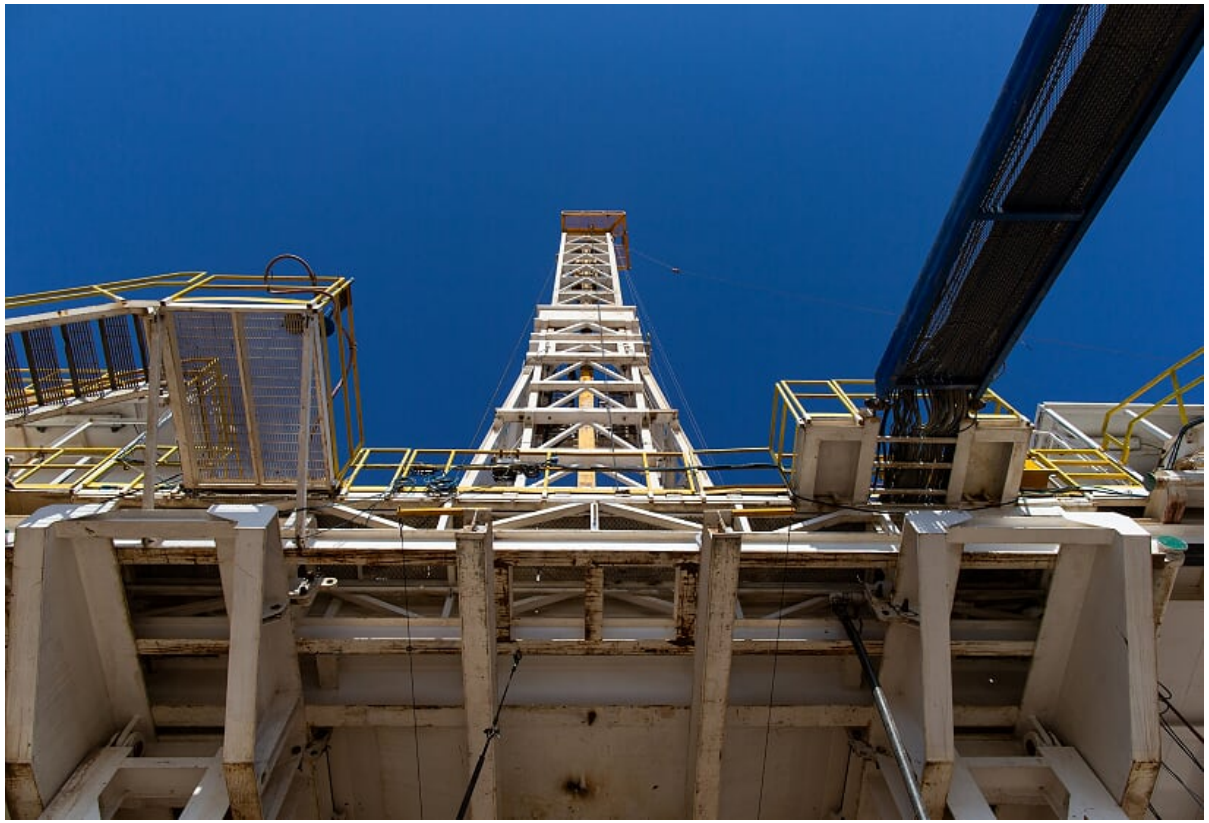
PEARL PETROLEUM

دانة غاز
DANAGAS

شركة بترول الهلال
Crescent Petroleum

Objectives of Meeting

- Introduce the Environmental and Social Impact Assessment (ESIA) team
- Provide an overview of the Project
- Outline the ESIA process and ESIA report
- Provide opportunities to raise questions and concerns related to the Project and ESIA



Pearl Petroleum

- Formed as a consortium in 2009 with Dana Gas and Crescent Petroleum as shareholders
- The Austrian Mineral Oil Administration (OMV), the Hungarian Oil and Gas Public Limited Company (MOL) and the German RWE subsequently joined the consortium (with a ten per cent share each)
- Crescent Petroleum and Dana Gas operate major gas fields in Kurdistan (Chemchemal, Khor Mor and Block 19/20) as Operator on behalf of Pearl

The ESIA Team

- RSK – **the ESIA lead** – is a leading international environmental, social and engineering services company. A diverse team of environmental and social specialists from RSK will undertake the ESIA in collaboration with local specialists from national universities and NGOs.

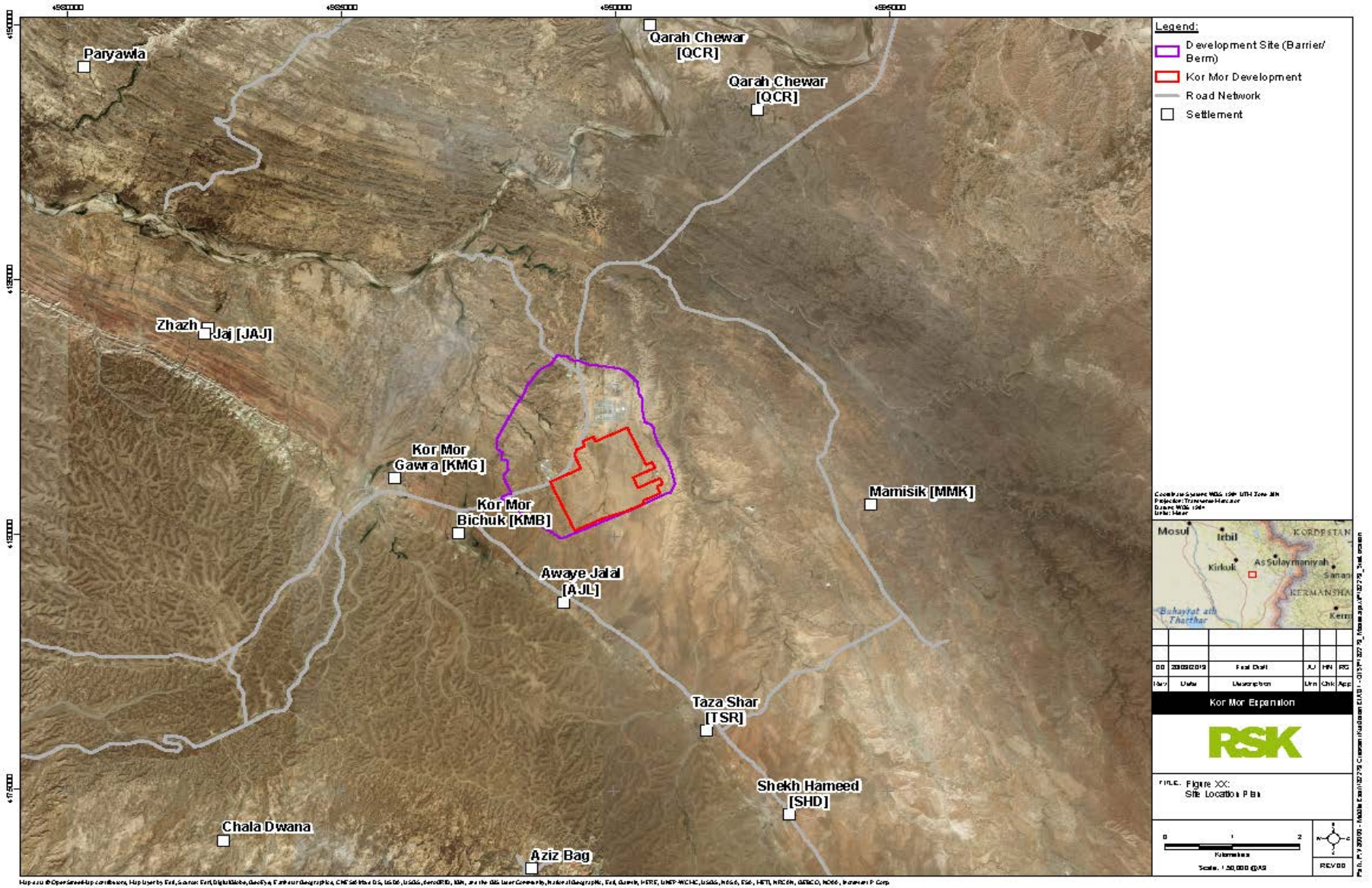
- Hatch is a leading international management, engineering and development consultancy. Hatch has undertaken the **Front-End Engineering Design (FEED)** and will continue to provide support during the ESIA.

- The Operator will work with RSK and Hatch during the undertaking of the ESIA.

Khor Mor Existing Gas Processing Facility

- Close to the village of Khor Mor in the governorate of Sulaymaniyah (Kurdistan Region of Iraq)
- Constructed from 2007 – 2011
- 600 hectare (ha) site, 50 ha of which is currently occupied
- Extraction of hydrocarbon from the Khor Mor reservoir
- Separation of hydrocarbon into main products: natural gas, Liquified Petroleum Gas (LPG) and condensate
- Natural gas is transported to power stations in Chemchemal, Erbil and Sulaymaniyah

Khor Mor Existing Gas Processing Facility



Khor Mor Existing Gas Processing Facility

The Khor Mor 250 Expansion Project

Objectives:

- To contribute to the region's energy supply through more efficient, cleaner electricity generation
- To contribute to local employment and services provision

The Khor Mor 250 Expansion Project

- Construction of a new gas processing facility (within the existing site boundary), additional flowlines from new gas field production wells to the processing facility and supporting infrastructure

- Construction anticipated to start up by mid 2020, with completion and first production of gas/liquids by early 2022

- Requirement of an ESIA by the Ministry of Natural Resources (MNR)

Overview of the ESIA Process

SCOPING

The aim of this phase is to identify the scope of the ESIA, the study area, available information and high-level potential impacts that need to be further evaluated during the ESIA.

BASELINE STUDIES

Baseline studies are undertaken to understand the local socio-economic and natural environment. Specialists speak to people and carry out research in local communities to better understand the environment and the way people live.

IMPACT ASSESSMENT

Based on the baseline studies, the potential impacts and benefits of a project are identified and evaluated in terms of the significance of their effects on people, their livelihoods and the natural environment.

MITIGATION AND MANAGEMENT

Mitigation measures are recommended to avoid or reduce the negative impacts identified in the impact assessment and maximise the potential positive benefits. These are included in management plans for the project.

DISCLOSURE

The draft ESIA report containing conclusions regarding possible impacts is submitted to the national regulators who provide feedback and may request additional studies or changes. The outcomes of the ESIA are also presented to stakeholders.

REGULATORY APPROVAL

The revised ESIA Report is submitted to the national regulators for approval, which is required for the project to proceed.

