Attachment - 11 List of Important Bird Areas

Site No.	Site Name	Coordinates	
		Latitude (N)	Longitude (E)
001	Benavi	37 20	43 25
002	Dori Serguza	37 20	43 30
003	Ser Amadiya	37 10	43 22
004	Bakhma, Dukan and Darbandikhan dams	36 10	44 55
005	Huweija marshes	35 15	43 50
006	Anah and Rawa	34 32	41 55
007	Mahzam and Lake Tharthar	34 20	43 22
008	Samara dam	34 15	43 50
009	Abu Dalaf and Shari lake	34 15	44 00
010	Augla, Wadi Hauran	33 55	41 02
011	Baquba wetlands	33 55	44 50
012	Gasr Muhaiwir, Wadi Hauran	33 33	41 14
013	Attariya plains	33 25	44 55
014	Abu Habba	33 20	44 20
015	Al Jadriyah and Umm Al Khanazeer island	33 20	44 24
016	Haur Al Habbaniya and Ramadi marshes	33 16	43 30
017	Haur Al Shubaicha	33 15	45 18
018	Al Musayyib - Haswa area	32 48	44 17
019	Hindiya barrage	32 42	44 17
020	Haur Al Suwayqiyah	32 42	45 55
021	Bahr Al Milh	32 40	43 40
022	Haur Al Abjiya and Umm Al Baram	32 28	46 05
023	Haur Delmaj	32 20	45 30
024	Haur Sarut	32 19	46 46
025	Haur Al Sa'adiyah	32 10	46 38
026	Haur Ibn Najim	32 08	44 35
027	Haur Al Hachcham and Haur Maraiba	32 05	46 12
028	Haur Al Haushiya	32 05	46 54
029	Shatt Al Gharraf	31 57	46 00
030	Haur Chubaisah area	31 56	47 20
031	Haur Sanniya	31 55	46 48
032	Haur Om am Nyaj	31 45	47 25

Site No.	Site Name	Coordinates	
		Latitude (N)	Longitude (E)
033	Haur Al Rayan and Umm Osbah	31 40	47 01
034	Haur Auda	31 33	46 51
035	Haur Uwainah	31 25	46 20
036	Haur Al Hawizeh	31 22	47 38
037	Haur Lafta	31 21	45 30
038	Central Marshes	31 10	47 05
039	Haur Al Hammar	30 44	47 03
040	Shatt Al Arab marshes	30 27	47 58
041	Khawr Al Zubair	30 12	47 54
042	Khawr Abdallah	29 55	48 32

Evans, M.I. (1994). Important Bird Areas in the Middle East. BirdLife International, Cambridge, UK.

Attachment - 12 IUCN Redlist Species (2010) in Iraq

IUCN Redlist Species (2010) in Iraq

1. Mammals (terrestrial mammals)

No.	Scientific name	English name	Status	Population trend
1	Acinonyx jubatus	Cheetah	Vulnerable	decreasing
2	Allactaga euphratica	Euphrates Jerboa	Near Threatened	decreasing
3	Dama mesopotamica	Persian Fallow Deer	Endangered	increasing
4	Equus hemionus	Asiatic Wild Ass	Endangered	decreasing
5	Gazella subgutturosa	Goitered Gazelle	Vulnerable	decreasing
6	Hyaena hyaena	Striped Hyaena	Near Threatened	decreasing
7	Lutra lutra	Eurasian Otter	Near Threatened	decreasing
8	Lutrogale perspicillata	Smooth-coated Otter	Vulnerable	decreasing
9	Myotis capaccinii	Long-fingered Bat	Vulnerable	decreasing
10	Nesokia bunnii	Bunn's Short-tailed Bandicoot Rat	Endangered	decreasing
11	Oryx leucoryx	Arabian Oryx	Endangered	decreasing
12	Panthera leo	Lion	Vulnerable	decreasing
13	Rhinolophus euryale	Mediterranean Horseshoe Bat	Near Threatened	decreasing
14	Rhinolophus mehelyi	Mehely's Horseshoe Bat	Vulnerable	decreasing
15	Vormela peregusna	European Marbled Polecat	Vulnerable	decreasing

IUCN 2010. IUCN Red List of Threatened Species. Version 2010.4. <www.iucnredlist.org>. Downloaded on 06 June 2011

2. Birds

No.	Scientific name	English name	Status	Population trend
1	Acrocephalus griseldis	Basra Reed-warbler	Endangered	decreasing
2	Aegypius monachus	Cinereous Vulture	Near Threatened	decreasing
3	Anser erythropus	Lesser White-fronted Goose	Vulnerable	decreasing
4	Aquila clanga	Greater Spotted Eagle	Vulnerable	decreasing
5	Aquila heliaca	Eastern Imperial Eagle	Vulnerable	decreasing

No.	Scientific name	English name	Status	Population trend
6	Aythya nyroca	Ferruginous Duck	Near Threatened	decreasing
7	Branta ruficollis	Red-breasted Goose	Endangered	decreasing
8	Chlamydotis undulata	Houbara Bustard	Vulnerable	decreasing
9	Circus macrourus	Pallid Harrier	Near Threatened	decreasing
10	Coracias garrulus	European Roller	Near Threatened	decreasing
11	Emberiza cineracea	Cinereous Bunting	Near Threatened	decreasing
12	Falco cherrug	Saker Falcon	Vulnerable	N/A
13	Falco naumanni	Lesser Kestrel	Vulnerable	decreasing
14	Falco vespertinus	Red-footed Falcon	Near Threatened	N/A
15	Ficedula semitorquata	Semi-collared Flycatcher	Near Threatened	decreasing
16	Gallinago media	Great Snipe	Near Threatened	N/A
17	Geronticus eremita	Northern Bald Ibis	Critically Endangered	N/A
18	Glareola nordmanni	Black-winged Pratincole	Near Threatened	decreasing
19	Haliaeetus leucoryphus	Pallas's Fish-eagle	Vulnerable	decreasing
20	Limosa limosa	Black-tailed Godwit	Near Threatened	decreasing
21	Marmaronetta angustirostris	Marbled Teal	Vulnerable	decreasing
22	Neophron percnopterus	Egyptian Vulture	Endangered	decreasing
23	Numenius arquata	Eurasian Curlew	Near Threatened	decreasing
24	Numenius tenuirostris	Slender-billed Curlew	Critically Endangered	N/A
25	Otis tarda	Great Bustard	Vulnerable	decreasing
26	Oxyura leucocephala	White-headed Duck	Endangered	decreasing
27	Pelecanus crispus	Dalmatian Pelican	Vulnerable	decreasing
28	Serinus syriacus	Syrian Serin	Vulnerable	decreasing
29	Tetrax tetrax	Little Bustard	Near Threatened	N/A
30	Vanellus gregarius	Sociable Lapwing	Critically Endangered	N/A

IUCN 2010. IUCN Red List of Threatened Species. Version 2010.4. <www.iucnredlist.org>. Downloaded on 06 June 2011

3. Reptiles

No.	Scientific name	English name	Status	Population trend
1	Carinatogecko heteropholis	Iraqui Keel-scaled Gecko	Data Deficient	unknown
2	Eublepharis angramainyu	N/A	Data Deficient	decreasing
3	Montivipera raddei	Armenian Viper, Radde's (Rock) Viper	Near Threatened	decreasing
4	Rafetus euphraticus	Euphrates Softshell Turtle	Endangered	(needs updating)
5	Testudo graeca	Spur-thighed Tortoise	Vulnerable	(needs updating)

IUCN 2010. IUCN Red List of Threatened Species. Version 2010.4. <www.iucnredlist.org>. Downloaded on 06 June 2011

4. Amphibians

No.	Scientific name	English name	Status	Population trend
1	Neurergus crocatus	N/A	Vulnerable	decreasing
2	Pseudepidalea variabilis	N/A	Data Deficient	unknown
3	Salamandra infraimmaculata	Arouss Al Ayn	Near Threatened	N/A

IUCN 2010. IUCN Red List of Threatened Species. Version 2010.4. <www.iucnredlist.org>. Downloaded on 06 June 2011

5. Fresh Water Fish

No.	Scientific name	English name	Status	Population trend
1	Caecocypris basimi	N/A	Vulnerable	(needs updating)
2	Typhlogarra widdowsoni	N/A	Vulnerable	(needs updating)

IUCN 2010. IUCN Red List of Threatened Species. Version 2010.4. <www.iucnredlist.org>. Downloaded on 06 June 2011

Attachment - 13 World Heritage Sites

World Heritage Sites

Information from UNESCO World Heritage Centre

1. Hatra

Governorate of Ninawa

Coordinates: N35 35 17.016 E42 43 5.988

Date of Inscription: 1985

Criteria: (ii)(iii)(iv)(vi)

Property : 324 ha

Brief description of the site: A large fortified city under the influence of the Parthian Empire and capital of the first Arab Kingdom, Hatra withstood invasions by the Romans in A.D. 116 and 198 thanks to its high, thick walls reinforced by towers. The remains of the city, especially the temples where Hellenistic and Roman architecture blend with Eastern decorative features, attest to the greatness of its civilization

2. Ashur (Qal'at Sherqat)

Governorate of Salah ad Din

Coordinates: N35 27 32.004 E43 15 34.992

Date of Inscription: 2003

Criteria: (iii)(iv)

Property : 70 ha

Buffer zone: 100 ha

Brief description of the site: The ancient city of Ashur is located on the Tigris River in northern Mesopotamia in a specific geo-ecological zone, at the borderline between rain-fed and irrigation agriculture. The city dates back to the 3rd millennium BC. From the 14th to the 9th centuries BC it was the first capital of the Assyrian Empire, a city-state and trading platform of international importance. It also served as the religious capital of the Assyrians, associated with the god Ashur. The city was destroyed by the Babylonians, but revived during the Parthian period in the 1st and 2nd centuries AD.

3. Samarra Archaeological City

Samarra Township, Salah al-Din Governorate

Coordinates: N34 20 27.562 E43 49 24.755

Date of Inscription: 2007

Criteria: (ii)(iii)(iv)

Property : 15,058 ha

Buffer zone: 31,414 ha

Brief description of the site: Samarra Archaeological City is the site of a powerful Islamic capital city that ruled over the provinces of the Abbasid Empire extending from Tunisia to Central Asia for a century. Located on both sides of the River Tigris 130 km north of Baghdad, the length of the site from north to south is 41.5 km; its width varying from 8 km to 4 km. It testifies to the architectural and artistic innovations that developed there and spread to the other regions of the Islamic world and beyond. The 9th-century Great Mosque and its spiral minaret are among the numerous remarkable architectural monuments of the site, 80% of which remain to be excavated

4. Proposed World Heritage Sites (IRAQ FOURTH NATIONAL REPORT TO THE CONVENTION ON BIOLOGICAL DIVERSITY (2010))

(1) Ur
Date of Submission: 07/07/2000
Criteria: (i)(iii)(iv)
Category: Cultural
Submitted by: Department of Antiquities and Heritage
Coordinates: 17 km south-east of the city of Nassiriya

(2) Nimrud
Date of Submission: 07/07/2000
Criteria: (i)(ii)(iii)
Category: Cultural
Submitted by: Department of Antiquities and Heritage
Coordinates: 34 km south of Mosul

(3) Ancient City of Nineveh
Date of Submission: 07/07/2000
Criteria: (i)(ii)(iii)(iv)(v)(vi)
Category: Cultural
Submitted by: Department of Antiquities and Heritage
Coordinates: 410 km north of the city of Bagdad on the eastern bank of the River Tigris

(4) Fortress of Al-Ukhaidar
Date of Submission: 07/07/2000
Criteria: (i)(ii)
Category: Cultural

Submitted by: Department of Antiquities and Heritage

Coordinates: 50 km south-west of Karbala

(5) Wasit

Date of Submission: 07/07/2000

Criteria: (i)(ii)(iv)

Category: Cultural

Submitted by: Department of Antiquities and Heritage

Coordinates: 54 km from the centre of Kut, along UM Adejail/Road

(6) Sacred Complex of Babylon

Date of Submission: 29/10/2003

Criteria: (iii)(vi)

Category: Cultural

Submitted by: Ministry of Culture

Coordinates: The site, part of the larger archaeological area of Babylon, is situated 90 km south of Baghdad, on the east of the Euphrates River, around 320 km above its junction with the Tigris.