Regulatory and Institutional Framework for ESIA

- **Legislative requirements of the KRG**
  - *Instructions (No. 1) of 2015 on the Environmental Impact Assessment of Petroleum Operations*
  - *Technical Guidelines on the Environmental Impact Assessment of Petroleum Operations in the Kurdistan Region of Iraq*

- **International best practice**
  - *International Finance Corporation's (IFC's) Performance Standards (PS) on Environmental and Social Sustainability (2012)*
  - *IFC Environmental, Health and Safety (EHS) Guidelines*

- **Operator's internal corporate standards and requirements**
  - *Quality, Health, Safety, Security and Environment (QHSSE) Policy Statement*
  - *Social Performance Standard*

Baseline Studies

Information on local socio-economic and environmental conditions will be obtained via:

- Previous ESIAs submitted in Kurdistan
- Secondary sources (desktop research)
- Primary baseline data collection:
  - Physical environment surveys (air quality, noise)
  - Biodiversity surveys (fauna, avifauna, habitats, flora)
  - Socio-economic surveys (local communities, village Anjuman, health staff, teachers)

Impact Assessment, Mitigation and Management

- Potential for the Project to impact the physical environment (e.g. air, water), socio-economic environment (e.g. people, economy) and the ecological environment (e.g. flora, fauna)

- Impacts with high or moderate significance warrant mitigation measures to reduce them to as low as reasonably practicable (ALARP) and maximise any potential benefits

- Approach taken to identify and incorporate mitigation measures for the Project is based on the best practice hierarchy of decisions and measures in order of priority, as follows:
  - Avoid at source/reduce at source
  - Abate on site
  - Abate off-site/at receptor
  - Repair or remedy

- Mitigation measures identified in the ESIA will be implemented via an Environmental and Social Management Plan (ESMP) during Project implementation

Stakeholder Engagement

- **Objectives:**
    - To inform stakeholders about the Project and ESIA
    - To obtain the input of stakeholders into Project impact identification and management
    - To provide opportunities for stakeholders to express Project- and ESIA-related opinions and concerns
    - To provide feedback to stakeholders on the findings of the ESIA study

Grievance Management Procedure

Objective:

- To ensure that stakeholders have an easy means of lodging grievances related to the Khor Mor 250 Expansion Project and ESIA and to ensure that there will be a follow-up.

Using the Grievance Management Procedure

1. Report your grievance to Operator's Social Performance Department (SPD).

2. The SPD will investigate your grievance. Additional information may be requested from yourself (or other individuals, where relevant) at this time.

3. The findings of the investigation and a proposed resolution will be discussed with you.

4. If you accept the resolution, it will be implemented as quickly as possible. If you reject the resolution, your grievance will be escalated to an Appeals Committee for review and eventual resolution.

5. Following implementation of the resolution, you will be notified by the SPD and the grievance will be officially closed out.

   Note that further details on reporting grievances will be provided to community leaders.

Description of the ESIA report

Key sections of the ESIA report will include:

- Description of the proposed Project, including operations and activities
- Baseline characteristics of the socio-economic and natural environment within the expected area of influence
- Potential impacts of the Project
- Mitigation measures
- Relevant national regulations and international requirements
- Environmental and social management plan

Timeline

Indicative dates for the ESIA:

- Undertaking of the ESIA and preparation of the draft ESIA report – August 2019 to December 2019

- Disclosure of the draft ESIA report and submission of the final ESIA report – January 2020

Q&A

PEARL PETROLEUM

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شركة هلال
Crescent Petroleum

Posters

KHOR MOR 250 EXPANSION PROJECT

PEARL PETROLEUM

شركة نفط الهلال
Crescent Petroleum

دانة غاز
DANAGAS

Khor Mor 250 Expansion Project - What We Do

Pearl Petroleum operates the Khor Mor gas facility located close to the village of Khor Mor in the governorate of Sulaymaniyah in the Kurdistan Region of Iraq.

This facility extracts hydrocarbon from the Khor Mor reservoir, which was first discovered in the 1930s. The hydrocarbon is then separated into:

- Natural gas
- Liquified Petroleum Gas (LPG)
- Condensate.

The gas is used in power stations in Chemchemal, Sulaymaniyah and Erbil to produce more efficient, cleaner electricity.

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Crescent Petroleum
DANAGAS

Khor Mor 250 Expansion Project - What we are doing to expand production

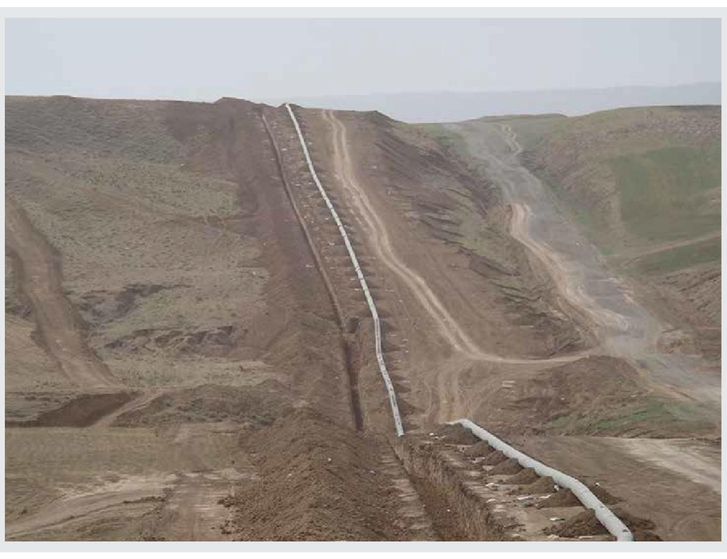
The Khor Mor 250 Expansion Project is a natural extension to the existing facility at Khor Mor.

The Project involves the construction of a new gas processing facility inside the existing site, alongside new flowlines from new gas wells near the facility. There will also be new supporting infrastructure outside the site boundary.

Once completed, the Project will increase production at the site, contributing further to the region's energy supply and providing local employment and services opportunities in the Kurdistan Region of Iraq.

Khor Mor 250 Expansion Project - What are the key components?

- New gas processing facility
- New well flowlines
- A Central Control Building and Laboratory
- New site utilities and power generation
- Construction workshops, yards, offices and accommodation camp



Khor Mor 250 Expansion Project – What this means for you

- Physical environment
- Socio-economic environment
- Ecological environment

Khor Mor 250 Expansion Project – Environmental and Social Impact Assessment (ESIA) Process

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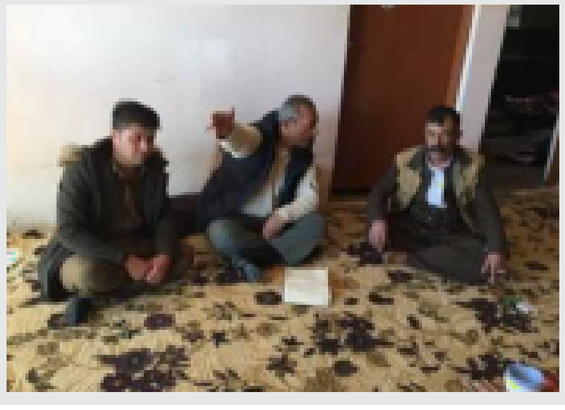
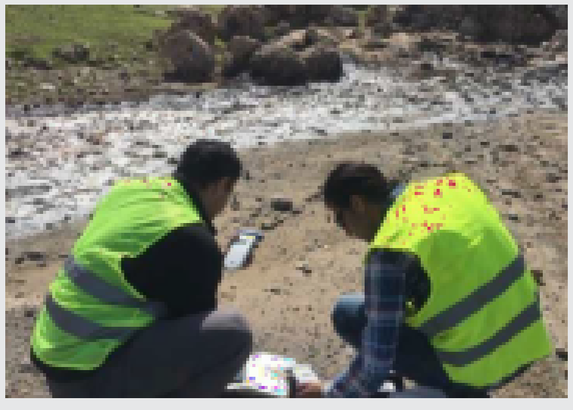
STAKEHOLDER ENGAGEMENT





PEARL PETROLEUM

Crescent Petroleum

DANAGAS

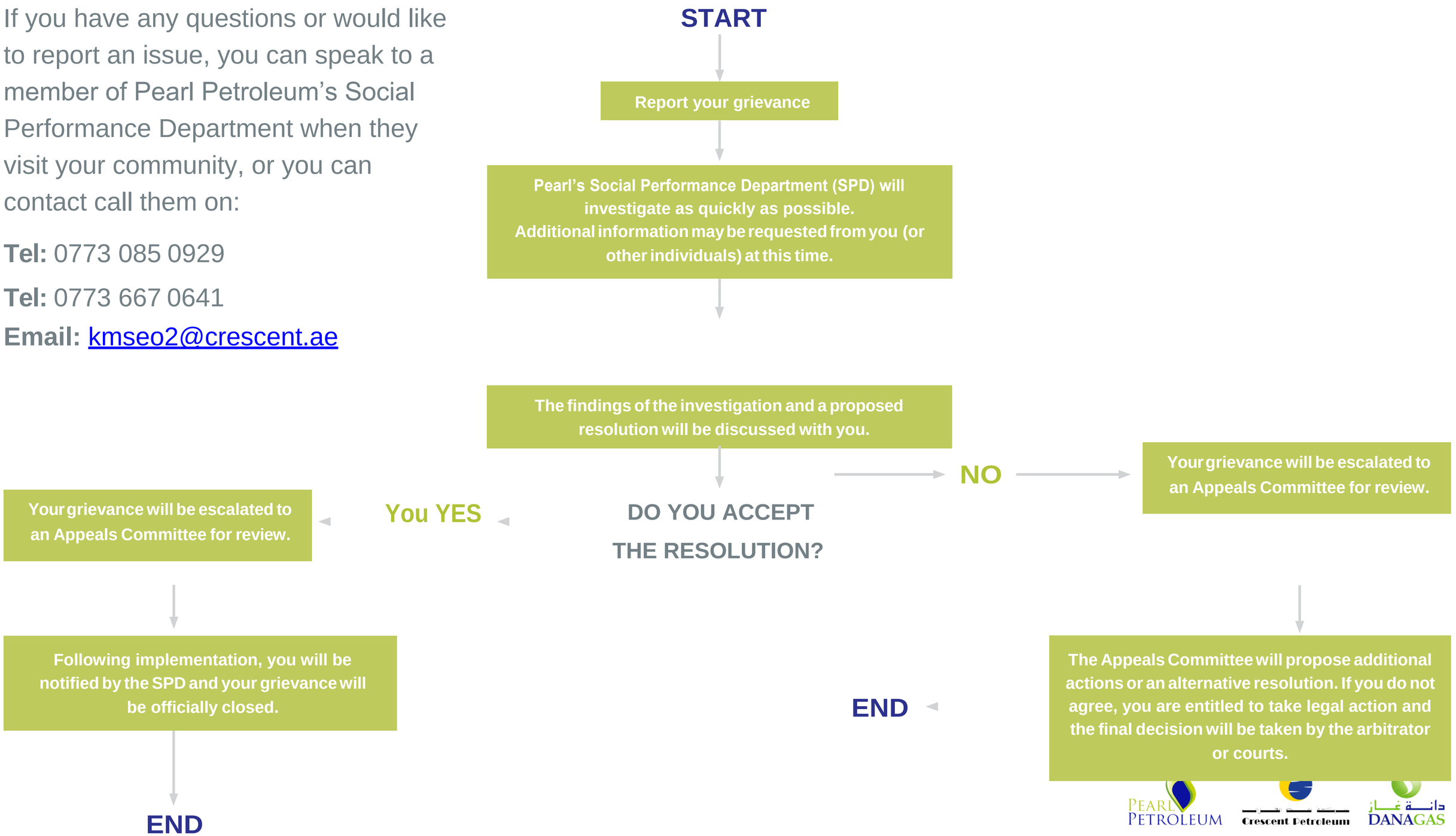
Khor Mor 250 Expansion Project - We would like to hear from you if you have any questions.