(7) Marshlands of Mesopotamia

Date of Submission: 29/10/2003

Category: Mixed

Submitted by: Ministry of Culture

Coordinates: 31°-32° N - 46°5'-47°5' E

(8) Erbil Citadel

Date of Submission: 08/01/2010

Criteria: (i)(ii)(iii)(iv)(v)

Category: Cultural

Submitted by: High Commission for Erbil Citadel Revitalization & State Board for Antiquities and Heritage

State, Province or Region: Kurdistan Region

Coordinates: N36 11 23 E44 00 35

(9) Site of Thilkifl

Date of Submission: 21/01/2010

Criteria: (i)(ii)(iii)(iv)(v)(vi)

Category: Cultural

Submitted by: The State Board of Antiquities and Heritage

State, Province or Region: Babel (Al-Hilla), Al-Kifil sub-district.

Coordinates: N32 13 37 E44 22 02

(10) Amedy City

Date of Submission: 02/02/2011

Criteria: (i)(ii)(iii)(vii)(viii)

Category: Mixed

Submitted by: Permanent Delegation of Republic of Iraq to UNESCO

State, Province or Region: Kurdistan Region

(11) Wadi Al-Salam Cemetery in Najaf

Date of Submission: 24/01/2011

Criteria: (iii)(v)(vi)

Category: Cultural

Submitted by: Permanent Delegation of Iraq to UNESCO

State, Province or Region: Al-Najaf region, Al-Najaf province

Coordinates: N32 00 00 E44 18 59

Attachment - 14 Study on Environmental and Social Considerations Terms of Reference (TOR)

The Preparation Study for Development of Southern Large Scale Thermal Power Plant in Iraq

Study on Environmental and Social Considerations Terms of Reference (TOR)

1. Institutional Structure of the Study on Environmental and Social Considerations

The institutional structure of the Study on Environmental and Social Considerations (SESC) is shown as Figure 1.

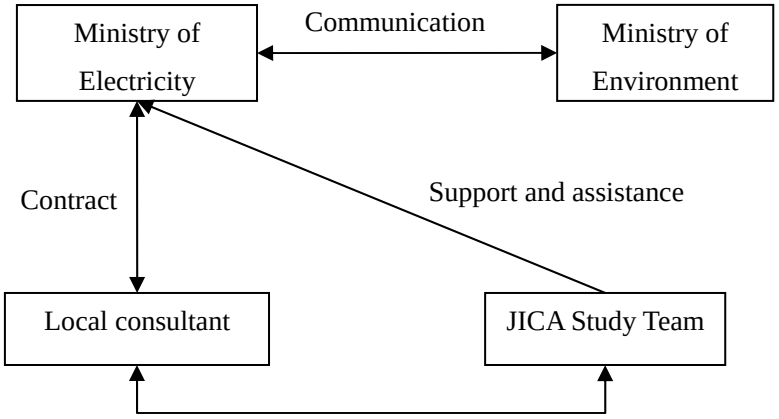

Figure 1. Institutional Structure

Ministry of Electricity (MOE) takes overall responsibility for the SESC in close communication with the Ministry of Environment (MOEN). The Local Consultant (LC) is employed by MOE and is responsible for conducting the SESC, writing and editing an Environmental Impact Assessment (EIA) Report and reporting to MOE. The JICA Study Team assists MOE and the LC to conduct the SESC, of which tasks include collecting some baseline data and writing some parts of the EIA Report. Detailed tasks of each team are described in “4. Tasks of each team”.

2. Scope and Period of the SESC

2.1 Scope of the SESC

The main purpose of the SESC of the Project is to formulate an EIA Report of the Feasibility Study (F/S) site for the Project. The SESC has the following four main components:

1) Collecting information on the Social environment conditions around the F/S site.

2) Reviewing EIA procedure in Iraq

- To review the existing studies for confirming compliance status of environmental and social considerations for the Project, and highlighting items, which require additional considerations accordance to "JBIC Guidelines for Confirmation of Environmental and Social Considerations".
- To confirm the existing national EIA procedure, and to formulate the EIA Report and to conduct stakeholder meetings concerning the EIA.

3) Assessing environmental impacts

- To assess the negative impacts induced by the Project.
- To propose mitigation measures to avoid and minimize the impacts.

4) Preparing the "JICA Environmental Checklist and "Monitoring Sheet" for the Project.

The SESC shall cover the F/S site and its surrounding area. MOE and LC should consult with the Provincial MOEN about the extent of the area for the SESC. Figure 2 shows the F/S site.

Figure 2. F/S site for Nasiriyah II Thermal Plant

2.2 Period of the SESC

The entire period of the ESC is from 1 November 2011 to 15 March 2011.

3. Scope of the SESC

The SESC specifically aims;

- To assist the Ministry of Electricity to conduct a stakeholder meetings (i.e. public consultation) on the EIA of the F/S site;
- To conduct study on the F/S site to collect more detailed data on the social environment in and around the F/S site;
- To assess the potential impacts that might be generated during the construction and operation phases of the Project;
- To formulate necessary mitigation measures against the potential negative impacts due to the project implementation to avoid and minimize them;
- To prepare an environmental monitoring plan so that MOE can prevent environmental negative impacts and take necessary actions during the project implementation; and,
- To formulate the EIA Report, this should be adequate to obtain an environmental approval from the Government of Iraq.

4. Tasks of each team

4.1 Ministry of Electricity

MOE is responsible for smooth implementation of the SESC and has the following tasks;

- To employ a local consultant according to Iraq laws to conduct the SESC;
- To coordinate other two teams namely, the LC and the JICA Study Team;
- To collaborate with MOEN to conduct the SESC;
- To conduct two public consultation meetings to explain the Project and Environmental and Social Considerations to the relevant people and organizations around the F/S site;
- To check the contents of the EIA Report; and
- To submit the EIA Report to MOEN to obtain an environmental approval for the Project.

4.2. Local consultant

LC is responsible for conducting the SESC and has the following tasks;

- To confirm the latest legal framework of EIA system in Iraq and its procedure;
- To facilitate meetings between MOE and the Provincial Office of MOEN;
- To conduct an social environmental survey around the F/S site;
- To assess the potential impacts that might be generated during the construction and

operation phases of the Project;

- To formulate necessary mitigation measures against the potential negative impacts due to the project implementation to avoid and minimize them;
- To assist MOE to conduct two public consultation meetings for the Project;
- To write some parts of the Report and hand them over to the JICA Study Team to check the contents;
- To check the contents of some parts of the Report which are written by the JICA Study Team;
- To formulate a draft EIA Report for the final check by MOE; and
- To reflect comments from MOE and to formulate the final EIA Report for the submission to MOE.

4.3. JICA Study Team

The JICA Study Team assists MOE and the LC to conduct the SESC and has the following tasks;

- To write some parts of the EIA Report by utilizing data collected and hand them over to the LC for their scrutiny;
- To comment on the parts of the EIA Report written by the LC;
- To communicate with MOE for smooth implementation of the SESC; and,
- To assist the LC and MOE to formulate the “JICA Environmental Checklist (Appendix 1)” and “Monitoring Sheet (Appendix 2)” for the Project

Responsible parts of the EIA Report for the LC and the JICA Study Team are described in “5. Contents of the SESC – 5.1 Contents of the EIA Report”.

5. Contents of the SESC

5.1 Contents of the EIA Report

The Contents of the EIA Report with responsible teams (LC and JICA Study Team) are described in Table 1 from the next page.

Table 1 Contents of the EIA Report with responsible teams (LC and JICA Study Team)

No	Title	Description	Sub-title	Responsible team	
				LC	JICA Study Team
1	Executive Summary	Concisely discusses significant findings and recommended actions.		MAIN AUTHOR	Checks the contents.
2	Introduction	Concisely introduces the Project and the Report		MAIN AUTHOR	Checks the contents.
3	Policy, legal and administrative framework	Discusses the policy, legal and administrative framework within which the EIA study is to be carried out.		Checks the contents	MAIN AUTHOR
4	Project description	Describes the Project and its geographic, ecological, social and temporal context, including any off-site investments that may be required.		Checks the contents	MAIN AUTHOR
5	Approach and Methodology	Describes the EIA methodology briefly.		MAIN AUTHOR	Checks the contents.
6	Baseline data	Describes relevant physical, biological and socio-economic conditions, including all changes anticipated before the project commences. Additionally, takes into account current and proposed development activities within the project area but not directly connected to the project. Data should be relevant to decisions about the Project.	6.1. General description of the environments of Iraq	Checks the contents	MAIN AUTHOR
			6.2. Description of the	-Natural and social	-Natural and social

No	Title	Description	Sub-title	Responsible team	
				LC	JICA Study Team
			environments around the site (Physical, natural and social environments)	environment: MAIN AUTHOR -Physical environment (water, air, noise and vibration): checks the contents	environment: Checks the contents -Physical environment (water, air, noise and vibration): MAIN AUTHOR
			6.3. Simulation of emissions (SOx and NOx)	MAIN AUTHOR Conducts the simulation	Checks the contents
7	Analysis of alternatives	Systematically compares feasible alternatives to the proposed project site, technology, design and operation including the "without project" situation in terms of their potential environmental impacts. For each of the alternatives, quantifies the environmental impacts to the extent possible, and attaches economic values where		Checks the contents	MAIN AUTHOR Zero option, site selection and selection

No	Title	Description	Sub-title	Responsible team	
				LC	JICA Study Team
		feasible. States the basis for selecting the particular project design proposed and offers justification for recommended emission levels and approaches to pollution prevention and abatement.			of equipment and system
8	Environmental Impacts	Predicts and assesses the project's likely positive and negative impacts, in quantitative terms to the extent possible. Identifies mitigation measures and any negative environmental impacts that cannot be mitigated. Explores opportunities for environmental enhancement. Identifies and estimates the extent and quality of available data, essential data gaps and uncertainties associated with predictions, and specifies topics that do not require further attention.		MAIN AUTHOR	Checks the contents
9	Environmental Management Plan (EMP)	Describes mitigation, monitoring and institutional measures (including their rough budgets) to be taken during construction and operation to eliminate adverse impacts, offset them, or reduce them to acceptable levels.		MAIN AUTHOR	Checks the contents
10	Consultation	Record of consultation meetings, including consultations for obtaining the informed views of the affected people, local non-governmental organizations (NGOs) and regulatory agencies.		MAIN AUTHOR	Checks the contents
11	Conclusions	Describes the conclusions and recommendations derived from the discussions in the previous chapters. This chapter also describes a		MAIN AUTHOR	Checks the contents

No	Title	Description	Sub-title	Responsible team	
				LC	JICA Study Team
		future schedule of the EMP according to the implementation schedule of the Project. It shall include review of the EMP, employment of staff for EMP implementation, periodical monitoring reports and other exercise.			

5.2 Contents of a social environmental survey around the F/S site

The LC conducts a social environmental survey around the F/S site as part of "6. Baseline data – 6.2 Description of the environments around the site" of the EIA Report described above. The survey items are described in Table 2.

Table 2 Items for the social environmental survey around the F/S site

Survey item	Contents
Demographic status	➢ statistic data on population
Land use	➢ current use pattern ➢ land use plan
Regional economy	➢ development plan ➢ status of employment ➢ current status of other industries (e.g. agriculture and fisheries) in the area
Utilization of river	➢ transportation, fisheries and others ➢ issue on water right
Status of infrastructure (status and their locations from the site)	➢ roads, bridges, railway ➢ public infrastructure such as hospitals and schools
Solid waste management	➢ responsible body in the province and the city ➢ current status of dumping site(s) ➢ current waste management treatment system (non-hazardous and hazardous wastes) of the existing Nasiriyah Thermal Plant and other industrial plants

5.3 Simulation of emissions

The LC conducts a simulation of emissions from the proposed thermal plant as part of "6. Baseline data – 6.3. Simulation of emissions (SOx and NOx) " of the EIA Report described above. The data for the simulation will be provided by the JICA Study Team by the end of November 2011.

5.4 Environmental impacts

The LC assesses the extent/significance of anticipated impacts that might be likely generated during both the construction and operation stages of the Project. The impacts shall be estimated quantitatively by using the baseline information. Table 3 (page 11) is a draft scoping table of the Project. The LC checks the contents of the table and revises it if necessary. Based on the revised table, the LC conducts the assessment.

If no impact is expected, its reason should be clearly described using the Project description and baseline data; why no impact is expected.

Cumulative impacts

Since the F/S site is part of the existing power plant, the cumulative impacts caused by the proposed and existing plants are carefully assessed and mitigated.

Table 3 Scoping (DRAFT) for the F/S site

			Construction Stage	Operation Stage
Environmental Pollution	1	Air pollution	✓ Temporally air pollution is expected by construction heavy vehicles and other equipment. Dust from soil needs to be considered.	✓ Emission from the thermal plant is expected.
	2	Water pollution	✓ Water pollution is expected from construction heavy vehicles, equipment, workshops and workers quarters.	✓ Water pollution is expected from the thermal plant.
	3	Solid waste	✓ Construction wastes are expected.	✓ Wastes are expected from the thermal plant.
	4	Noise/Vibration	✓ Noise and vibration are expected from construction heavy vehicles, equipment, and workshops.	✓ Noise and vibration are expected especially from the generators.
	5	Odor		
Natural Environment	6	Climate		
	7	Hydrology		
	8	Flood		
	9	Underground water		
	10	Ground subsidence		
	11	Soil erosion	✓ During the construction, soil erosion by wind is expected.	
	12	Protected areas		

			Construction Stage	Operation Stage
	13	Terrestrial ecosystems		
	14	River ecosystems	✓ If the intake needs to be extended to the middle of the river, disturbance is expected.	
	15	Endangered species		
	16	Global warming		✓ CO_2 emission increases.
Social Environment	17	Involuntary resettlement		
	18	Employment/livelihood	✓✓ For the construction works, many workers are expected to be employed.	
	19	Local economy	✓✓ For the construction works, many workers are expected to be employed.	✓ The thermal plant can give positive impact to the local economy.
	20	Land utilization		
	21	Social infrastructure/service facilities	✓ A road runs through the proposed site, and it needs to be diverted. Road works need to be carefully planned to give least negative impacts to the local people. Locations of hospitals and schools need to be checked. If they are close to the site, appropriate mitigation measures should be taken.	
	22	River traffic		✓(?) If there is river transportation, the intake may give negative impact to the traffic in dry season.

			Construction Stage	Operation Stage
	23	Land traffic	✓ See the "21 Social infrastructure/service facilities".	
	24	Sanitation	✓ Water pollution is expected from workers quarter.	
	25	Risks for infectious diseases such as HIV/AIDS	✓ There is a risk that immigrants for the construction works may bring in these infectious diseases.	
	26	Local custom		
	27	Burden on socially vulnerable groups		
	28	Uneven distribution of benefits and losses		
	29	Utilization /Right of water, including groundwater		✓(?) The water right of the river needs to be checked..
	30	Cultural heritage		
	31	Landscape		✓ The thermal plant gives negative to the landscape.
	32	Accident	✓ Road accidents need to be avoided by appropriate measures. Accidents at the construction site may be expected, and safety procedures should be employed.	✓ Accidents at the thermal plant may be expected, and safety procedures should be employed.

✓✓: Big impact is expected. ✓Some impact is expected. No mark: No impact. (?) needs more investigation.

5.5 Environmental management plan

The LC describes mitigation, monitoring and institutional measures (including their rough budgets) to be taken during construction and operation to eliminate adverse impacts, offset them, or reduce them to acceptable levels. In particular, it describes institutional organization for environmental management during construction and operation stages. In the Report, it is required to show organizational chart and responsibilities and tasks of division/staff.

5. 6 Public consultation meetings

The LC is responsible for assisting MOE to conduct two public meetings as part of "8. Consultation" of the EIA Report described above. The 1st meeting shall be held before commencing the SESC to explain the Project and the rough contents of the SESC, and the 2nd meeting shall be held after the Draft EIA Report is completed to explain the results of SESC such as the expected impacts and their mitigation measures, and monitoring plan.

Their venue, participants, contents will be decided in close consultation with MOE and MOEN. The LC is required to facilitate the process with MOE and MOEN.

The Minutes of Meeting should be attached to the EIA Report. They should contain the following contents;

- Dates and places of consultation
- Total number of attendance of consultation
- Types of participants (e.g. local residents, local authorities, councilor, etc.)
- How and why the participants are selected
- Contents of the explanations (materials shown or distributed to the participants should be attached to the EIA Report)
- Opinions/comments expressed by the participants, and the answer of MOE
- Reflection of the comments to the Project; this section can be described in the following table.

Table 4 Reflection of the comments to the Project

	Commenter	Comments/Opinions	Responses to the Comments	Reflection of the comments to the project
1.				
2.				
3.				
4.				

5.				

6. Reporting and Reports

The LC reports the progress status of the SECS once a week to MOE, and MOE informs it to the JICA Study Team.

The LC is required to submit the products as listed below.

- Progress report of the SECS
- Draft EIA report
- Final EIA report with necessary data as appendices

All products shall be written in English with adequate proof reading, and be written by MS Word in A4 size paper. The font shall be Times New Roman in the size of 11 with adequate space. The LC submits them in both hard copy and digital formatted copy.

Whenever datum (or data) from other sources are used in the Report, adequate citation is required. Photographs from internet are not allowed to used in the Report since it is against the international law on intellectual property right.

6. Schedule of the SESC

Table 5 and Figure 3 shows the schedule of the SESC.

Table 5 Schedule of the SESC

Month	MOE	LC	JICA Study Team
October, 2011	- By the end of October, MOE employs the LC		- By the end of October, it submits the Project Profile to MOE
November, 2011	- 1st public consultation meeting	- 1st public consultation meeting - Survey on social environment of F/S site - Submission of Progress Report to	

Month	MOE	LC	JICA Study Team
	- 3rd Mission	MOE (by 15/Nov/2011, before the 3rd Mission)	- It submits the Interim Report including part of EIA Report at the 3rd Mission
December, 2011		- It submits the comments on the Interim Report to MOE and the JICA Study Team. - It conducts the SESC especially on impact assessment, and formulates the 1st Draft EIA Report. - It submits the 1st Draft EIA Report by 25/ Dec/2011 to MOE and the JICA Study Team.	- It submits comments on Progress Report to MOE and the LC in early December.
January, 2012	- 4th Mission	- It formulates the Draft EIA Report, and submits it to MOE & JICA Study Team by 15/Jan/2012.	- It submits comments on the 1st Draft EIA Report to MOE and the LC by 10/Jan/2012. - 4th Mission
February, 2012	- 2nd Public consultation meeting	- 2nd Public consultation meeting	- It submits the comments on the Draft

Month	MOE	LC	JICA Study Team
		- It reflects the comments to the EIA Report, and submits it to MOE and the JICA Study Team by the end of February 2012.	EIA Report to MOE and the LC in early February.
March, 2012	- It confirms the contents of the EIA Report, and submits it to MOEN by the end of March 2012.		

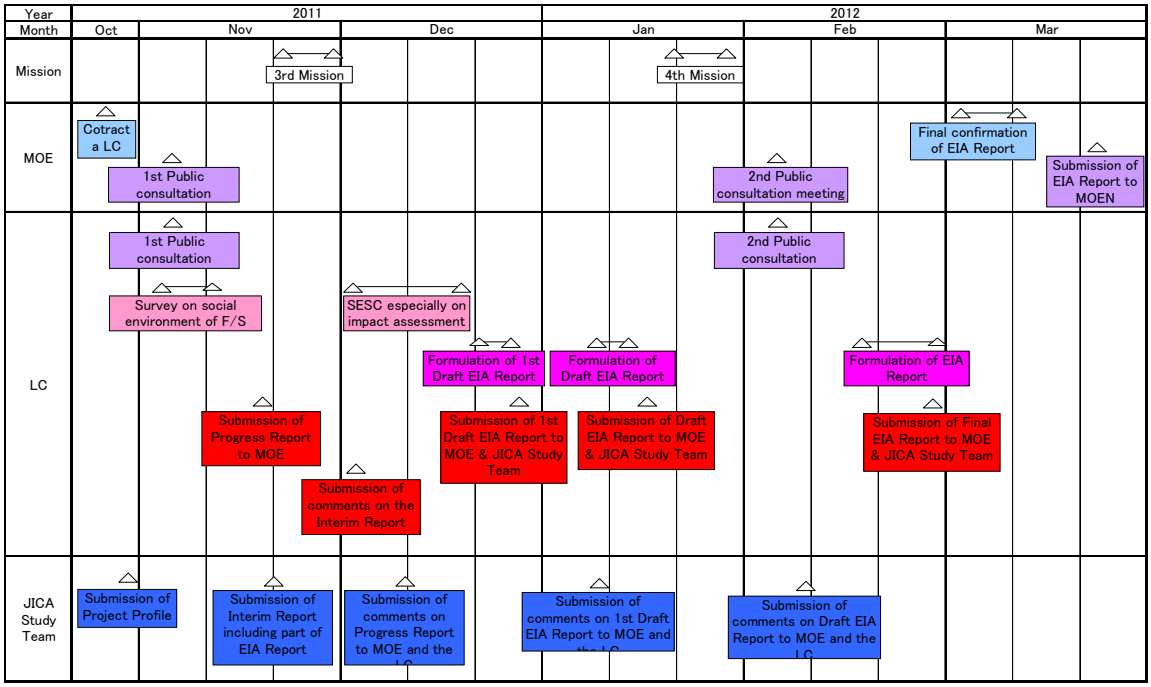

Figure 3 Schedule of the SESC

(End of the document)

Appendix 1

JICA Environmental Check List for Thermal Power Plant

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
1 Permits and Explanation	(1) EIA and Environmental Permits	(a) Have EIA reports been already prepared in official process? (b) Have EIA reports been approved by authorities of the host country's government? (c) Have EIA reports been unconditionally approved? If conditions are imposed on the approval of EIA reports, are the conditions satisfied? (d) In addition to the above approvals, have other required environmental permits been obtained from the appropriate regulatory authorities of the host country's government?	(a) (b) (c) (d)	(a) (b) (c) (d)
	(2) Explanation to the Local Stakeholders	(a) Have contents of the project and the potential impacts been adequately explained to the Local stakeholders based on appropriate procedures, including information disclosure? Is understanding obtained from the Local stakeholders? (b) Have the comment from the stakeholders (such as	(a) (b)	(a) (b)

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
		local residents) been reflected to the project design?		
	(3) Examination of Alternatives	(a) Have alternative plans of the project been examined with social and environmental considerations?	(a)	(a)
2 Pollution Control	(1) Air Quality	(a) Do air pollutants, such as sulfur oxides (SOx), nitrogen oxides (NOx), and soot and dust emitted by the power plant operations comply with the country's emission standards? Is there a possibility that air pollutants emitted from the project will cause areas that do not comply with the country's ambient air quality standards? Are any mitigating measures taken? (b) In the case of coal-fired power plants, is there a possibility that fugitive dust from the coal piles, coal handling facilities, and dust from the coal ash disposal sites will cause air pollution? Are adequate measures taken to prevent the air pollution?	(a) (b)	(a) (b)

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
	(2) Water Quality	(a) Do effluents including thermal effluents from the power plant comply with the country's effluent standards? Is there a possibility that the effluents from the project will cause areas that do not comply with the country's ambient water quality standards or cause any significant temperature rise in the receiving waters? (b) In the case of coal-fired power plants, do leachates from the coal piles and coal ash disposal sites comply with the country's effluent standards? (c) Are adequate measures taken to prevent contamination of surface water, soil, groundwater, and seawater by the effluents?	(a) (b) (c)	(a) (b) (c)
	(3) Wastes	(a) Are wastes, (such as waste oils, and waste chemical agents), coal ash, and by-product gypsum from flue gas desulfurization generated by the power plant operations properly treated and disposed of in accordance with the country's regulations?	(a)	(a)
2 Pollution	(4) Noise and Vibration	(a) Do noise and vibrations comply with the country's standards?	(a)	(a)