If you have any questions or would like to report an issue, you can speak to a member of Pearl Petroleum's Social Performance Department when they visit your community, or you can contact call them on:

Tel: 0773 085 0929

Tel: 0773 667 0641

Email: kmseo2@crescent.ae



Background Information Document (BID)

Khor Mor 250 Expansion Project

Background Information Document

Pearl Petroleum was founded in 2009 and is jointly owned by five shareholders, the largest being Dana Gas and Crescent Petroleum. The company operates major gas fields in Kurdistan (Chemchemal, Khor Mor and Block 19/20)

The company is planning to expand its existing gas facility – Khor Mor – located close to the village of Khor Mor in the governorate of Sulaymaniyah in the Kurdistan Region of Iraq.

The Project will involve the design, procurement and construction of a new gas processing facility capable of processing and producing natural gas and liquid products.

Project Information

The Khor Mor 250 Expansion Project is a natural extension to the existing facility at Khor Mor. The existing facility extracts hydrocarbon from the Khor Mor Reservoir, which is then separated into natural gas, Liquified Petroleum Gas (LPG) and condensate. Natural gas is transported from the existing facility to power stations in Chemchemal, Sulaymaniyah and Erbil. The site currently has a total of seven production wells; four are located within the site boundary and three are located outside the site boundary.

The Khor Mor 250 Expansion Project involves the construction of a new gas processing facility within the existing site boundary, alongside new flowlines (from new production wells to the new processing facility) and new supporting infrastructure outside the site boundary.

In addition, the Project will include the following components:

- new well flowlines
- a Central Control Building and Laboratory
- new site utilities and power generation
- construction workshops, yards, offices and accommodation camp.

Once completed, the Project will increase the production of gas and liquid products at the site, contributing further to the region's energy supply through more efficient, cleaner electricity generation and providing local employment and services opportunities in the Kurdistan Region of Iraq.

Environmental and Social Impact Assessment (ESIA)

In line with national legislation and international standards, an ESIA of the Khor Mor 250 Expansion Project will be undertaken.

The ESIA will require completion of various studies and engagement with stakeholders to ensure it meets international standards.

The ESIA will identify potential impacts, both positive and negative, and recommend actions to manage potential significant negative impacts and maximise positive benefits.

Stakeholder engagement is an important part of the ESIA process and a national requirement. Stakeholder engagement involves sharing Project information with stakeholders. Engagement meetings will provide an opportunity for stakeholders to ask questions and make comments about the Project, and to listen and respond to their concerns via the ESIA process.

The ESIA Process

Scoping

The aim of this phase is to identify the scope of the ESIA, the study area, available information and high-level potential impacts that need to be further evaluated during the ESIA.

Baseline Studies

Baseline studies are undertaken to understand the local socio-economic and natural environment. Specialists speak to people and carry out research in local communities to better understand the environment and the way people live.

Impact Assessment

Based on the baseline studies, the potential impacts and benefits of a project are identified and evaluated in terms of the significance of their effects on people, their livelihoods and the natural environment.

Mitigation and Management

Mitigation measures are recommended to avoid or reduce the negative impacts identified in the impact assessment and maximise the potential positive benefits. These are included in management plans for the project.

Disclosure

The draft ESIA report with conclusions regarding possible impacts is submitted to the national regulators who provide feedback and may request additional studies or changes. The outcomes of the ESIA are also presented to stakeholders.

Regulatory Approval

The revised ESIA report is submitted to the national regulators for approval, which is required for the project to proceed.

How will you be involved?

During the ESIA Process

During the ESIA process, government authorities, civil society, educational institutions and local communities are engaged with through individual, small group and community meetings.

The purpose of these meetings is to provide you with details about the Khor Mor 250 Expansion Project and ESIA, obtain your input into the ESIA and seek your opinions and concerns about the Project and ESIA.

After the Completion of the Draft ESIA Report

After the completion of the draft ESIA report, the same individuals, groups and communities will be met with, in addition to any other stakeholders identified during the ESIA.

The purpose of these meetings is to provide you with a summary of the findings of the ESIA study, especially the identified impacts and mitigation measures, and obtain your feedback on these findings so that they can be included in the final ESIA report.

Potential Benefits and Impacts

- physical environment
- socio-economic environment
- ecological environment

Grievance Management Procedure

A grievance management procedure has been established to provide you with an easy means of reporting any grievance related to the Khor Mor 250 Expansion Project and ESIA.

To report a grievance, please speak to a member of Pearl's (Dana Gas') Social Performance Department (SPD) when they are in your community or contact them on:

Tel: 0773 085 0929

Tel: 0770 667 0641

Email: kmseo2@crescent.ae

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APPENDIX 6
IMPACT ASSESSMENT CRITERIA TABLES

Table A6.1: Criteria for determination of magnitude of potential environmental and social impacts on each receptor[1]

Receptor	Impact type	Impact magnitude rating			
		Slight	Low	Medium	High
Air quality	Un-degraded airshed	Project contribution < 25% of AAQS (see Project standards for air quality)	Project contribution between 25% and 50% of AAQS and predicted environmental concentration < 100% of AAQS	Project contribution between 25% and 50% of AAQS and predicted environmental concentration > 100% of AAQS or Project contribution between 50% and 100% of AAQS and predicted environmental concentration < 100% of AAQS	Project contribution between 50% and 100% of AAQS and predicted environmental concentration > 100% of AAQS or predicted environmental concentration > 100% of AAQS
	Degraded or ecologically sensitive airshed	Project contribution < 10% of AAQS	Project contribution between 10% and 15% of AAQS	Project contribution between 15% and 25% of AAQS	Project contribution greater than 25% of AAQS
Daytime noise levels ($L_{eq\ 1hr}$ dBA) during construction	All daytime exposure periods	<65	65-70	>70-75	>75
Night-time noise levels ($L_{eq\ 1hr}$ dBA) during construction	All daytime exposure periods	<50	50-55	>55-60	>60
Daytime noise levels ($L_{eq\ 1hr}$	Noise disturbance	<40	40-45	>45-50	>50

[1] This concerns conventional air pollutants with local and / or regional impact. GHGs are handled differently, as per the overview of methodology in the body of the report.

Receptor	Impact type	Impact magnitude rating			
		Slight	Low	Medium	High
dBA) during operation	impact magnitude				
	Amenity impact magnitude	<5	5-10	>10-15	>15
Night-time noise levels ($L_{eq\ 1hr}$ dBA) during operation	Noise disturbance impact magnitude	<35	35-40	>40-45	>45
	Amenity impact magnitude	<5	5-10	>10-15	>15
Soil	Soil erosion	Disturbance of soils with low erosion potential in landscapes with slopes <4%	Less than 25% of soils disturbed have a medium or high erosion potential and are in landscapes with slopes 4% to 30%	25% to 50% of soils disturbed have a medium or high erosion potential and are in landscapes with slopes 4% to 30%	More than 50% of soils disturbed have a medium or high erosion potential and are in landscapes with slopes 4% to 30%
	Riparian erosion (see also Surface Water)	No perceptible or readily measurable change from baseline riparian erosion rates	Perceptible change in baseline riparian erosion rates	Clearly evident (i.e. perceptible and readily measurable) change from baseline riparian erosion rates, but affecting a small geographic area	Major (i.e. order of magnitude) change from baseline riparian erosion rates, and affecting a large geographic area
	Loss of land/soils used for agriculture	No impact to soils that are used for agriculture	Less than 25% of the soils impacted are used for agriculture	Between 25% to 50% of the soils impacted are used for agriculture	Greater than 50% of the soils impacted are used for agriculture
	Soil quality	Alteration of chemical composition of soil by adding toxic material, slight increase in total contaminative potential. Concentrations not	Increase in concentration of organic or inorganic compounds or other contaminants in soil presenting a minor risk to environmental, biological	Degradation of soil quality providing ongoing contamination source and/or resulting in high risk to potential receptors, including	Degradation of soil quality providing ongoing contamination source and/or resulting in high risk to potential receptors. Concentrations exceeding

Receptor	Impact type	Impact magnitude rating			
		Slight	Low	Medium	High
		exceeding guideline values.	and human (site users only) receptors. Concentrations exceeding investigation levels. Effects confined within the Project footprint or to a small, isolated location(s) outside the Project area.	local community. Concentrations exceeding investigation levels. Effects extend beyond the area of disturbance to the surrounding area but are contained within the general area.	investigation levels. Effects are widespread.
	Topography and drainage characteristics	Changes to site profiles or elevations (<±0.5 m), and/or compaction or disturbance of surface soils / placement of hard-stand not resulting in measurable alteration to drainage characteristics	Changes to site profiles or elevations (<±1 m), and/or compaction or disturbance of surface soils / placement of hard-stand not resulting in measurable alteration to drainage characteristics	Earthworks altering profiles and elevations (<±3 m); and/or placement of hard-stand or poorly managed drainage system resulting in alteration of drainage characteristics	Alteration of existing profiles great enough (>±3 m) to impact neighbouring land (e.g. drainage flows onto neighbouring land), subsidence, and/or placement of hard-stand and/or poorly managed drainage system resulting in alteration of drainage characteristics
	Subsurface lithology	Addition of foundation materials, reworking or removal of soils altering a shallow low-sensitivity geological succession.	Addition of foundation materials, reworking or removal of soils altering a shallow medium-sensitivity geological succession.	Addition of foundation materials, reworking or removal of soils altering a shallow high-sensitivity geological succession.	Mining or exploitation of geological formations (e.g. quarrying activities).
Hydrogeology	Groundwater quality and spatial extent	Groundwater quality impacts are likely to be well within ambient ranges or Iraq standards and isolated in extent (i.e. <1ha)	Groundwater quality impacts are likely to be well within ambient ranges or Iraq standards and localised in extent (i.e. 1 to 10ha)	Groundwater quality impacts are likely to result in occasional exceedances of ambient ranges or Iraq standards and extend area-wide (i.e. 10 to 100ha)	Groundwater quality impacts are likely to routinely or permanently exceed ambient ranges or Iraq standards over large areas (i.e. >100ha)
	Duration	Short-term, localised	Short-term, localised effects	Localised effects on	Severe effects on groundwater