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
Control	(5) Subsidence	(a) In the case of extraction of a large volume of groundwater, is there a possibility that the extraction of groundwater will cause subsidence?	(a)	(a)
	(6) Odor	(a) Are there any odor sources? Are adequate odor control measures taken?	(a)	(a)
3 Natural Environment	(1) Protected Areas	(a) Is the project site located in protected areas designated by the country's laws or international treaties and conventions? Is there a possibility that the project will affect the protected areas?	(a)	(a)
	(2) Ecosystem	(a) Does the project site encompass primeval forests, tropical rain forests, ecologically valuable habitats (e.g., coral reefs, mangroves, or tidal flats)? (b) Does the project site encompass the protected habitats of endangered species designated by the country's laws or international treaties and conventions? (c) If significant ecological impacts are anticipated, are adequate protection measures taken to reduce the impacts on the ecosystem? (d) Is there a possibility that the amount of water (e.g., surface water, groundwater) used by the project will	(a) (b) (c) (d) (e)	(a) (b) (c) (d) (e)

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
		adversely affect aquatic environments, such as rivers? Are adequate measures taken to reduce the impacts on aquatic environments, such as aquatic organisms? (e) Is there a possibility that discharge of thermal effluents, intake of a large volume of cooling water or discharge of leachates will adversely affect the ecosystem of surrounding water areas?		
4 Social Environment	(1) Resettlement	(a) Is involuntary resettlement caused by project implementation? If involuntary resettlement is caused, are efforts made to minimize the impacts caused by the resettlement?(b) Is adequate explanation on compensation and resettlement assistance given to affected people prior to resettlement?(c) Is the resettlement plan, including compensation with full replacement costs, restoration of livelihoods and living standards developed based on socioeconomic studies on resettlement?(d) Are the compensations going to be paid prior to the resettlement?(e) Are the compensation policies prepared in document?(f) Does the resettlement plan pay particular attention to	(a)(b)(c)(d)(e)(f)(g)(h)(i)(j)	(a)(b)(c)(d)(e)(f)(g)(h)(i)(j)

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
		vulnerable groups or people, including women, children, the elderly, people below the poverty line, ethnic minorities, and indigenous peoples?(g) Are agreements with the affected people obtained prior to resettlement?(h) Is the organizational framework established to properly implement resettlement? Are the capacity and budget secured to implement the plan?(i) Are any plans developed to monitor the impacts of resettlement?(j) Is the grievance redress mechanism established?		
	(2) Living and Livelihood	(a) Is there a possibility that the project will adversely affect the living conditions of inhabitants? Are adequate measures considered to reduce the impacts, if necessary? (b) Is sufficient infrastructure (e.g., hospitals, schools, and roads) available for the project implementation? If the existing infrastructure is insufficient, are any plans developed to construct new infrastructure or improve the existing infrastructure? (c) Is there a possibility that large vehicles traffic for transportation of materials, such as raw materials and	(a) (b) (c) (d) (e)	(a) (b) (c) (d) (e)

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
		products will have impacts on traffic in the surrounding areas, impede the movement of inhabitants, and any cause risks to pedestrians? (d) Is there a possibility that diseases, including infectious diseases, such as HIV, will be brought due to the immigration of workers associated with the project? Are adequate considerations given to public health, if necessary? (e) Is there a possibility that the amount of water used (e.g., surface water, groundwater) and discharge of thermal effluents by the project will adversely affect existing water uses and uses of water areas (especially fishery)?		
4 Social Environment	(3) Heritage	(a) Is there a possibility that the project will damage the local archeological, historical, cultural, and religious heritage? Are adequate measures considered to protect these sites in accordance with the country's laws?	(a)	(a)
	(4) Landscape	(a) Is there a possibility that the project will adversely affect the local landscape? Are necessary measures taken?	(a)	(a)

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
	(5) Ethnic Minorities and Indigenous Peoples	(a) Are considerations given to reduce impacts on the culture and lifestyle of ethnic minorities and indigenous peoples? (b) Are all of the rights of ethnic minorities and indigenous peoples in relation to land and resources respected?	(a) (b)	(a) (b)
	(6) Working Conditions	(a) Is the project proponent not violating any laws and ordinances associated with the working conditions of the country which the project proponent should observe in the project? (b) Are tangible safety considerations in place for individuals involved in the project, such as the installation of safety equipment which prevents industrial accidents, and management of hazardous materials? (c) Are intangible measures being planned and implemented for individuals involved in the project, such as the establishment of a safety and health program, and safety training (including traffic safety and public health) for workers etc.? (d) Are appropriate measures taken to ensure that	(a) (b) (c) (d)	(a) (b) (c) (d)

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
		security guards involved in the project not to violate safety of other individuals involved, or local residents?		
5 Others	(1) Impacts during Construction	(a) Are adequate measures considered to reduce impacts during construction (e.g., noise, vibrations, turbid water, dust, exhaust gases, and wastes)?(b) If construction activities adversely affect the natural environment (ecosystem), are adequate measures considered to reduce the impacts?(c) If construction activities adversely affect the social environment, are adequate measures considered to reduce the impacts?	(a)(b)(c)	(a)(b)(c)
	(2) Accident Prevention Measures	(a) In the case of coal-fired power plants, are adequate measures planned to prevent spontaneous combustion at the coal piles (e.g., sprinkler systems)?	(a)	(a)
	(3) Monitoring	(a) Does the proponent develop and implement monitoring program for the environmental items that are considered to have potential impacts? (b) What are the items, methods and frequencies of the monitoring program? (c) Does the proponent establish an adequate	(a) (b) (c) (d)	(a) (b) (c) (d)

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
		monitoring framework (organization, personnel, equipment, and adequate budget to sustain the monitoring framework)? (d) Are any regulatory requirements pertaining to the monitoring report system identified, such as the format and frequency of reports from the proponent to the regulatory authorities?		
6 Note	Reference to Checklist of Other Sectors	(a) Where necessary, pertinent items described in the Power Transmission and Distribution Lines checklist should also be checked (e.g., projects including installation of electric transmission lines and/or electric distribution facilities). (b) Where necessary, pertinent items described in the Ports and Harbors checklist should also be checked (e.g., projects including construction of port and harbor facilities).	(a) (b)	(a) (b)
	Note on Using Environmental Checklist	(a) If necessary, the impacts to transboundary or global issues should be confirmed (e.g., the project includes factors that may cause problems, such as transboundary waste treatment, acid rain, destruction of the ozone layer, and global warming).	(a)	(a)

1) Regarding the term “Country’s Standards” mentioned in the above table, in the event that environmental standards in the country where the project is located diverge significantly from international standards, appropriate environmental considerations are requested to be made.

In cases where local environmental regulations are yet to be established in some areas, considerations should be made based on comparisons with appropriate standards of other countries (including Japan's experience).

2) Environmental checklist provides general environmental items to be checked. It may be necessary to add or delete an item taking into account the characteristics of the project and the particular circumstances of the country and locality in which it is located.

Appendix 2

JICA MONITORING FORM

-If environmental reviews indicate the need of monitoring by JICA, JICA undertakes monitoring for necessary items that are decided by environmental reviews. JICA undertakes monitoring based on regular reports including measured data submitted by the project proponent. When necessary, the project proponent should refer to the following monitoring form for submitting reports.

-When monitoring plans including monitoring items, frequencies and methods are decided, project phase or project life cycle (such as construction phase and operation phase) should be considered.

１．Responses/Actions to Comments and Guidance from Government Authorities and the Public

Monitoring Item	Monitoring Results during Report Period
ex.) Responses/Actions to Comments and Guidance from Government Authorities	

２．Mitigation Measures

- Air Quality（Emission Gas / Ambient Air Quality）

Item	Unit	Measured Value（Mean）	Measured Value（Max.）	Country's Standards	Referred International Standards	Remarks (Measurement Point, Frequency, Method, etc.)
SO_2						
NO_2						
CO						
O_3						
Soot and dust						
SPM						
Dust						

- Water Quality（Effluent/Wastewater/Ambient Water Quality）

Item	Unit	Measured Value（Mean）	Measured Value（Max.）	Country's Standards	Referred International Standards	Remarks (Measurement Point, Frequency, Method, etc.)
pH						
SS (Suspended Solid）						
BOD/COD						
DO						
Total Nitrogen						
Total Phosphorus						
Heavy Metals						
Hydrocarbons / Mineral Oils						
Phenols						
Cyanide						
Temperature						

- Waste

Monitoring Item	Monitoring Results during Report Period

- Noise / Vibration

Item	Unit	Measured Value（Mean）	Measured Value（Max.）	Country's Standards	Referred International Standards	Remarks (Measurement Point, Frequency, Method, etc.)
Noise level						

Vibration level						

- Odor

Monitoring Item	Monitoring Results during Report Period

３． Natural Environment

- Ecosystem

Monitoring Item	Monitoring Results during Report Period
ex.) Negative effects/Actions to Valuable species	

４． Social Environment

- Resettlement

Monitoring Item	Monitoring Results during Report Period

- Living / Livelihood

Monitoring Item	Monitoring Results during Report Period

Attachment - 15 EIA Report

ENVIRONMENTAL IMPACT ASSESSMENT OF NASIRYAH II THERMAL POWER PLANT

Ministry of Electricity, Republic of Iraq

Anbar University /

Engineering Consulting Bureau

In collaboration with the JICA Study Team on

"Preparatory Study for Development of Southern Large Scale Thermal Power Plant in Iraq"

March 2012

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ABBUREVIATIONS

Abbreviations	Words
A	Adverse Effect
ACC	Air Cooled Condenser
B	Beneficial Effect
BCM	Billion Cubic Meters
BOD	Biological Oxygen Demand
BPIE	Board of Protection and Improvement of Environment
BS	British Standard
BTU	British Thermal Unit
CC	Combined Cycle
CEMS	Continuous Emission Monitoring System
CO	Carbon Monoxide
CO_2	Carbon Dioxide
COD	Chemical Oxygen Demand
C/T	Cooling Tower
dBA	Decibel A
DE	Diesel Oil
DO	Dissolved Oxygen
EA	Environmental Assessment
EIA	Environmental Impact Assessment
EL	Elevation Level
EMP	Environmental Management Plan
EPC	Engineering/ Procurement/ Construction
FOR	Forced Outraged Rate
F/S	Feasibility Study
GL	Ground Level
GM	General Manager
GT	Gas Turbine
H	High Intensity
HFO	Heavy Fuel Oil
HRSG	Heat Recovery Steam Generator
IBA	Important Bird Area
IC	Interconnection

Abbreviations	Words
IFC	International Finance Corporation
IPP	Independent Power Producer
ISO	International Organization for Standardization
IUCN	International Union for Conservation of Nature and Natural Resources
JBIC	Japan Bank for International Cooperation
JICA	Japan International Cooperation Agency
KBA	Key Biodiversity Area
L	Low Intensity
LDO	Light Diesel Oil
LNG	Liquefied Natural Gas
LOLE	Loss of Load Expectation
LOLP	Loss of Load Probability
M	Medium Intensity
MJ	Mega Joule
MOE	Ministry of Electricity
MOEN	Ministry of Environment
MOO	Ministry of Oil
MWR	Ministry of Water Resources
N/A	Not applicable
N.E.	Not Expected
NI	Nature Iraq
NO_2	Nitrogen Dioxide
NOx	Nitrogen Oxides
OHS	Occupational Health and Safety
PDP	Power Development Planning
PM	Particulate Matter
ppm	parts per million
PPS	Power Producer and Supplier
PPV	Peak Particle Velocity
Pre-FS	Pre-Feasibility Study
RO	Reverse Osmosis
SO_2	Sulphur Dioxide
SOx	Sulphur Oxides
SPM	Suspended Particulate Matter

Abbreviations	Words
SS	Suspended Solid
ST	Steam Turbine
TDS	Total Dissolved Solid
TEQ	Toxic Equivalent
TNC	The Nature Conservancy
TOC	Total Organic Carbon
TPP	Thermal Power Plant
TSP	Total Suspended Particulates
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational Scientific and Cultural Organization
US	United States
USD	United States Dollar
VOC	Volatile Organic Compounds
wcc	within construction cost
WHO	World Health Organization
WHS	World Heritage Site
woc	within operation cost
WWF	World Wide Fund for Nature

Executive summary

BACKGROUND

Iraq had only total available capacity of power plants of 7,920MW against the maximum power demand of 13,750MW as of 2010[1]. Therefore, serious power shortage has been caused. Support needs for the power sector, particularly needs for full-scale repair works and new power generation projects have been growing. The Government of Iraq therefore requested a Yen Loan Project of "Southern large-scale thermal power plant development project" to the Government of Japan. In response, the former Japan Bank for International Cooperation conducted Pre-Feasibility Study on the 17 candidate sites for large-scale thermal power plant in 2007 -2008. The "Preparatory Study for Development of Southern Large Scale Thermal Power Plant in Iraq" (herein after "the Project") has been conducted with the Ministry of Electricity (MOE) under the Japan International Cooperation Agency (JICA) to identify the best site among the above-mentioned candidate sites for a new thermal power plant, a feasibility study has been conducted on the identified site, Nasiryah.