Receptor	Impact type	Impact magnitude rating			
		Slight	Low	Medium	High
		effects on groundwater quality, but likely to be highly transitory (e.g. lasting a matter of hours) and well within natural fluctuations	on groundwater quality, but which are likely to return to equilibrium conditions within a short timeframe (i.e. hours or days at most)	groundwater quality that are likely to be reasonably long lasting (e.g. weeks or months) and/or give rise to indirect ecological and/or socio-economic impacts	quality that are likely to be long lasting (e.g. months or more) or permanent, and/or give rise to indirect ecological and/or socio-economic impacts
	Groundwater Resource and Availability	There are no known or expected groundwater users within the likely area of influence of Project abstraction boreholes.	There are known or expected groundwater users within the likely area of influence of Project abstraction boreholes, but their supplies may not be reduced by the Project.	There are known or expected groundwater users within the likely area of influence of Project abstraction boreholes, and their supplies may be reduced by the Project	There are known or expected groundwater users within the likely area of influence of Project abstraction boreholes, and their supplies will be affected by the Project
Surface water	Surface water features	Changes to surface water features (e.g. reworking or removal of soil or structures, addition of access roads and tracks, increased traffic) not leading to measurable changes in the surface water system (i.e. rivers, streams or canals)	Changes to surface water features (e.g. reworking or removal of soil or structures, addition of access roads and tracks, increased traffic) leading to localised (i.e. 1 to 10ha) changes in flow pathways during the rainy season	Changes to surface water features (e.g. reworking or removal of soil or structures, addition of access roads and tracks, increased traffic) leading to area-wide (i.e. 10 to 100ha) changes to preferential flow pathways during the rainy season, or resulting in diversion works	Changes to surface water features (e.g. reworking or removal of soil or structures, addition of access roads and tracks, increased traffic) leading to widespread (i.e. >100ha) alteration of surface water bodies, changes to preferential flow pathways and regime during the rainy season, or resulting in large scale re- diversion works
	Flow Rate	Decrease in surface water flow downstream of project asset not discernible by local users at any time of the year.	Decrease in surface water flow downstream of project asset is likely to be discernible by local users but is unlikely to cause	Decrease in surface water flow downstream of project asset is sufficient to cause complaints from local	Decrease in surface water flow downstream of project asset is likely to cause users to use less water than they normally use and to seek one or more

Receptor	Impact type	Impact magnitude rating			
		Slight	Low	Medium	High
			users to use less water than they normally use at any time of year.	users but is unlikely to cause users to use less water than they would normally use or to seek a supplementary source of water at any time of year.	supplementary sources of water to make up the deficit during the dry season.
	Surface water quality	Reduction in water quality (suspended sediment, turbidity, colour, odour and taste) downstream of project asset not discernible by local users at any time of year. Concentrations not exceeding Iraq standards	Reduction in water quality (suspended sediment, turbidity, colour, odour and taste) downstream of project asset is likely to be discernible by local users but is unlikely to cause users to use less water than they normally use or to seek supplementary sources of water at any time of year. Concentrations not exceeding Iraq standards	Reduction in water quality (suspended sediment, turbidity, colour, odour and taste) downstream of project asset is sufficient to cause complaints from local users but is unlikely to cause users to use less water than they would normally use or to seek supplementary sources of water at any time of year. Concentrations exceeding Iraq standards	Reduction in water quality (suspended sediment, turbidity, colour, odour and taste) downstream of project asset is likely to cause users to use less water than they normally use and to seek supplementary sources of water to make up the deficit at all times of the year. Concentrations exceeding Iraq standards
Biodiversity	Flora and fauna	Disruption of behaviour or species interactions that is barely detectable with respect to natural variability	Minor disruption of behaviour or species interactions not impacting overall health/integrity of the population of the species. Affects a specific group of localised individuals within	Moderate disruption of behaviour or species interactions Affects a portion of a population and may bring about a change in abundance and/or distribution over one or	Affects an entire population or species in sufficient magnitude to cause a decline in abundance and/or change in distribution beyond which natural recruitment (reproduction, immigration from unaffected areas) would

Receptor	Impact type	Impact magnitude rating			
		Slight	Low	Medium	High
			a population over a short time period (one generation or less), but does not affect other trophic levels or the population itself	more generation, but does not threaten the integrity of that population or any population dependent on it	not return that population or species, or any population or species dependent upon it, to its former level within several generations Introduction of alien invasive species
	Habitats	Disruption of habitat is barely detectable with respect to natural variability	Minor shift away from baseline conditions. Direct or indirect impacts will be discernible but underlying character composition and/or attributes of baseline condition will be similar to pre development circumstances or patterns. Approximately 1 to 5% of a habitat affected within the Project AOI	Post-development character, composition, and/or attributes of baseline habitat will be partially changed but the overall integrity of the habitat is not threatened Approximately 5 to 20% of a habitat is within the Project AOI	Post-development character, composition, and/or attributes of baseline habitat will be fundamentally changed and the overall integrity of the habitat or species within it are threatened Approximately 20 to 100% of a habitat is within the Project AOI
	Protected areas or proposed protected areas	N/A	No change in status of protected area or proposed protected area	Change in classification of protected area or proposed protected area to a lower level of protection	Delisting of protected area or proposed protected area
	Ecosystem services	Disruption of ecosystem service is barely detectable with respect to natural variability	The Project results in a small reduction in the availability or functionality of the ecosystem service, and/or has implications for a small number of people relative to the population within the Project AOI There is a perceptible	The Project results in a moderate reduction in the availability or functionality of the ecosystem service, and/or has implications for a substantial number of people relative to the population within the	The Project results in the loss of all or a significant proportion of the availability or functionality of an ecosystem service, and/or has implications for the majority of people within the Project AOI The long-term viability of the service is threatened

Receptor	Impact type	Impact magnitude rating			
		Slight	Low	Medium	High
			difference from baseline conditions.	Project AOI Does not threaten the long-term viability of the service.	
Socio-economic	Job creation	Job creation benefits are barely detectable to stakeholders in surrounding communities	Local job creation meets, but does not exceed local expectations	Job creation, although significant, falls short of local expectations, contributing to community dissatisfaction; or local job creation improves income levels, but not for all sections of the population	Unfulfilled expectations of job creation leading to demonstrations, sabotage, and contributing to social unrest Significant generation of local employment, resulting in long-term local economic improvement and community benefits
	Livelihoods of local populations	Impacts to livelihoods are barely detectable to stakeholders in surrounding communities	Small changes to livelihood, with only minor impacts on productivity or profitability which are neither sufficient to make those livelihood activities unviable, nor (if impacts are positive) sufficient to attract competitors in that sector	Partial restriction of access to livelihood resources, or markets, which results in changes to productivity or profitability	Complete loss of livelihood resources attributable, or perceived to be attributable to the Project, involuntary relocation of households, businesses or productive resources
	Quality of life for local residents and communities	Impacts on quality of life are barely detectable to stakeholders in surrounding communities	Perceptions of air quality, noise, vibration, dust, light pollution or other nuisances contribute to low-level community dissatisfaction, irrespective of measured data or applicable legal or agreed limits	Air quality noise, dust, vibration, dust, light pollution or other impacts cause noticeable and serious interference with daily life, irrespective of measured data or applicable legal or agreed limits	Severe deterioration in the living environment due to Project impacts ion air quality noise, dust, vibration, dust or light pollution, irrespective of measured data or applicable legal or agreed limits

Receptor	Impact type	Impact magnitude rating			
		Slight	Low	Medium	High
	Social cohesion	Project impacts on social cohesion with surrounding communities are barely detectable	Low-level discord between incoming workers or contractors, migrants and local communities, resulting in loss or reduced levels of trust.	Minor increase in social pathologies, including antisocial behaviour, vandalism, crime, alcohol / drug abuse, thefts, minor acts of violence, prostitution Incoming workers' families subject to unfair treatment, discrimination or lack of opportunities	Severe social cohesion problems, inter-ethnic tensions or violence, threats to security and safety, potentially resulting in work stoppages or delays, or threats to productivity
	Local economy, markets and prices	Impacts on prices for local goods and services are barely detectable	Seasonal and/or minor localised price impacts (inflation or deflation) on food and consumables, due to market re-adjustments accompanying incoming workforce and their families	Significant price impacts attributed to the Project, resulting in changes to overall standards of living	Major economic impacts: significant overall impacts on local market prices and availability of goods, including housing, services and consumables
	Transportation	N/A	No travel pattern or travel time change to local population. No disruption to safe transport of people, goods and material or animals	Limited effect on travel pattern or travel time and safe transport of goods, material and animals (i.e. effect on travel time and cost can be tolerated by users) Low cost transport network improvement will be required	Significant effect on travel pattern or travel time and on safe transport of people, goods, material and animals Effect on travel time and cost cannot be tolerated by users and authority intervention will be required (e.g. road improvement, subsidies, alternative transport)
	Reputation	Local public awareness but no discernible concern No media coverage	Local public concern Local media coverage	Regional public concern Local stakeholders, e.g. community, NGO, industry and government, are aware	National public concern Impact on local and national stakeholder relations. National government and NGO involvement with potential for

Receptor	Impact type	Impact magnitude rating			
		Slight	Low	Medium	High
				Extensive attention in local media. Some regional or national media coverage	international NGO action Extensive attention in national media. Some international coverage Potential for regulatory action leading to restricted operations or impact on operating licences
	Conditions of employment (includes contractors and suppliers)	Conditions of employment generally comply with international (especially ILO) and KRG requirements, with occasional minor exceptions (e.g. occasional missed attendance at school).	Disagreements over employment conditions resulting in tense worker-management relationships, lack of cooperation and less than optimal productivity Employees or workers required to pay employment agents fees Perception of unequal pay for similar work (e.g. nationalities, women, different contractors)	Poor worker-management relationships, resulting in partial (one or more, but not all contractors) temporary work stoppages or disruptions School-age children consistently missing school due to Project-related work.[2] .	Serious labour unrest - demonstrations, strikes or sabotage, resulting in production delays or losses.
	Recruitment methods	Dissatisfaction regarding recruitment methods is barely detectable within stakeholders in surrounding communities	Dissatisfaction with transparency of recruitment procedures, wage levels or conditions offered, contributing to decline in trust	Recruitment perceived to be biased in favour of selected tribal / ethnic groups, contributing to community tensions	Serious inter- or intra-community unrest attributed to recruitment bias in favour of one or more groups (justified or otherwise)
	Site security and community safety	Dissatisfaction regarding site security and community safety is barely	Potential safety hazard (unattended plant, unfenced equipment dump, etc.)	Minor accident, attributed by the community (with or	Severe injury or fatal accident, attributed by the community (with or without justification) to

[2] ILO guidelines hold that children over twelve years of age may, outside the hours fixed for school attendance, be employed on light work which is not such as to prejudice their attendance at school or their capacity to benefit from the instruction there given.

Receptor	Impact type	Impact magnitude rating			
		Slight	Low	Medium	High
		detectable within stakeholders in surrounding communities	causing community anxiety	without justification) to lack of due care on the part of the Project	the Project
Archaeology	Archaeology and cultural heritage	Negligible or slight changes to the setting of an archaeological or cultural heritage asset or group of assets	None or very limited impacts to archaeological or other cultural heritage resources, to the extent that the asset(s) is marginally altered Impacts limited to non-critical resources Minor changes to the setting of an archaeological or cultural heritage asset or group of assets	Some degradation of archaeological or other cultural heritage resources Clear modification of critical resources so that the archaeological or cultural heritage asset is Considerable changes to the setting of an archaeological or cultural heritage asset or group of assets	Permanent or irreversible loss or degradation of critical archaeological or other cultural heritage resources Comprehensive changes to the setting of an archaeological or cultural heritage asset or group of assets

Notes

AAQS = ambient air quality standards

Un-degraded airshed: baseline < AAQS.