DESCRIPTION OF THE IDENTIFIED SITE AND PLANT FOR THE PROJECT

Nasiryah, Thi Qar Province, was identified the best site among the 17 candidate sites through the site selection exercises (described "Analysis of alternatives" below). The site is located at south of the existing Nasiryah Thermal Power Plant (TPP). The area of the site is 50 ha. Since there is a plan to construct another TPP next of the existing Nasiryah TPP, the new plant is named as Nasiryah II.

The profile of Nasiryah II is summarized as follows:

- Capacity: 1,800 MW
- Generation type: Combined Cycle Power Generation with two (2) 2-on-1 trains, each of which consists of two (2) gas turbines and one (1) steam turbines
- Fuel: natural gas
- Cooling system: Hybrid air cooled condenser (ACC), for which water is taken from Euphrates River
- Completion year: 2018

ANALYSIS OF ALTERNATIVES

Alternatives are analyzed to optimize the Project in terms of financial, technical and

[1] Ministry of Electricity

environmental points of view.

Zero option: This option is excluded because of the following two alternatives are concluded as unfeasible: other electric sources such as hydroelectric power generation; and importation of electricity from the neighboring countries.

Site selection: Two steps of site selection were conducted to select the most feasible site from financial, technical and environmental points of view. At the 1st step, three (3) candidate sites were selected among 17 candidate sites, namely Nasiryah, Hartha 2 and Alkahala Emara 1&2. At the 2nd step, the same but more detailed study was exercised, and Nasiryah was selected as the feasibility study site. From the environmental points of view, the Nasiryah II site has no settlers (no involuntary resettlement is expected), is away from the proposed national park, the World Heritage Sites and Important Bird Areas (no direct impacts are expected), and does not have any important habitats for endangered species listed in IUCN Redlist (no direct impacts are expected).

Facility design:
(1) Cooling system
Iraq is now facing the critical water issues as follows;

- Decline of the entire water discharge of the Euphrates and Tigris Rivers;
- Decline of water quality especially high salinity of the downstream parts of the rivers; and,
- Increase of water consumption in domestic, commercial and industrial fields.

Further, Nasiryah II needs to consider the existence of the important marshlands downstream. Although the southern part of the marshlands has originally high salinity, it may receive impacts. Considering these water issues and the goal of the Project, a philosophy of "least water consumption and least water discharge" is developed to apply in the facility design, which is expected to give the smallest impacts to the environment.

Since a TPP utilizes large volume of water for its cooling system, an intensive discussion on alternatives of cooling system has been conducted. Hybrid ACC has been selected because it meets the philosophy - "least water consumption and least water discharge", and it is economically viable. Comparing the water consumption and waste water discharge of the existing Nasiryah TPP, Nasiryah II can greatly reduce them per generating power.

(2) Other requirements

The facilities are designed to observe the Iraqi and international standards. Regarding the global warming issue, combined cycle generation and natural gas (fuel) are selected to reduce the amount of CO_2 emission as much as possible.

ENVIRONMENTAL IMPACT ASSESSMENT

Rationale: Establishment of a gas power station is categorized as Class B under the Iraqi law, and it is required to go through the Environmental Impact Assessment (EIA) Process to obtain an Environmental Compliance Certificate from the Ministry of Environment (MOEN). JICA also has its guidelines on an EIA study for its supporting project, and according to its guidelines[2], the Project is categorized as Category A which requires a comprehensive study and a report. It is therefore an EIA study was conducted for the Feasibility Study on Nasiryah II under both the Iraqi law and the JICA Guidelines.

Baseline date: Baseline data on the physical, natural and social environments of Iraq and of the area around Nasiryah II were collected. The data of Iraq were utilized for the analysis of alternatives such as the site selection exercises, and the data around the Nasiryah II were utilized for the EIA.

Environmental impacts: Based on the project description and the baseline data, identification of induced impacts and their assessment were conducted for the construction and operation stages. A simulation for air emissions from the plant was conducted to assess its impacts. Many of the expected impacts have already been avoided or minimized by the site selection and the facility design, and other impacts are categorized as medium to low intensity or not expected. The expected impacts will be mitigated.

Environmental management plan: Appropriate measures including monitoring are proposed to mitigate these expected impacts both in the construction and operation stages.

Consultation: A meeting with the major tribal leaders and two stakeholders' meetings were held to explain the details of the Project and the contents of the EIA to the local people and authorities, and to reflect their ideas and concerns to the EIA report.

[2] Japan Bank for International Cooperation (JBIC): Guidelines for Confirmation of Environmental and Social Considerations (2002). Yen Loan activities are now conducted by JICA and the guidelines (2002) is applied for the Project.

CONCLUSIONS AND RECOMMENDATIONS

Conclusions: The EIA Study has indicated that the Project is designed to fulfill both Iraqi laws and JICA Guidelines for environmental considerations. The main points are summarized as follows:

- Comprehensive and logical evaluation of candidate sites have been successfully conducted to have resulted in the best site, Nasiryah, for the mega-power project (Nasiryah II Project) in financial, technical and environmental aspects;
- The facilities of Nasiryah II are designed to harmonize the current conditions of the water issues and the goal of the Project and to follow the Iraqi and international environmental standards;
- Every mitigation measure will be taken under MOE's supervision during both the construction and operation stages; and,
- Stakeholders and relevant authorities have been involved in the process of authorization of the EIA activities of the Project, and their comments are reflected in the Project.

Recommendations: MOE has participated in the committee of the national water resource development strategy managed by Ministry of Water Resources (MWR). The first preliminary report will be issued in March 2012. In the next meeting MOE intends to raise the actual figure of river water demand for all the thermal power projects planned over the country. The initiative of MOE needs to be developed to realize the philosophy-"least water consumption and least water discharge" in close collaboration with other authorities such as MWR and MOEN.

1. Introduction

1.1. Background

Iraq had only total available capacity of power plants of 7,920MW against the maximum power demand of 13,750MW as of 2010[3]. Therefore, serious power shortage has been caused by decline of capacity of generation and power network facilities, unstable fuel supply, difficulties of procurement of spare parts in the aged power plants, stagnation of investment in new power development and so on, in consequence of the War. Besides, the largest power demand area is Baghdad, the national capital of Iraq, and industrial zones in Southern and Northern areas also have become major power demand areas.

Since function of the power sector had depressed significantly in consequence of the long-term War despite that the power sector is a basic infrastructure for all economic and social activities, reconstruction of the power sector is stated as one of the primary roles in the National Development Strategy in Iraq of February 2007.

The power sector is a strategic field of Japanese Overseas Development Assistance in Iraq, and Japan has supported the following projects through her Yen loan, The power sector is a strategic field of Japanese Overseas Development Assistance in Iraq, and Japan has supported the following projects through its Yen loan, “Al-Mussaib Thermal Power Plant Rehabilitation Project”, “Electricity Sector Reconstruction Project” and “Al-Akkaz Gas Power Plant Construction Project”.

The power supply to the basic infrastructures such as waterworks, hospitals and civic life is unstable, and the power outage of more than 10 hours in a day lasts in the most areas in Iraq. Support needs for the power sector, particularly needs for full-scale repair works, new power generation projects have been growing. The Government of Iraq therefore requested a Yen Loan Project of “Southern large-scale thermal power plant development project” to the Government of Japan. In response, from July 2007 to June 2008, the former Japan Bank for International Cooperation conducted Pre-Feasibility Study on the 17 candidate sites for large-scale thermal power plant and selected Shat Al-Basra as the most promising candidate site for the thermal plant development.

There are some problems in the power sector in Iraq. For example, planned maintenance of the power generation, transmission and distribution facilities is not performed and electricity tariff is not enough to cover the operational costs of the facilities. In order to improve generating capacity which has not been improved at all, the Ministry of Electricity (MOE) in Iraq started recently to prepare introduction of regulations which implies to develop generating facilities by independent power producers (IPPs). IPP investment conference

[3] Ministry of Electricity

was held in Jordan in November and December 2008, it was stated that power development projects for IPP would be incorporated into the Iraq electricity Master Plan hereafter. At the same conference, Shat Al-Basra, the priority project site, was presented by MOE as a development project by IPP. As for the electricity tariff, averaged electricity selling price is hiked from 2.5 Iraqi dinar (0.21 US cent/kWh) to 27 Iraqi dinar (2.3 US cent/kWh), and is planned to be raised up to 85 Iraqi dinar (7 US cents / kWh) in the future.

The conducting organization of the Project is MOE, and it has responsibility of operation and maintenance of the power facilities and equipment and associated regulations. Meanwhile, neither corporation nor privatization is scheduled in the near future. MOE carried out feasible maintenance works such as routine repairs under severe constraints during the sanctions period, and has potentially high technical capabilities and staff of approximately 70,000 people. There are approximately 12,000 staff in the power network department and approximately 30,000 staff in the distribution department, and 15% of staff in each department is engineer.

Since the Government of Iraq requested a project to the Government of Japan as a candidate of a new Yen loan project. The “Preparatory Study for Development of Southern Large Scale Thermal Power Plant in Iraq” (herein after “the Project”) is carried out to prepare a feasibility study report under the Japan International Cooperation Agency (JICA). JICA has dispatched a study team (JICA Study Team) to work closely with MOE.

1.2. Current status and future plan of electricity sector

In December, 2010, the final report on Iraqi Power Development Master Plan was released by Parsons Brinckerhoff as a consultant. This Master Plan study was financed by the US Government State Department and executed under the supervision of the State Department’s Iraq Transition Assistance Office and MOE.

The Master Plan illustrates the power demand forecast and power development plan as the following sections.

1.2.1. Current status of power demand and supply

The power demand in 2010 is expected to reach approximately 12,000MW assuming Iraqi power system is developed as planned. Meanwhile, the installed capacity in 2010 is only 9,700MW including 700MW of imported power from Iran. In addition to that, the reliable installed capacity could be lower than 9,000MW due to e high forced outage rate recorded in Iraqi system. Therefore, Loss of Load Probability (LOLP) seems to be 72% so that load shedding has frequently occurred in 6,300 hours of 8,760 hours in a year.

1.2.2. Power demand forecast

In the Master Plan, a 7% Gross Domestic Product growth and accordingly huge power demand are expected even after 2011 as per in Figure 1-1.

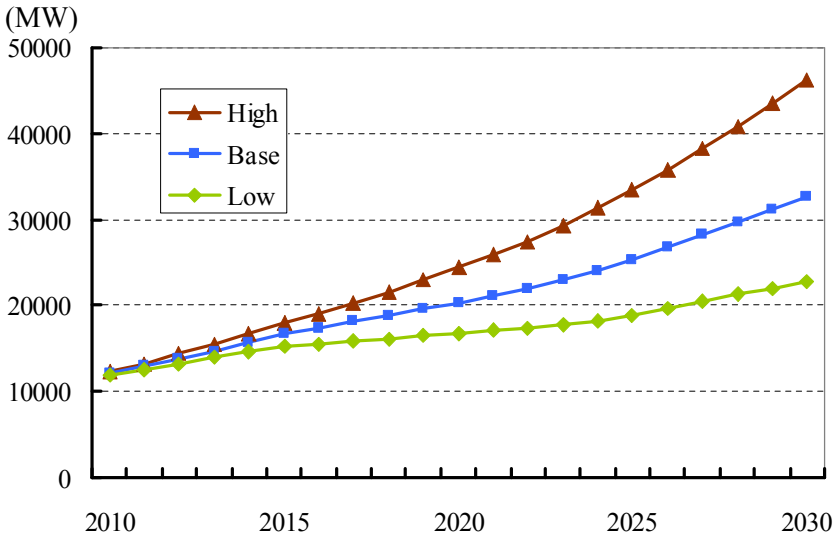


Figure 1-1 Power demand forecast[4]

In Base Case, the power demand should increase by 20,000MW in 20 years that means increase by 1,000MW in a year.