Degraded airshed: baseline > AAQS and/or ecologically sensitive habitats.

$L_{eq\ 1hr}$ = equivalent continuous sound pressure level over a one-hour period.

Amenity impact magnitude: incremental increase above background levels ($L_{eq\ 1\ hour}$ – $L_{90\ 1\ hour}$) where background noise level is greater than 30 dB(A) L90 during the night and 35 dB(A) L90 during the daytime.

Impact magnitude for operational noise is based on sensitive receptors in predominantly residential or rural areas. Where residential areas are located within commercial/industrial districts or on the main road, a relaxation to the operational phase impact magnitude of 10 dB(A) will apply e.g. worker's camps. This follows the principles of Kurdistan local standards (add cross reference).

'<' = less than.

'>' = greater than.

Table A6.2: Sensitivity criteria for the potential environmental and social impacts/receptors

Receptor/impact	Sensitivity criteria		
	Low	Medium	High
Air quality	Receptors where sensitivity to air pollution is minimal, e.g. industrial areas and desert.	Receptors moderately sensitive to air pollution, where it may cause some disturbance, e.g. agricultural areas.	Receptors where people or habitats are particularly susceptible to air pollution, e.g. residential areas, schools, healthcare clinics and ecologically sensitive areas.
Noise	Receptors where sensitivity to distraction or disturbance from noise is minimal, e.g. industrial areas, desert.	Receptors moderately sensitive to noise, where it may cause some distraction or disturbance, e.g. agricultural areas.	Receptors where people or habitats are particularly susceptible to noise, e.g. residential areas, schools, healthcare clinics and ecologically sensitive areas.
Soil erosion	Soils with low erosion potential, and/or are resistant to compaction and scarring.	Soils with medium and/or high erosion potential that drain to water resources that support diverse aquatic habitats or are a locally important source of potable water for communities living nearby, and/or the surface is prone to compaction and scarring.	Soils with medium and/or high erosion potential that drain to water resources that support economically important or ecologically significant aquatic species or provide essential habitat for those species or are a locally important source of potable water for communities living nearby, and/or are sensitive to compression.
Riparian erosion	Flat sloped, shallow and/or well vegetated riparian zones	Riparian zones with medium slopes and some vegetation	Steep riparian zones with limited or no vegetation
Loss of land/soils used for agriculture	Soils that are not suitable for agriculture, i.e. desert soils of low fertility without available water supply	Soils that are suitable for agricultural use, but are used for grazing and limited subsidence agriculture, or are located in an area not intended for agricultural use	Soils that are used for agricultural production or are located in an area that is regionally important for agricultural production
Soil quality	Soils of no geological, ecological or economic value, and/or soils that have the ability to recover quickly	Soils of moderate geological, ecological or economic value, and/or soils that have the ability to recover only over multiple seasons.	Soils of important geological, economic or ecological value, and/or soils that have the ability to recover only over many seasons.
Hydrogeology	The groundwater resource has little to no role in terms of supply services for local communities	The groundwater resource has local importance in terms of supply, but there is ample capacity and/or adequate opportunity for alternative sources of	The groundwater resource has local importance in terms of supply, with no suitable technically or economically feasible alternatives, or is important at a regional or

Receptor/impact	Sensitivity criteria		
	Low	Medium	High
		comparable quality	trans-boundary watershed level for supply
Surface waters	Water non-potable and unsuitable for irrigation or watering livestock No use for navigation or industry Water supply meets local needs and there is no shortfall of resources	Water non-potable for humans but suitable for irrigation and watering livestock Water used for navigation, industry or agriculture and human needs Water supply does not meet local needs	Water is used for industrial, irrigation, watering livestock or potable uses Supports human needs Area lacking water resources
Flora and fauna	Species are not protected or listed Species are abundant / common and not critical for ecosystem functions Areas of little or no vegetation	Species are globally common but are rare in Iraq, or important to ecosystem functioning (e.g. predator / prey species), or a species that is under threat or has a declining population Species listed as Near Threatened by IUCN.	Regionally significant populations of globally threatened or endangered species (i.e. listed as Vulnerable, Endangered or Critically Endangered species by IUCN), which are or are likely to be found within the Project AOI, and are likely affected by the Project Species important to ecosystem functioning, such as predator or prey species
Habitats	Sites of local biodiversity value that are not intact, fragile or unique. May include wildlife corridors Habitats that recover quickly following disturbance (i.e. habitats comprising species that readily re-colonise disturbed areas) Habitats that can be classified as 'modified' in accordance with IFC Performance Standard 6 (IFC, 2012)	Habitats that are suffering significant decline at a national or regional level Areas of high species or habitat diversity, or 'naturalness' Habitats that are capable of unassisted recovery to natural conditions following disturbance, although this may require several years (e.g. reed beds and other habitats where growing conditions are favourable) Habitats that can be classified as 'natural' in accordance with IFC Performance Standard 6 (IFC, 2012)	Sites designated for protection at national or international level Habitats recognised as intact or unique (e.g. true deserts, fragile soils, wetlands) or areas recognised by NGOs as having high environmental value (e.g. Key Biodiversity Areas) Habitats that are unlikely to return to natural conditions without some intervention (such as re-seeding or planting), but which are capable of assisted recovery (including most semi-deserts) Habitats that can be classified as 'critical' in accordance with IFC Performance Standard 6 (IFC, 2012)
Ecosystem services	The ecosystem service is of low importance to beneficiaries (local,	The ecosystem service has moderate importance to beneficiaries and	The ecosystem service is of high importance to beneficiaries and has moderate replaceability

Receptor/impact	Sensitivity criteria		
	Low	Medium	High
	regional and global) or is of moderate importance but with many spatial alternatives available	moderate replaceability (some spatial alternatives), high importance to beneficiaries and many spatial alternatives, or low importance and few to no spatial alternatives	(some spatial alternatives); is of moderate importance to beneficiaries and has few or no spatial alternatives; or is essential to beneficiaries but has many spatial alternatives
Employment	Households with adequate employment / income to meet their basic needs, enjoying a standard of living above the local average Households with no individuals actively seeking work	Households with inadequate income to meet basic needs, and/or one or more members actively seeking work	Households with inadequate income and without an individual in regular or sufficient employment
Local communities	Middle to high-income persons or families Persons with ample access to goods and services	Middle-income persons or families with limited access to goods / services Nomads and semi-nomads who pass through the Project AOI	Low income or unemployed persons with no access, or severely limited access, to services Vulnerable households Nomads and semi-nomads who utilise the Project AOI to maintain their livelihood
Social cohesion	Occupants of well-established, existing households, not members of any marginalised group, permanently employed, and with sufficient resources to maintain livelihoods and security	Periodically employed persons and minority groups with no legal right to occupy their land/ homes	Highly vulnerable or sensitive populations or minority groups who perceive themselves as targets of discrimination
Local economy, markets and prices	Owners and employees of well-established businesses with secure contracts associated with the Project or Project-dependent services, fully able to maintain their market presence, or enterprises without any direct interest in oil-field-related business Well-paid or relatively wealthy residents, able to withstand price fluctuations	Owners and employees of small and medium-sized enterprises with a secure market position Businesses with an indirect interest, but not a wholly dependent relationship to the Project Middle-income household residents Producers or consumers of produce likely to be subject to price fluctuations	Owners and employees of businesses whose markets will be displaced or expanded by increased Project activity Any people or businesses subject to involuntary relocation or economic displacement Businesses which lose oilfield contracts on which they have been reliant, or which win significant new contracts on the Project New businesses created to take advantage of increased opportunities afforded by the Project

Receptor/impact	Sensitivity criteria		
	Low	Medium	High
			Marginalised people reliant on livelihoods unconnected to the oil industry, such as herders and producers of raw materials which are marketed remotely from the site, whose produce will not be subject to price inflation Poor households, i.e. those living below the national poverty line
Physical resources and infrastructure (e.g. utilities, transport network, educational, recreational)	Individuals or households with access to their own adequate and reliable facilities (e.g. transport, electricity, private education) and are not directly affected by changes to these utilities	Households which partially rely on affected infrastructure, including transport, recreation, electricity and/or education.	Households wholly dependent on affected public infrastructure for the supply of services or utilities
Road users (including pedestrians)	Convenient alternative routes available	Limited number of alternative routes available	No alternative route easily available
Reputation	The Project AOI does not include known culturally, environmentally or politically significant or sensitive areas	The Project AOI includes locally or nationally recognized, environmentally or politically significant or sensitive areas	The Project AOI includes internationally recognized, environmentally or politically significant or sensitive areas
Workers	Expat workers, highly-paid workers, temporary migrant workers with little or no long- term direct interest in the Project	Full-time local employees (including contractors)	Low paid/casual/occasional workers
Recruitment methods	Those already employed or not seeking employment	Project employees, seeking work for family members or friends	Unemployed, seeking work on the Project Tribal, ethnic or minority group members who perceive discrimination
Archaeology and cultural heritage	Archaeological and cultural heritage assets of local importance Archaeological and cultural heritage assets compromised by poor preservation, and/or poor survival of	Archaeological and cultural heritage assets or regional importance Archaeological and cultural heritage assets with potential to contribute to regional research objectives	Nationally and internationally significant archaeological and cultural heritage monuments protected by the Kurdistan government, Iraqi federal law and/or international conventions

Receptor/impact	Sensitivity criteria		
	Low	**Medium**	**High**
	contextual associations Archaeological and cultural heritage assets of limited value, but with potential to contribute to local research objectives Areas of negligible or low potential for previously unrecorded buried archaeology	Area where archaeological or other cultural heritage resources are present, and/or area where chance of disturbance of previously unknown or unrecorded buried archaeology is moderate	Undesignated sites of the quality and importance to be designated Assets that can contribute significantly to acknowledged national research objectives Area where significant or important archaeological or other cultural heritage resources are present, and/or area where chance of disturbance of previously unknown or unrecorded archaeology is high

APPENDIX 7
AIR QUALITY MODEL ASSUMPTIONS

The US Environmental Protection Agency (USEPA) AERMOD or CALPUFF models are used for evaluating the possible impacts of point source air emissions. This allows for assessing impact in a wider range of local meteorological conditions and also factors in the influence of terrain on dispersion. To perform the modeling study, USEPA recommends that equivalent emission parameters, referred to as 'Pseudo-parameters' have to be estimated for stack height, diameter and exit velocity. Pseudo-parameters account for hot, turbulent and buoyant plume.

These parameters do not necessarily have any physical relevance; however, they are calculated so as to simulate the movement of the exhaust plume as would be from a point source. The pseudo parameters calculated in this study and which was used for modeling are:

1) Effective Stack height

The effective stack height is the total height of the flare, including flame and nominal (physical) height of the flare. The following equation is used to estimate effective height:

$$H_{eff} = H_s + 4.56 \times 10^{-3} \times (Q_n/4.1868)^{0.478}$$

$$Q_n = Q_T \times (1-f)$$

Where:

H_s = Physical stack height above ground

H_{eff} = Effective stack height

Q_T = Total heat available from combustion in Joules/s,

F = % heat lost by radiation (a function of molecular weight of the flared gas stream)

Q_n = Net heat release

2) Effective exit velocity

Effective exit velocity is the velocity of the plume following combustion and is calculated as a representative value at the flame tip. Exit velocity of the plume is dependent on the 'lift rate' of the exhaust gases caused by the heat from combustion. While there is no specific threshold on gas exit velocity, the USEPA and other regulators have suggested a minimum gas exit velocity of 20m/s to provide sufficient momentum and prevent stack tip downwash.