1.2.3. Power Development Master Plan

The principle of Iraqi Power Development Master Plan is as follows;

- Target of LOLP is 0.3% to ensure reliable power supply in future. This is equivalent to 26 hour a year at Loss of Load Expectation (LOLE) figure.
- Short term development of simple cycle gas turbine power generating plants is urgent to eliminate recent power shortage. These power plants should be fueled by utilizable resources nearby for the short term regardless fuel type and cost effectiveness.
- The fuel should be converted to gas in consideration of cost effectiveness by developing a gas pipeline system in succeeding years
- Since the simple cycle gas turbine (GT) power generating plant is low in thermal efficiency, upgrading to combined cycle gas turbine (CCGT) power generating plant is planed by adopting a steam turbine (ST) to the existing two gas turbines in order to improve its thermal efficiency.

[4] Iraqi Power Development Master Plan (2010)

Additional 1,300MW power generation capacity is anticipated to be installed to the power system in every year to meet the growth of base power demand and required power supply reliability. In this regard, electricity demand and installed power generating capacity in 2030 is eventually as shown in Figure 1-2 (DE: diesel oil, IC: interconnection).

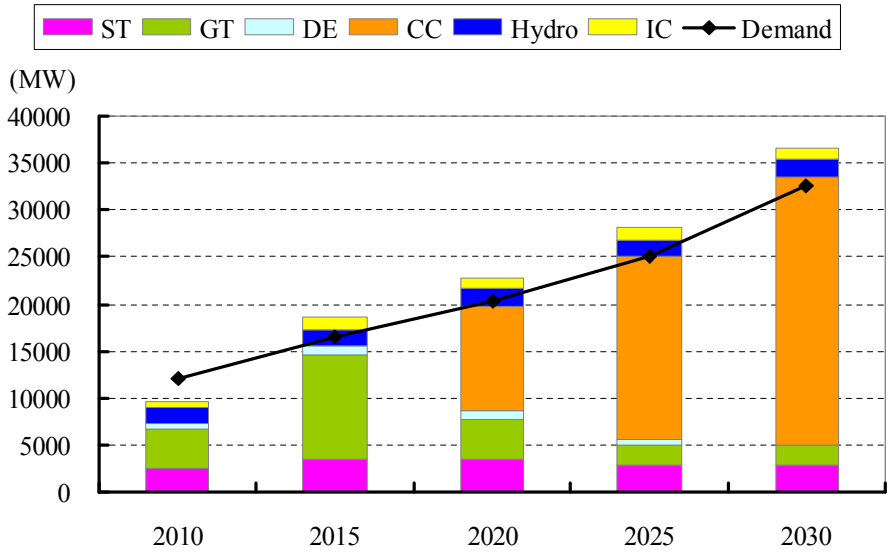


Figure 1-2 Relation between maximum demand and installed capacity[5]

CCGT will account for 78% of Iraqi power generating capacity in 2030 since the existing GTs can be upgraded to CCGT and additional CCGT plants can be newly installed after 2016. Gas consumption will be increased by replacing other fuel like Heavy Fuel Oil (HFO) and will account for 65% of Iraqi fuel consumption in 2020 and 84% in 2030 respectively.

Figure 1-3 shows the trend of the average figures of thermal efficiency of Iraqi thermal power plants.

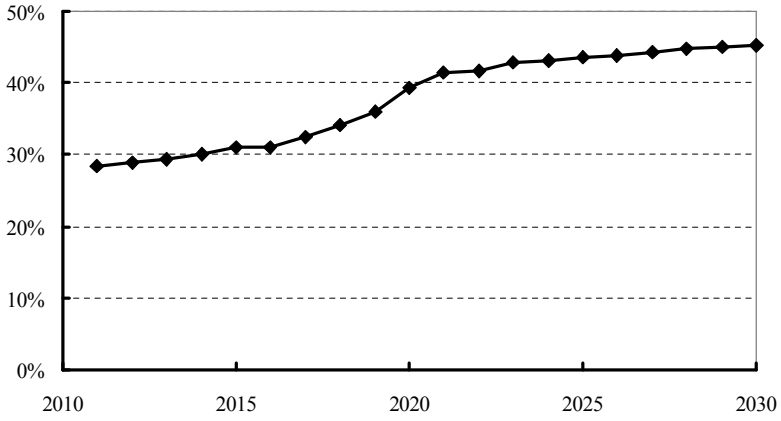


Figure 1-3 Trend of thermal efficiency[6]

[5] JICA Study Team prepares it based on the Master Plan (2010).

The thermal efficiency in or before 2015 is supposed to be about 30% because the low-efficiency GT power generating plants will have been in operation for the urgent power supply purpose. After 2016, upgrading existing GT plants to CC thermal power plants (TPP) is planned by adding steam turbines and generators, and in addition, some CCTPPs are planed to be newly installed to the grid. Consequently, the thermal efficiency in Iraqi system would be dramatically improved by 40% in 2020.

In the 2020s, the thermal efficiency could be gradually improved and eventually reach to 45% in 2030.

1.2.4. Regional power demand and supply

Table 1-1 shows maximum demand record in each region in Iraq excluding Kurdish autonomous area.

Table 1-1 Maximum demand (region-wise) [7]

(Unit: MW)

North		Baghdad		Central		South		Total
Al Anbar	373	Baghdad	3,002	Babil	422	Missan	310	
Diyala	282			Al Qadisiyah	344	Basra	1,045	
Nineveh	964			Karbala	300	Thi Qar	459	
Salah ad Din	436			Wasit	287	Al Muthana	230	
Kirkuk	367			Al Najaf	400			
	2,422		3,002		1,753		2,044	9,211
	26.3%		32.6%		19.0%		22.2%	100%

[6] JICA Study Team prepares it based on the Master Plan (2010).
[7] JICA Study Team prepares it based on the Master Plan (2010).

Assuming the future power demand in each region is increased proportionately, demand-supply balance in each region and year is expected as in Figure 1-4.

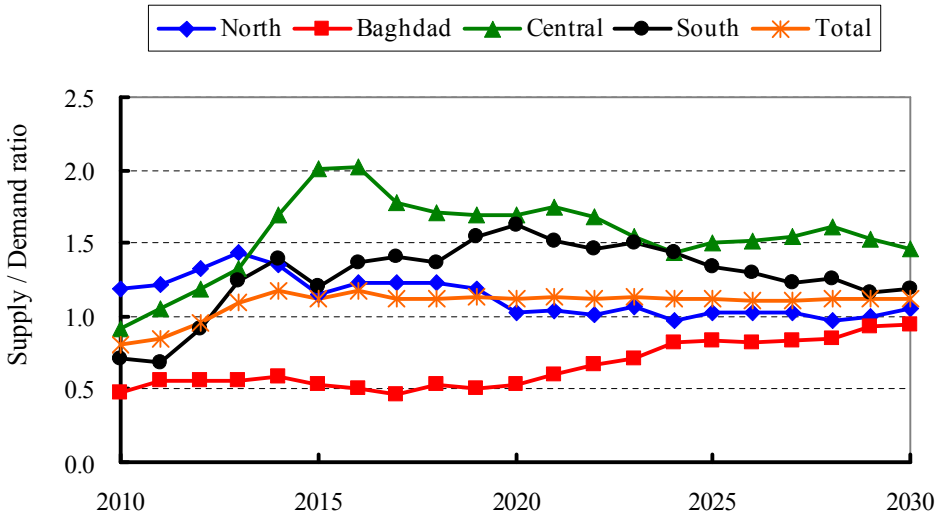


Figure 1-4 Demand and supply balance (region-wise) [8]

In the Baghdad area, power generating capacity is in short and cannot meet its demand (supply / demand ratio is under 1.0). Therefore, large amount of electricity will need to be accommodated from the central region of Iraq.

1.3. EIA study for Nasiryah II and the EIA report

Establishment of a gas power station is categorized as Class B under the Iraqi law, and it is required to go through the Environmental Impact Assessment (EIA) Process to obtain an Environmental Compliance Certificate from the Ministry of Environment (MOEN) (refer to "2. Policy, legal and administrative framework"). JICA also has its guidelines on an EIA study for its supporting project, and according to its guidelines[9], the Project is categorized as Category A which requires a comprehensive study and a report.

It is therefore an EIA study is conducted for the Feasibility Study on Nasiryah II Thermal Power Plant under both the Iraqi law and the JICA Guidelines (also refer to "4. Approach and methodology").

[8] JICA Study Team prepares it based on the master plan (2010).

[9] Japan Bank for International Cooperation (JBIC): Guidelines for Confirmation of Environmental and Social Considerations (2002). Yen Loan activities are now conducted by JICA and the guidelines (2002) is applied for the Project.

2. Policy, legal and administrative framework

2.1. Policies on environmental issues

"Iraq: National Development Plan 2010-2014 (Ministry of Planning, 2010)" sets a vision on the environmental issues as following:

> Protecting the environment and tackling sources of environmental pollution by planning a sound environmental management approach aimed at transforming the approach to dealing with natural resources to a more sustainable one that preserves biological diversity, raises environmental awareness, and promotes the principle of environmental citizenship to achieve the Millennium Development Goals.

To pursue the vision, there are two goals to be achieved:

First Goal: Promoting Sustainable Development

Means of achieving the objective:

1. Adopting defined and environmentally sustainable investment projects that various ministries, local communities, federal and regional governments participate in selecting.
2. Instituting a special system for environmental impact assessment in Iraq to ensure that investment projects included in the development plan meet environmental requirements and specifications.
3. Reinforcing international cooperation through signing environmental agreements with neighboring countries to protect the environment, as well as joining international environmental conventions.

Second Goal: Monitoring the Environmental Reality

Means of achieving the objective:

1. Developing an integrated system for environmental monitoring, evaluation, and follow-up.
2. Monitoring the types and sources of pollution and measuring them against national and international standards.
3. Importing and developing devices for measuring pollutants for follow-up and analysis purposes.
4. Promulgating a set of environmental legislations that include laws, regulations, instructions and environmental standards aimed at protecting and improving the

environment and preventing pollution so as to match global developments in this area.

5. Using environment-friendly technology in addressing sources that threaten the environment, especially solid waste.

2.2. Legislation on Environmental Impact Assessment

2.2.1. Ministry of Environment

Coalition Provisional Authority issued the Order No. 44 in November 2003 establishing the Ministry of Environment (MOEN) to protect and conserve the Iraq's environment for the people of Iraq. MOEN is responsible for protecting and conserving the environment in a view of harmonizing other sectors' development and for implementing its functions by developing policies, running environmental programs and promulgating and enforcing standards[10].

The organization structure of the MOEN to carry out its functions was approved in October 2008 as shown in Figure 2-1. Under the Technical Directorate (shaded in Figure 2-1), there is Environmental Impact Assessment and Land Use Department[11].