3) Effective stack diameter

The effective stack diameter considers that the size of the flame and exhaust gases are potentially larger than original inner diameter or flare nozzle tip. Effective diameter is therefore calculated using the following formula:

$$D_{eff} = 2 \times \sqrt{(F_{b,actual} \times T_{stack})/(g \times V_{eff} \times (T_{stack} - T_{amb}))}$$

Where:

D_{eff} = effective diameter at the flame tip (m)

V_{eff} = effective exit velocity (m/s)

$F_{b,\ actual}$ = Heat released by combustion (m^4/s^3)

The calculated pseudo-parameters which were used as inputs to the modeling study, are presented in Table A7.1 below.

Table A7.1 Flare stack parameters for modeling

Sl NO	Source	Effective Height (m)	Effective Diameter (m)	Exit Velocity (m/s)	Stack Temp (K)	NO_2 (g/s)	SO_2 (g/s)	CO (g/s)	PM10 (g/s)
1	HP Flare (with LT Flare)	100.1	38.75	20	1273	64.30	97.63	349.87	50.95
2	LP Flare	40.22	7.56	20	1273	1.78	2.72	9.67	1.35
3	LLP Flare	29.27	2.77	20	1273	0.12	0	0.68	0.04

Receptors

Receptors were placed in a nested grid as described in Table A7.2 below (see also Figure A7.1). Receptors were placed to a distance of 50 km from the facility. Terrain elevations were extracted and assigned to the model domain from the SRTM 30 digital elevation model. Sensitive receptors were jointly identified with the client and are listed in the table below. Terrain elevations were processed and assigned to the receptors using AERMAP.

Table A7.2: Nested grid receptor spacing

Distance from Source	Spacing (m)
0-200	20
200-500	50
500-1000	100
1000-2000	200
2000-5000	500
5000-10000	1000
10000-20000	1000
20000-50000	5000

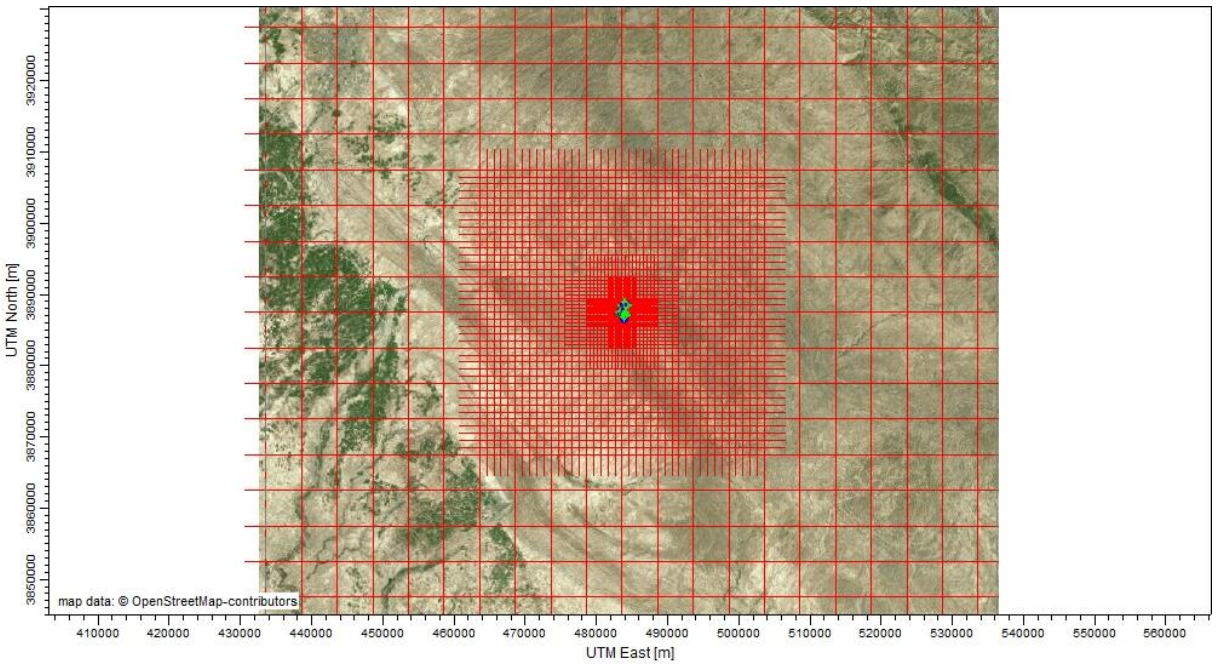

Figure A7.1 Nested receptor grid

APPENDIX 8
COMMITMENTS REGISTER

Table A8.1 Environmental commitments register

UNIQUE ID / NUMBER	COMMITMENT	Phase (select from list)	Action Owner
ENV01	Consider raising stack height of KM250A point sources of emissions to at least 20 m to improve dispersion and reduce impact.	Operations	Pearl Petroleum
ENV02	Consider establishing a sulphur recovery unit (SRU) to have an alternative treatment of sour gas.	Operations	Pearl Petroleum
ENV03	Undertake a quantitative impact assessment to evaluate the drawdown impact on local water users.	Construction	Pearl Petroleum
ENV04	Develop a Water Management Plan to ensure future sustainable management of water resources.	Construction	Pearl Petroleum
ENV05	Ensure that an abstraction permit is obtained from local authorities.	Construction	Pearl Petroleum
ENV06	Undertake refuelling at designated areas according to industry guidelines.	Construction	Pearl Petroleum
ENV07	Store chemicals and hydrocarbons within secondary containment and according to Good International Industrial Pratices (GIIP).	Construction	Pearl Petroleum
ENV08	Adopt quiet working methods, where reasonably practicable, using plant with lower noise and vibration emissions.	Construction	Pearl Petroleum
ENV09	Avoid or limit noisy construction activities during the night-time period.	Construction	Pearl Petroleum
ENV10	Use acoustic screens and/or enclosures for static items of plant which generate noise levels that have the potential to cause disturbance.	Construction	Pearl Petroleum
ENV11	Carry out regular inspections of noise mitigation measures to ensure integrity is maintained at all times.	Construction	Pearl Petroleum
ENV12	Provide briefings for all site-based personnel so that noise issues are understood, and mitigation measures are adhered to.	Construction	Pearl Petroleum
ENV13	Produce a Biosecurity Plan and Bio-restoration Plan.	Construction	EPC Contractor
ENV14	Undertake a preconstruction survey for important plant species in areas identified as potential habitat in particular along flowlines where routes are likely to be re-surveyed.	Construction	EPC Contractor
ENV15	Evaluate practical alternatives to avoid or reduce impacts to the important plant species if these species are identified within areas subject to land disturbing activities.	Construction	EPC Contractor
ENV16	Prohibit the collection of natural resources, such as plant materials for firewood, food or medicine.	Construction	EPC Contractor
ENV17	Use appropriate technique (seed harvesting/cutting/translocation) to move individual plants from the construction footprint if the individual cannot be avoided during land disturbing activities.	Construction	EPC Contractor

ENV18	Undertake site clearance with due consideration to main breeding season.	Construction	EPC Contractor
ENV19	Establish a 10 m buffer zone, if possible and practical, around the burrow or nest where no construction may occur until monitoring indicates that the species has left the nest/burrow.	Construction	EPC Contractor
ENV20	Evaluate alternatives to relocate the species, if sensitive species active nest or burrow cannot be avoided; and seek approval from regulator.	Construction	EPC Contractor
ENV21	Prohibit deliberate disturbance of killing of fauna by site workers - any unintentional killing or injury of species to be reported and tracked internally.	Construction	EPC Contractor
ENV22	Limit vegetation removal to the extent possible.	Construction	EPC Contractor
ENV23	Consider animal bypass around flowline construction zones, as deemed necessary.	Construction	EPC Contractor
ENV24	Restore habitats in temporary workspaces after construction activities are complete including returning the segregated topsoil to the site and restore ecology with native species.	Construction	EPC Contractor
ENV25	Reduce the time between construction and reinstatement for works undertaken in sensitive habitats to the extent possible.	Construction	EPC Contractor
ENV26	Ensure that the Waste Management Plan (WMP) provides for avoidance of waste storage or other waste management procedures that reduce potential forage by nuisance species.	Construction	EPC Contractor
ENV27	Undertake toolbox talks with staff to educate them on what species are likely to be present on-site and on correct actions to be taken if any animals are encountered.	Construction	EPC Contractor
ENV28	Limit office operations to daylight hours, where possible.	Operations	EPC Contractor
ENV29	Develop and implement a Lighting Plan (LP) for the new and existing faculties to limit spread by using directional lighting, hoods, etc. and only light the working areas.	Operations	EPC Contractor
ENV30	Discussion should be held with the Ministry of Natural Resources and other parties regarding the fate of buried pipelines which are sometimes left in place subsequent to decommissioning by agreement of all parties.	Construction	Pearl Petroleum
ENV31	This risk will be further reduced by recycling and reuse of materials/equipment where possible offsite.	Construction	Pearl Petroleum

Table A8.2 Social commitments register

UNIQUE ID / NUMBER	COMMITMENT	Phase (select from list)	Action Owner
SOC01	Prioritise the sourcing of goods and services from local and regional businesses, providing required quality and delivery timescales can be met.	Construction Pre-commissioning Decommissioning	Pearl Petroleum
SOC02	Support the development and capacity building of local and regional businesses, either directly or as part of government of sector-wide initiatives.	Construction Pre-commissioning Operations	Pearl Petroleum
SOC03	Compile an annual environmental and social performance report, made available to stakeholders, which details how local and regional businesses have been prioritised in the sourcing of goods and services and provided with capacity building support.	Construction Pre-commissioning Operations	Pearl Petroleum
SOC04	Prior to construction, undertake a benchmarking exercise to gather data on the average price of local basic good and services; use the data to monitor changes in the cost of goods and services against baseline conditions.	Construction Pre-commissioning Operations	Pearl Petroleum
SOC05	Implement a comprehensive Social Monitoring Plan that includes monitoring socio-economic changes in local communities (e.g. in living standards, household well-being and other daily necessities) through regular community meetings and through regular price surveys.	Construction Pre-commissioning Operations	Pearl Petroleum
SOC06	Undertake targeted engagement with vulnerable people should local price inflation become an issue. Design and implement additional support measures (e.g. the provision of goods to vulnerable people) on a case-by-case basis with support from third parties (e.g. development agencies) as appropriate.	Construction Pre-commissioning Operations	Pearl Petroleum
SOC07	Extend the existing Community Grievance Management Procedure to the KM250A Project to ensure that Project affected communities and other stakeholders have unrestricted access and opportunity to raise concerns and grievances related to the Project.	Construction Pre-commissioning Operations	Pearl Petroleum
SOC08	Develop an Influx Management Strategy (including a 'no hiring at the gate' policy), providing clear information on the scale, scope and process of accessing Project-related employment and business opportunities.	Construction	Pearl Petroleum EPC Contractor

SOC09	Provide information on the Project's recruitment strategy and key messages about the scale, scope and process of accessing Project-related employment and business opportunities to local communities to ensure that stakeholder expectations are suitably managed.	Construction	Pearl Petroleum
SOC10	Include similar information and messages in the worker codes of conduct in order to ensure that accurate information is conveyed to interested parties.	Construction	Pearl Petroleum
			EPC Contractor
SOC11	Ensure that the Social Monitoring Plan (see SOC05) includes monitoring changes in population size and the arrival of economic migrants .	Construction	Pearl Petroleum
SOC12	Work with, and where feasible support, local authorities in planning for and managing the spatial changes (e.g. in land use) and increasing demands on infrastructure and services that occur as the local area surrounding the Project grows.	Construction	Pearl Petroleum
SOC13	Prioritise employment of people from local communities, followed by people from other parts of the Kurdistan Region.	Construction	Pearl Petroleum
		Pre-commissioning	
		Operations	
SOC14	State the proportion of workers who will be hired from local communities and/or the wider region in order to maximise their employment opportunities.	Construction	EPC Contractor
		Pre-commissioning	
		Operations	
	Oversee Contractors' recruitment activities to ensure adherence to local hiring requirements.	Construction	Pearl Petroleum
		Pre-commissioning	
		Operations	
SOC15	Give information about the Project's recruitment strategy and key messages about the scale, scope and process of accessing Project-related employment and business opportunities to local communities to ensure that stakeholder expectations are suitably managed.	Construction	Pearl Petroleum
		Pre-commissioning	
		Operations	
SOC16	At the end of employment, formally recognise workers' involvement in the Project through the provision of references and/or certificates outlining workers' job role(s), the duration of their employment and other details (e.g. training undertaken) as appropriate.	Construction	Pearl Petroleum
			EPC Contractor
		Pre-commissioning	Pearl Petroleum
			EPC Contractor
		Operations	Pearl Petroleum
			EPC Contractor
SOC17	As part of the tendering process, include training and competency development in order to support capacity building amongst the Project workforce and within the Project supply chain, and provide formal recognition of this training for workers (e.g. through references and/or certifications) where possible.	Construction	EPC Contractor
		Pre-commissioning	
		Operations	

SOC18	Provide on-the-job training to the Project workforce in order to enable workers to gain new or improved skills and provide formal recognition of this training (e.g. through references and/or certifications) to workers where possible.	Construction Pre-commissioning Operations	Pearl Petroleum
SOC19	Ensure that the proportion of foreign workers is reduced and replaced by personnel who come from local communities and other parts of Kurdistan.	Construction Pre-commissioning Operations	Pearl Petroleum
SOC20	Gather data on average incomes associated with the public and private sector to benchmark wage levels in the local area; use the data to benchmark wage levels in the local area (this should be coordinated with SOC05).	Construction Pre-commissioning Operations	Pearl Petroleum
SOC21	Ensure that the Social Monitoring Plan (see SOC05) includes sources of employment and changes in wage levels.	Construction Pre-commissioning Operations	Pearl Petroleum
SOC22	Review the existing process for recruitment to ensure that it is able to cope with an increase in the number of jobs available as a result of the Project; make changes to the existing process as appropriate.	Construction Pre-commissioning Operations	Pearl Petroleum
SOC23	Where appropriate, develop a Local Community Employment Plan (LCEP), which will become part of the existing Local Goods and Services Plan, prioritising the employment of people from local communities, followed by people from other parts of the Kurdistan Region.	Construction Pre-commissioning	EPC Contractor
	Oversee contractors' recruitment activities to ensure adherence to local hiring requirements.	Construction Pre-commissioning	Pearl Petroleum
SOC24	Manage overall relationship with local communities through a range of strategies, including regular engagement and ongoing social investment. Include long-term capacity building and skills development programmes in the latter.	Construction Pre-commissioning Operations Decommissioning	Pearl Petroleum

SOC25	In the Local Community Employment Plan (see SOC23), include provisions to ensure that Project employment opportunities for local people reflect engagement with local authorities and are perceived to be equitably distributed across the communities through ongoing engagement with village Anjuman.	Construction	EPC Contractor
		Pre-commissioning	
		Operations	
SOC26	Internally review existing systems for managing conflict, for example grievances and road blocks, to ensure that they are sufficiently robust to manage conflicts which may arise as a result of the Project; make changes to existing systems as appropriate.	Construction	Pearl Petroleum
		Pre-commissioning	
		Operations	
SOC27	Develop retrenchment plans with the aim of ensuring social cohesion and reducing the impacts of the termination of employment contracts.	Construction	EPC Contractor
		Pre-commissioning	
		Decommissioning	
SOC28	During the recruitment process, and for the duration of their employment, ensure transparency with workers regarding the temporary nature of their employment on the Project and regularly remind workers of this fact. Clearly state the duration of workers' employment in their employment contracts and discuss with workers the need to prepare for the termination of their employment contracts. See also SOC22 and SOC23.	Construction	Pearl Petroleum
			EPC Contractor
		Pre-commissioning	Pearl Petroleum
			EPC Contractor
		Decommissioning	Pearl Petroleum
			Other contractor
SOC29	Select contractors through a robust pre-qualification and due diligence process and include standards on labour and working conditions, aligned with those prescribed by the International Finance Corporation (IFC), in all contractual documents.	Construction	Pearl Petroleum
		Pre-commissioning	
		Operations	
		Decommissioning	
SOC30	Ensure that KM250A worker grievance procedures are developed and implemented in compliance with Pearl Petroleum's overarching worker grievance procedure and are available for use by all workers.	Construction	EPC Contractor
		Pre-commissioning	EPC Contractor
		Decommissioning	Other contractor
	Approve contractors' worker grievance procedures (which should align with the existing Worker Grievance Management Procedure).	Construction	Pearl Petroleum
		Pre-commissioning	Pearl Petroleum
		Decommissioning	Other contractor
SOC31	Hold regular meetings (e.g. toolbox talks) with Project personnel, including contractor and sub-contractor employees, to ensure that workers are satisfied with their employment and workplace; provide opportunities for workers to raise concerns and report problems at these meetings.	Construction	Pearl Petroleum
		Pre-commissioning	Pearl Petroleum
		Operations	Pearl Petroleum
		Decommissioning	Pearl Petroleum

SOC32	As part of the worker induction process, explain to employees (including sub-contractor employees) their legal rights and entitlements alongside the content of their employment contracts.	Construction	EPC Contractor
		Pre-commissioning	EPC Contractor
		Operations	Other contractor
		Decommissioning	Other contractor
SOC33	Where appropriate and feasible, oblige each contractor to be transparent on their supply chain. Undertake a risk-based screening assessment to prioritise the types of goods and services to be procured; subject these goods and services to an audit against national and regional regulatory requirements and international standards.	Construction	Pearl Petroleum
		Pre-commissioning	Pearl Petroleum
		Decommissioning	Pearl Petroleum
SOC34	Develop and implement contractor Health and Safety Plans and Work Management Procedures that align with the existing Pearl Petroleum Occupational Health and Safety Plan.	Construction	EPC Contractor
		Pre-commissioning	EPC Contractor
		Decommissioning	Other contractor
	Approve contractors' Health and Safety Plans and Work Management Procedures; undertake auditing to ensure contractor compliance with these plans and procedures.	Construction	Pearl Petroleum
		Pre-commissioning	Pearl Petroleum
		Decommissioning	Pearl Petroleum
SOC35	Develop and implement Occupational Health and Safety (OHS) training programmes that are culturally and linguistically appropriate; update training programmes based on changes in the scope of work being undertaken, incident statistics and regulatory requirements.	Construction	Pearl Petroleum
			EPC Contractor
		Pre-commissioning	Pearl Petroleum
			EPC Contractor
		Operations	Pearl Petroleum
		Decommissioning	Pearl Petroleum
			Other contractor
SOC36	Ensure that remuneration is justified and adequate for the level of expertise and experience provided; include details of remuneration in employment contracts with workers (including sub-contractor workers).	Construction	EPC Contractor
		Pre-commissioning	
		Decommissioning	Other contractor
SOC37	Ensure that no Project land take will occur unless the process of the corresponding KRG agency has been completed such that timely compensation is paid to Project-affected persons (PAPs), including land users (e.g. livestock rearers). Pearl Petroleum to prevent access to land by Project personnel (including Pearl Petroleum staff, contractors and sub-contractors) if there is no consent or agreement in place. See also SOC38.	Construction	Pearl Petroleum
SOC38	Develop and implement a Livelihood Restoration Plan (LRP) to address the short- and long-term economic impacts from temporary and permanent (life of Project) loss of access to land. Include, in the LRP, a gap analysis of the differences between international standards and regional processes, principles of land access, an entitlements matrix based on a mitigation and compensation framework, details of the valuation of assets and establishment of compensation rates, the land access procedure, provisions for vulnerable people, Management of Change Procedure and monitoring and evaluation. Integrate the LRP (where relevant and appropriate to do so) with the Rental Value and Compensation Committee's own activities.	Construction	Pearl Petroleum

SOC39	Support the Livelihood Restoration Plan (LRP) by stakeholder engagement with the Project affected people (PAPs) to ensure that the livelihood restoration strategy is clearly explained and accepted, that the approach to legacy issues is clear and that PAPs understand that they are all treated equally. See also SOC38.	Construction	Pearl Petroleum
SOC40	Monitor the Livelihood Restoration Plan (LRP) for a period of up to five years following implementation to assess the effectiveness of livelihood restoration measures; implement corrective actions, as appropriate. See also SOC38.	Construction	Pearl Petroleum
SOC41	Agree a cut-off date with the Government prior to the commencement of survey activities for the Livelihood Restoration Plan (LRP) and clearly communicate the cut-off date to the Project affected people. See also SOC38.	Construction	Pearl Petroleum
SOC42	Develop and implement land entry, exit and reinstatement procedures on third party lands, including information to affected land owners and land users. See also SOC38.	Construction	EPC Contractor
SOC43	Seek to support the efforts of local authorities in resolving existing conflicts over land in the Project area.	Construction	Pearl Petroleum
SOC44	Undertake regular meetings with village Anjuman and local communities, including the Project affected people (PAPs), to ensure that information about the Project's land acquisition and compensation strategy is clearly communicated and that stakeholder concerns are effectively addressed. See also SOC05.	Construction	Pearl Petroleum
SOC45	Undertake pre-construction surveys to identify any watering wells and pasture land to which access must be maintained.	Construction	EPC Contractor
SOC46	Leave gaps in soil stacks and pipe stings along the right of way to ensure that access to watering wells and pasture land is maintained. Provide crossing points across open trenches and welded pipes as necessary.	Construction	EPC Contractor
SOC47	In the event that loss of access to watering wells and/or pasture land is unavoidable, provide alternative water supplies and pasture land/appropriate compensation in line with the Livelihood Restoration Plan (LRP). See also SOC38.	Construction	Pearl Petroleum
SOC48	Identify risks in health and safety plans and work management procedures and, within this, include provisions to ensure community safety, including safety barriers (e.g. fences) around open excavations to prevent local communities and livestock from falling into trenches.	Construction	EPC Contractor
SOC49	Post culturally appropriate safety signage and information in local communities and near to work sites to raise awareness about risks to the safety of persons and livestock.	Construction	Pearl Petroleum EPC Contractor
SOC50	Develop and implement a community safety awareness campaign in local communities with a particular focus on high-risk groups (e.g. children), potentially involving school visits to raise awareness on road safety risks.	Construction	Pearl Petroleum
SOC51	Where appropriate, develop a work-specific Traffic Management Plan (TMP) that aligns with the Pearl Petroleum Traffic Management Plan and that identifies sensitive social receptors along transportation routes and outlines mitigation measures (e.g. speed limit restrictions, vehicle maintenance activities, awareness campaigns, recruitment of traffic wardens) to reduce the risk of road traffic accidents occurring.	Construction	EPC Contractor