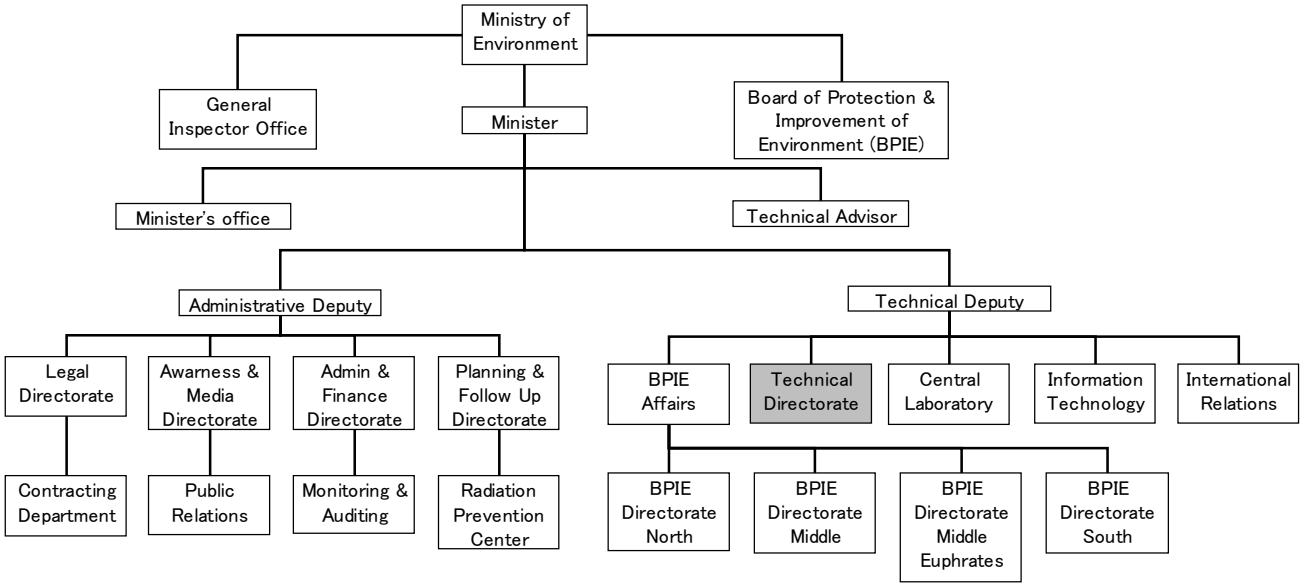


Figure 2-1 Organization structure of MOEN[12]

[10] Iraq Institutional Capacity Assessment Report (UNEP, 2006). In 2008, Law No. 37 formally established the Ministry of Environment.

[11] From the presentation material by MOEN at United Nations Economic Commission for Europe MOS 3 in November 2010.

[12] Modified from the organization chart shown in "Iraqi Fourth National Report to the Convention on Biological Diversity (2010)"

(1) Regional directorates and local units of MOEN

Each provincial MOEN under Board of Protection and Improvement of Environment (BPIE) Directorates (e.g. BPIE Directorates South) consists generally of the following units:

- Air Quality Monitoring Unit
- Water (Natural Sources and Drinking) Monitoring Unit
- Solid Waste and Chemical Hazardous Management Unit
- Biodiversity Unit
- Marshlands Unit
- EIA Unit
- Desertification and Land Use Unit
- Industrial Activities Monitoring Unit

Each Directorate contains the above-mentioned units, and special units connected with the deputy minister:

- Sustainable Development,
- Clean and Alternative Energy,
- New and Environmentally Friendly Technologies Unit.

The former MOEN of the Kurdistan Region had three main Governorate Directorates (Dohuk, Erbil and Sulaimaniya). The status of these offices is not known.

(2) National committees

The following six (6) national committees are managed by the MOEN:

- National Committee for Protected Areas
- National Committee for Biological Diversity
- National Committee for Ozone
- National Committee for Ramsar[13]
- National Committee for Climate change
- National Committee for RERAG

2.2.2. Environmental Impact Assessment[14]

The Law on Environmental Protection and Improvement (No. 27 of 2009) is the primary environmental legislation in Iraq. Chapter 4 of the law specifies a number of detailed provisions with which projects must comply.

[13] "Convention on Wetlands of International Importance Especially as Waterfowl Habitats" is usually called as "Ramsar Convention on Wetlands".

[14] From the presentation material by MOEN at United Nations Economic Commission for Europe MOS 3 in November 2010.

Article 10 (Chapter 4) of the law states the EIA report as in the following box.

I. The owner of any project before its establishment shall be abode to prepare a report regarding the estimation of environmental impact including as the following:
   A. The estimation of negative and positive impact of the project on the environment and impact of surrounding environment on it;
   B. The proposed means to avoid and to treat the causes of the pollution to be abode by Environmental regulations and directives;
   C. Emergency pollution cases and probability and the precautions should be taken to prevent its occurrence;
   D. The possible alternatives to use technology less harmful for the environment and rationalizing the resources usage;
   E. Reduction the waste and recycle or reuse it as much as possible; and,
   F. Evaluation of environmental feasibility for the project and evaluation the cost of pollution compare with the production
II. Economical and technical feasibility study for any project shall contain the report stipulated in the provision (first) of this article.

Projects are to be divided into three (3) categories as follows[15]:

Environment Polluting Activities Category (A): They are the intensive environment polluting activities, including huge agricultural or industrial projects that have several impacts on environment quality on large areas, so they have to be far away from the principal designs and their expansion of cities, districts, sub-districts and villages nominated for development according to the plan of rural housing with the condition of providing all treatment providing enough environmental protection.

Environment Polluting Activities Category (B): They are the activities polluting with less degrees than category (A), including industrial or agricultural and other resources producing site pollution that can be controlled, so they can be established inside the boundaries of principal designs and within the block allocated for them, provided that treatment units are to be available according to instructions and regulations; and in case it is not possible to control all pollutions aspects (bad smells and the like), the site will be set outside the boundaries of principal designs according to the site restrictions of such type of activities that are mentioned in details within the regulations.

Environment Polluting Activities Category (C): They are other human activities causing

[15] Environmental Regulations for Industrial, Agricultural and Service Projects (No.14 of 1990). This law is formulated to pursue the Law of Protecting and Improving the Environment (No. 76 of 1986).

minor pollution that can be treated, such as industrial factories that are not causing significant pollution, small agricultural projects, residence compounds, hotels and hospitals that produce pollutions of mainly organic content and can be easily treated via treatment units, so they can be established within the boundaries of the principal designs with no restrictions as well as outside them, according to the central regulations, that farm owners are allowed to establish un-polluting industries inside their farms.

Although the present law (No. 27 of 2009) uses the following table, the principle categorization of projects is the same as the above. The projects categorized as Class A and B need EIA reports (Table 2-1).

Table 2-1 EIA classes[16]

Class A	Class B
• Chemical , petrochemical and petroleum industries • Synthetic fiber industry • Protein plants • Pharmaceutical industries • Tannery plants • Cement plants • Gypsum plants • Bricks plants • Asbestos products plants • Mines • Glass and ceramic industries • Thermal power stations • Hazardous waste dumping sites • Asphalt plants • Iron , steel and aluminum industries • Waste water treatment plants • Rocks grinding plants	• Food industries • Slaughtering houses • Gas power stations • Solid waste landfills • Fish breeding lakes • Textile industries • Chemical industries ,low production capacity • Construction products industries • Metal Melting plants • Electronic and electrical industries. • Fertilizer storage building • Pesticides storage building • Soap industries • Ice production plant • Sand and rocks serving sites • Tobacco industries • Reuse waste oil plants • Electro power transfer station

[16] From the presentation material by MOEN at United Nations Economic Commission for Europe MOS 3 in November 2010.

Key Stages of the process of EIA (Figure 2-2) are described as follows:

Consultation and Scoping: They are the activities of identifying significant potential environmental impacts and deciding the focus of the EIA report and identifying the stakeholders. Consultation with MOEN Provincial office shall be held by the developer. The Provincial office may advise the developer on the scope of the EIA report and how to carry out farther consultation. Consultation should be held with the concerned public, stakeholders, municipalities and concerned ministries. Comments given during the consultation shall be taken into account and presented in the EIA report.

Preparing an EIA Report: The developer performs environmental studies to collect and prepare an EIA report, and the report shall cover the different phases of the realization of the project such as pre-construction, construction, operation and decommissioning or closure. The developer shall submit the EIA report and the agreements from the concerned ministries to the Provincial office and then to the Ministry of Environment in Baghdad (EIA Department).

Review of the EIA: MOEN in Baghdad reviews EIA reports. MOEN may require the developer to revise the project design or to conduct farther EIA studies and/or submit additional information. Any such requests from MOEN must be submitted by means of an official letter through the Provincial Office within 45 days from receiving the EIA report. The Provincial Office forwards the requests to the developer.

Environmental Compliance Certificate: MOEN gives the approval and issues the Environmental Compliance Certificate (license) for Class A and B Projects, in which the conditions that need to be fulfilled are stated. The Provincial Office issues the Environmental Compliance Certificate for Class C Project. Within the Environmental Compliance Certificate the developer can apply for a permit from the relevant ministries. No construction works or activities can be implemented before a permit is issued.

Monitoring: Monitoring is important to ensure that the terms, and condition stated in the Environmental Compliance Certification are fulfilled. Monitoring action shall be described in the Environmental Management Plan (EMP) which is part of EIA report.

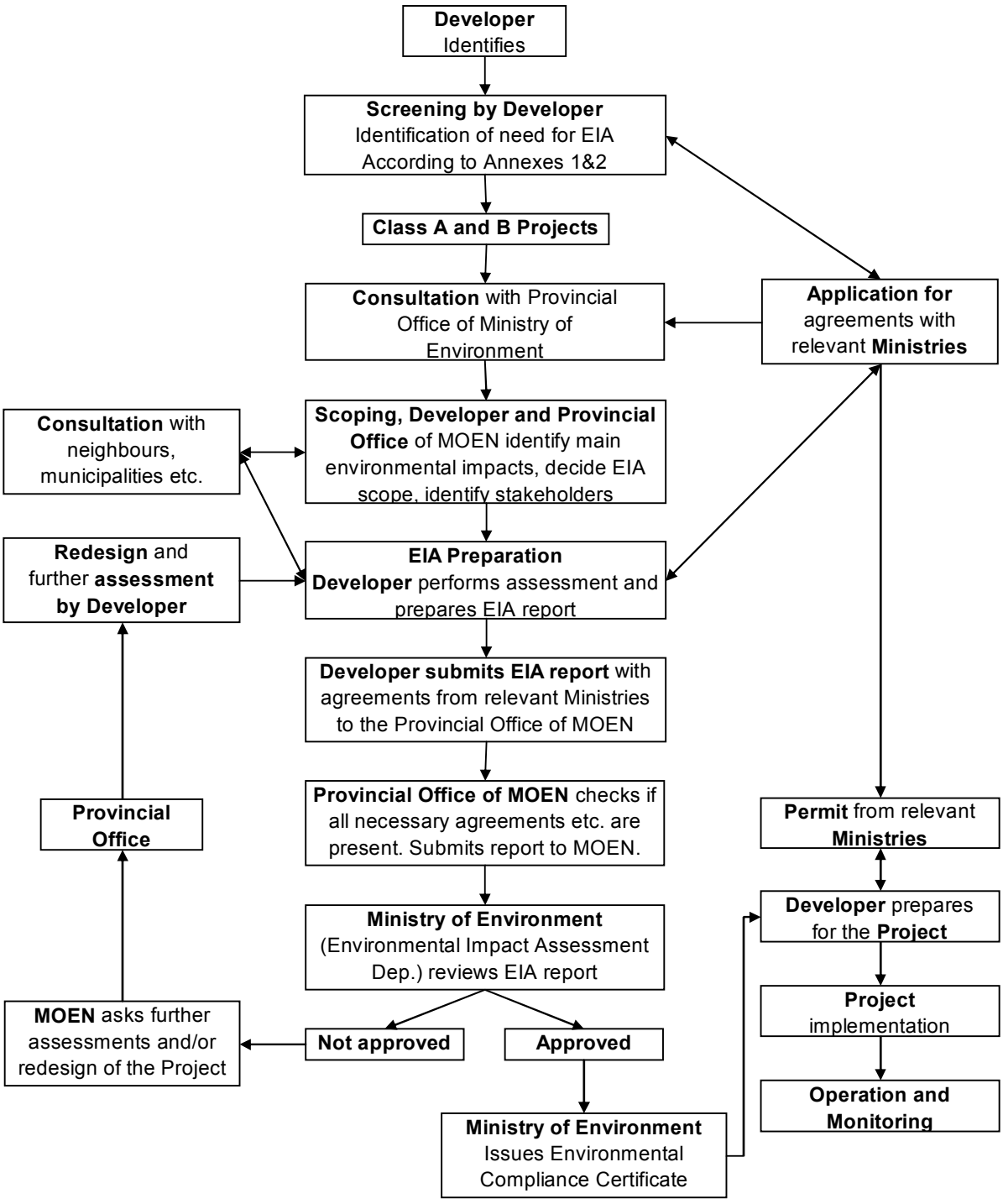


Figure 2-2 EIA process[17]

[17] From the presentation material by MOEN at United Nations Economic Commission for Europe MOS 3 in November 2010.