SOC52	Develop and implement Workers' Codes of Conduct (that aligns with the Pearl Petroleum Worker and Security Code of Conduct), inclusive of training for all Project personnel on local customs, culture and tradition, interacting with local communities, expected behaviour and the Community Grievance Management Procedure. Deliver training as part of the worker induction process and ensure that compliance with workers' codes of conduct is a contractual requirement for all employees.	Construction	EPC Contractor
		Pre-commissioning	
		Decommissioning	Other contractor
	Approve Workers' Codes of Conduct developed by contractors.	Construction	Pearl Petroleum
		Pre-commissioning	
		Decommissioning	
SOC53	Prohibit the out-of-hours movement of non-local workers (from other parts of Kurdistan or further afield) for reasons not related to work, in accordance with construction camp rules.	Construction	Pearl Petroleum
		Pre-commissioning	
		Decommissioning	
SOC54	Review established arrangements for security provision at the existing facility to ensure that they are sufficiently robust to manage security issues which may arise as a result of the Project; make changes to existing arrangements, as appropriate.	Construction	Pearl Petroleum
		Pre-commissioning	
		Decommissioning	
SOC55	Ensure that training for Project security personnel includes rules of engagement and human rights (e.g. the Voluntary Principles of Security and Human Rights).	Construction	Pearl Petroleum
		Pre-commissioning	
		Operations	
		Decommissioning	
SOC56	Undertake regular meetings with village Anjuman and local communities to ensure that information about the Project is clearly communicated and that stakeholder concerns are effectively addressed.	Construction	Pearl Petroleum
		Pre-commissioning	
		Operations	
SOC57	Ensure that the Social Monitoring Plan (see SOC05) provides for monitoring relations between local communities and the Project and any changes in perceptions towards Pearl Petroleum.	Construction	Pearl Petroleum
		Pre-commissioning	
		Operations	
		Decommissioning	
SOC58	Provide local communities with regular updates on the Project through community meetings; integrate reporting to local communities within the overarching Stakeholder Engagement Plan (SEP) implemented at the existing facility. See also SOC03 and SOC24.	Construction	Pearl Petroleum
		Pre-commissioning	
		Operations	
		Decommissioning	
SOC59	Review the KM250A Project Stakeholder Engagement Plan (SEP) periodically to ensure that information on Project activities such as the potential for non-routine flaring events to occur occasionally is included; make updates to the SEP, as appropriate.	Operations	Pearl Petroleum

SOC60	Include provisions in contractor Health and Safety Plans to ensure the fitness of workers (e.g. pre-deployment medical screenings which includes tests for communicable diseases) during the recruitment process.	Construction	EPC Contractor
		Pre-commissioning	
		Operations	
		Decommissioning	
SOC61	Include health and hygiene training for all employees, including sub-contractor employees, in health and safety plans to minimise the spread of communicable diseases.	Construction	EPC Contractor
		Pre-commissioning	
		Decommissioning	Other contractor
SOC62	Identify the risks to public health associated with their scope of work in Health and Safety Plans and detail mitigation measures as appropriate.	Construction	Pearl Petroleum
		Pre-commissioning	
		Operations	
		Decommissioning	
SOC63	Undertake a pre-construction survey to assess the condition of roads to be used by the Project (including but not limited to traffic signage, bridges and other road infrastructure).	Construction	Pearl Petroleum
			EPC Contractor
SOC64	Undertake a post-construction survey covering all of the areas surveyed pre-construction to assess the condition of roads and road-related infrastructure used by the Project; close out any actions (e.g. repairs) arising from the post-construction survey in a timely manner.	Construction	Pearl Petroleum
			EPC Contractor
SOC65	Include in In Traffic Management Plan(s) (TMPs) (see SOC51) any necessary restrictions on vehicle movements to defined access routes and demarcated work areas.	Construction	EPC Contractor
		Operations	
SOC66	As part of the worker induction process, communicate that medical assistance to all employees (including sub-contractor employees) is provided by the Project; prohibit workers from using local health services at this time.	Construction	EPC Contractor
		Pre-commissioning	
		Decommissioning	Other contractor

SOC67	Monitor water supplies in local communities against baseline conditions; integrate this monitoring into monitoring plans implemented at the existing facility.	Construction Operations	Pearl Petroleum
SOC68	Develop and implement water efficiency training programmes in local communities with the aim of promoting sustainable water consumption.	Construction Operations	Pearl Petroleum
SOC69	Undertake pre-construction surveys to identify community infrastructure (e.g. bridges, electricity pylons, power lines) which will need to be upgraded, moved or potentially damaged by the Project.	Construction	Pearl Petroleum EPC Contractor
SOC70	Communicate any planned activities which may affect community infrastructure (e.g. bridges, electricity pylons, power lines) to local authorities and affected communities in a timely manner; ensure that information provided stakeholders includes (but is not limited to) the nature, timing and duration of the planned activities.	Construction	Pearl Petroleum
SOC71	Repair any damage to community infrastructure in a timely manner.	Construction	EPC Contractor
SOC72	Request permission from the Erbil Directorate of Roads and Bridges to implement any road diversion; provide prior notification to the public and appropriate road signage before any road diversions.	Construction Operations Decommissioning	Pearl Petroleum
SOC73	Seek to avoid diversions during peak hours or creating blockages or diversions during peak activities on weekends.	Construction Operations Decommissioning	Pearl Petroleum
SOC74	Monitor the physical condition of the road on an as needed basis in order to raise concerns and work with the local governments to make repairs.	Construction Operations Decommissioning	Pearl Petroleum
SOC75	Provide targeted assistance, where possible and appropriate, to vulnerable groups identified in the KM250A Project Stakeholder Engagement Plan (SEP) to ensure that they have equal access to Project-related information and equal opportunities to raise questions and concerns.	Construction Pre-commissioning Decommissioning	Pearl Petroleum
SOC76	Ensure that recruitment processes for the Project are based on the skills required for the role with no discrimination according to age, sexuality or gender, ethnicity, religion and/or political opinion.	Construction Pre-commissioning Operations	Pearl Petroleum

SOC77	Continue to provide illiterate persons with additional support when applying for jobs on the Project.	Construction Pre-commissioning Operations	Pearl Petroleum
SOC78	Develop and implement a gender inclusion strategy (as part of the existing Pearl Petroleum Social Performance Standard) containing various measures to promote the inclusion of women in the Project. Consider including recruitment targets for women for contractors and sub-contractors, provisions to ensure women feel safe in the workplace and in Project accommodation and provisions to ensure that women are fairly engaged with during the recruitment process. Where appropriate and feasible, work in partnership with third parties (e.g. development agencies) to develop and implement the gender inclusion strategy.	Construction Pre-commissioning Operations	Pearl Petroleum
SOC79	Assess the potential risks that may be associated with women's participation in the Project and identify measures to mitigate these risks in the short-, medium- and long-term as part of the gender inclusion strategy. Consider targeted engagements with men to raise awareness about the benefits associated with women's involvement in the Project.	Construction Pre-commissioning Operations	Pearl Petroleum
SOC80	Undertake a comprehensive survey to establish the vulnerability of flowline land owners and land users as part of the Livelihood Restoration Plan (LRP) (see also SOC38).	Construction	Pearl Petroleum
SOC81	Based on the results of the survey, specify in the Livelihood Restoration Plan (LRP) additional support measures to ensure that vulnerable people are not disadvantaged during the Project land acquisition and compensation process (see also SOC38).	Construction	Pearl Petroleum
SOC82	Ensure that the KM250A Project Stakeholder Engagement Plan (SEP) provides special measures, where possible and appropriate, to ensure that women have equal access to Project-related information and equal opportunities to raise questions and concerns.	Construction Pre-commissioning Operations	Pearl Petroleum
SOC83	Develop and implement a targeted community information campaign on hydrotesting to ensure that local communities understand the noise, water and any other impacts associated with this exercise.	Pre-commissioning	Pearl Petroleum
SOC84	Seek to maximise the Project's contribution to the development of Kurdistan's oil and gas sector and regional economic growth through, for example, considering opportunities to work with universities as part of its Social Investment Programmes.	Operations	Pearl Petroleum
SOC85	Develop a draft plan for providing transition training to allow skilled employees to better access employment in other sectors; evaluate the level of interest in such training amongst workers prior to the finalisation and implementation of the plan.	Operations	Pearl Petroleum
SOC86	Where the Project affects the livelihood activities of crop farmers, provide appropriate compensation in line with the Livelihood Restoration Plan (LRP).	Operations	Pearl Petroleum

SOC87	Post culturally appropriate safety warnings and information in local communities and near to Project infrastructure to raise awareness about the risks of interfering or tampering with Project infrastructure.	Operations	Pearl Petroleum
SOC88	Develop and implement community safety awareness campaigns in local communities with the aim of discouraging interference or tampering with Project infrastructure.	Operations	Pearl Petroleum
SOC89	Develop and implement measures to reduce the impact of night-time non-routine flaring, for example installation of glazed windows or shades for residences with a clear view of flare flames.	Operations	Pearl Petroleum
SOC90	Develop and implement programmes which promote the long-term sustainability and independence of communities. Consider the avoidance of dependency will in the design of all Social Investment Programmess (SIPs) and consider planning for the end of Pearl Petroleum interventions from the outset.	Decommissioning	Pearl Petroleum
SOC91	Consider technical solutions to sharing costs and accountability for the provision of power and water.	Decommissioning	Pearl Petroleum
SOC92	Consider prioritising social investment that diversifies the local economy and reduces local communities' reliance on Pearl Petroleum at Khor Mor.	Decommissioning	Pearl Petroleum
SOC93	Consider skills and training to support regional development priorities.	Decommissioning	Pearl Petroleum
SOC94	Consider strategic engagement structures, such as community committees and participatory monitoring, to build community capacity to manage their development.	Decommissioning	Pearl Petroleum
SOC95	Consider leveraging its operations at Khor Mor to encourage other development actors to engage in the area.	Decommissioning	Pearl Petroleum
SOC96	Consider working in partnership with third parties (e.g. development agencies) to implement its Social Investment Programmes (SIPs).	Decommissioning	Pearl Petroleum