2.3. Legislation on environmental issues

2.3.1. Laws in Iraq

In Iraq, there are various environmental laws that are mainly concerned with the assessment, control, and monitoring of environmental pollution. Table 2-2 and 2-3 show the laws related to environmental issues.

Table 2-2 Existing Iraqi environment-related laws[18]

Reference	Title	Current status
2009 – Law No. 30 (formerly 1955 – Law No. 75)	Forest Law	Updated 2009, Ongoing
1965 – Law No. 64	Cities land use	Ongoing
1965 – Law No. 106	Rangelands and their Protection	Ongoing
1966 – Law No. 21	Noise prevention	Ongoing
1967 – Law No. 25	System of rivers and other water resources protection from pollution (includes 45 pollutants)	Updated 2001, Ongoing
1976 – Law No. 48	Fishing, exploitation and protection of living aquatic species.	Ongoing
2010 – Law No. 17 (formerly 1979 – LAW No. 21)	Law on the protection of wild animals and birds	Updated in 2010, Ongoing
1980 – Law No. 99	Protection from Ionizing radiation	Ongoing
1981 – Law No. 89	Public health (drinking water provision, sanitation and environmental monitoring)	Ongoing
1997 – Law No. 3 (formerly 1986 LAW No. 79)	Protection and improvement of environment	Updated 2008, Ongoing
1994 – Law No.24	Planning Body	Ongoing
1995 – Law No.12	Maintenance of networks of irrigation and drainage	Ongoing
2001 – Law No. 2	Water systems protection	Ongoing
2009 – Law No. 29 (1986-Regulation No. 76)	Updates Regulation No. 67, Regulate the regions for collecting debris (landfills).	Ongoing
OTHERS		
1961 – Regulation No. 33	Lease of beaches, islands and Miri surf lands on which pastures or liquorice are naturally grown	Ongoing

[18] Iraqi Fourth National Report to the Convention on Biological Diversity (2010).

Reference	Title	Current status
1981 – Regulation No. 13	Agricultural Research and Water Resources Center	Updated 2008, Ongoing
2009 – Regulation No. 17 (formerly 1985-Resolution No. 995)	Establishment of aquaculture operations	Updated 2009, Ongoing
1990 – Order No. Unknown	Environmental criteria for agricultural, industrial and public service projects	Ongoing
1991 – Decision No. 1 (EPB)	Cutting of trees	Ongoing
1992 – Instructions No. 11	Prohibition of plant importation into Iraq	Ongoing

Table 2-3 Newly approved and or updated Iraqi environment-related laws[19]

Reference	Title	Current status
2010 – Law No.1	Consumer protection law	Approved
2010 – Law No.11	Protection of the Iraqi production	Approved
2009 – Law No. 3	Joining in Basil convention for controlling the danger hazards.	Approved
2009 – Law No.7	Iraq joining the convention of Desertification	Approved
2009 – Law No. 27	Iraqi Environmental protection and improvement law	Approved
2009 – Law No.28	Agricultural Loans to support the Iraqi farmers	Approved
2009 – Law No. 30	Law of Forests and nurseries	Approved
2008 – Law No. 7	Iraq joining the Climate Change Convention and Kyoto protocol	Approved
2008 – Law No.12	Iraq joining Convention Concerning the Protection of the World Cultural and Natural Heritage	Approved
2008 – Law No. 37 (formerly 2003 – CPA ORDER 44)	Ministry of Environment Law - Establishment of the Ministry (instead of the former Council of Protection and Improvement of Environment)	Updated in 2008
2007 – Law No. 6	Iraq joining the Arabian memorandum of understanding in cooperation in marine transportation	Approved
2007 – Law No. 7	Iraq joining Convention on Wetlands of International Importance Especially as Waterfowl Habitats	Approved
2007 – Law No. 22	Iraq joining the international agreement for Olive Oil	Approved

[19] Iraqi Fourth National Report to the Convention on Biological Diversity (2010).

Reference	Title	Current status
2007 – Law No. 42	Iraq joining Vienna convention and Montreal protocol to protect the Ozone layer	Approved
2007 – Law No. 48	Iraq joining the regional commission for Fish traps	Approved
2007	Investment law for Oil refineries	Approved but not published
2008 – Law No. 31	Iraq joining the Convention on Biological Diversity	Approved
2010 – Order No. 74	Prohibition of plant importation into Iraq – To identify the Ministry of Environment and Ministry of Agriculture as having sole authority over plant importation, to state that all plants are prohibited for importation, and to support Instructions No. 11.	Ongoing

There are other important laws promoted by the Ministry of Environment and currently under approval, such as: the Draft Regulation on Nature Protected Areas and the Draft Law for Regulating Hunting Activity[20].

2.3.2. International and regional conventions

Iraq is members of various international and regional conventions on environmental issues. Table 2-4 shows the status of the important conventions.

Table 2-4 International and regional conventions[21]

Title	Current status
Atmosphere	
Vienna Convention for the Protection of Ozone Layer	2008
United Nations Framework Convention on Climate Change	2009
Waste Management	
Basel Convention on the Transboundary Movements of Hazardous Wastes and their Disposal	2011
Natural Conservation	
Convention on Biological Diversity	2009
Convention on Wetlands of International Importance Especially as Waterfowl Habitats	2008
Convention Concerning the Protection of the World Cultural and Natural Heritage	1974
United Nations Convention to Combat Desertification	2010
Regional convention	

[20] Iraqi Fourth National Report to the Convention on Biological Diversity (2010).
[21] The information of the conventions and agreement is obtained from each convention's website on 20 September 2011.

Title	Current status
Kuwait Regional Convention for Cooperation on the Protection of the Marine Environment from Pollution	1979

2.3.3. Standards

(1) National standards

Standards related to the Project are shown in Table 2-5, 2-6, 2-7 and 2-8.

Table 2-5 Iraqi national standards for ambient air quality [22]

No.	Pollutant	Period of measurement	Limitation value
1	SO_2	1 hr	0.1 ppm
		24 hr	0.04 ppm
		1 yr	0.018 ppm
2	CO	1 hr	35 ppm
		8 hr	10 ppm
3	NO_2	1 hr	0.04 ppm
		24 hr	0.05 ppm
4	O_3	1 hr	0.06 ppm
5	PM_{10}	24 hr	150 μg/m^3
6	$PM_{2.5}$	1 hr	15 μg/m^3
		24 hr	65 μg/m^3
7	Total suspended particulates (TSP)	1 hr	150 μg/m^3
		24 hr	350 μg/m^3
8	Dust falling	30 day	Residential area: 10 T/km^2/month
			Industrial area: 20 T/km^2/month
9	HC	3 hr	160 μg/m^3
10	Pb	24 hr	2 μg/m^3
		3 month	1.5 μg/m^3
		1 yr	1 μg/m^3
11	Gasoline	1 yr	0.003 mg/m^3
12	Dioxane	1 yr	0.6 pico g/m^3

[22] Ministry of Environment (in a process of approval, from Environmental Impact Assessment Study for Akkas Gaseous Power Plant Project, 2009)

Table 2-6 Iraqi national standards for emission air quality (maximum limit from fixed sources) [23]

No.	Name of air emission	Symbol	Source of emission	Max. limit of emission mg/Nm^3
1	Smoke and visible contaminant emission		Combustion or burning source	250
			Other sources	0.0
2	Opacity		All sources	20.0%
3	Carbon Monoxide	CO	All sources	500
4	Oxides of nitrogen (measured as NO_2)	NO_x	Combustion or burning source	70 - 500
			Materials production	1,000
5	Sulphur dioxide	SO_2	Combustion or burning source	500
			Materials production	2,000
			Other sources	1,000
6	Tri- sulphur oxide (include fog of sulphuric acid, measured as SO_3)	SO_3	Materials production	150
			Other sources	50
7	Total suspended particulates	TSP	Combustion or burning source	250
			Cement production	150
			Cement production	100
			Other sources	150
8	Ammonia and ammonium compounds		Materials production	50
			Other sources	10
9	Benzene	C_2H_6	All sources	5
10	Iron	Fe	Iron and steel factory	100
11	Lead and lead complex	Pb	All sources	5
12	Antimony and Antimony complex	Sb	Materials production	5
			Other sources	1
13	Arsine and Arsine complex	As	All sources	1
14	Cadmium and Cadmium	Cd	All sources	1

[23] Ministry of Environment (2011, in process of approval, from information of MOE)

No.	Name of air emission	Symbol	Source of emission	Max. limit of emission mg/Nm^3
	complex			
15	Mercury and Mercury complex	Hg	All sources	0.5
16	Chromium and Chromium complex	Cr	All sources	5
17	Nickel and Nickel complex	Ni	All sources	1
18	Copper	Cu	All sources	5
19	Hydrogen sulphide	H_2S	Materials Production	10
			Other sources	5
20	Chloride	Cl^-	Chloride Production	200
			Other sources	20
21	Hydrogen fluoride	HF	All sources	2
22	Hydrogen chloride	HCl	Chloride production	200
			Other sources	10
23	Silicon fluoride	SiF_4	All sources	10
24	Fluoride (include HF, Sif_4)	F^-	Aluminum smelter	20
			Other sources	50
25	Formaldehyde	CH_2O	Materials production	20
			Other sources	2
26	Carbon	C	Materials production	250
			Other sources	50
27	Volatile Organic Compounds	VOC	All sources	20
28	Dioxin and Furans		All sources	1 (ng TEQ/m^3)

Notes

1. Combustion or burning source means burners and boilers of oil and petro-chemical industries or manufacture and power station. Materials production means structural industries, chemical industries and dyes industries.
2. The concentration of any material in the second column, when it measured from any sources in the third column, before mixing with air, smoke, and other gases, the maximum limit in the fourth column.
3. The limit of smoke and visible emission, must not used with water vapor, and not for starting or shut downing burning.

No.	Name of air emission	Symbol	Source of emission	Max. limit of emission mg/Nm^3

4. The limit of NO_x for turbine units, working by using gas, and installing before this law is 125 mg/Nm^3.
5. Measuring TSP emitted from burning source measured at 12% of CO_2 as a reference.
6. Standard cubic meter is cubic meter of gas at 25 °C and 760 mm/hg.
7. Overall concentration of heavy metals (Pb, Cd, Cr, Ni, Hg, Cu, As, Sb) in any measurement must not exceed 5 mg/Nm^3.
8. The limit of VOC is for the unburned hydro-carbons.
9. The limits for all contaminants except Dioxin and Furans are measured for 24 hours. In measuring the concentrations of any material in the second column, the method used by the American Environmental Agency as reference method, or any equivalent standard method used.

*TEQ: Toxic Equivalent

Table 2-7 Iraqi national water quality standards[24]

NO.	Parameter (unit: mg/l)	Water Source			
		A-1 rivers	A-2 streams	A-3 lakes	A-4 springs
1	Color (-)	Normal	Normal	Normal	Normal
2	Temperature (deg C)	-	-	-	-
3	Suspended Solid	-	-	-	-
4	pH (-)	6.5-8.5	6.5-8.5	6.5-8.5	-
5	Dissolved Oxygen	>5	>5	>5	-
6	BOD	<3	<3	<3	-
7	COD (CrO method)	-	-	-	-
8	Cyanide CN^-	0.02	0.02	0.02	0.02
9	Fluoride F^-	0.2*	0.2*	0.2*	0.2*
10	Free Chlorine	Trace	Trace	Trace	Trace
11	Chloride Cl^-	200*	200*	200*	200*
12	Phenol	0.005	0.005	0.005	0.005
13	Sulphate SO_4^{2-}	200*	200*	200*	200*
14	Nitrate NO_3	15	15	15	15
15	Phosphate PO_4	0.4	0.4	0.4	0.4
16	Ammonium NH_4^+	1	1	1	1
17	DDT	nil	nil	nil	nil
18	Lead	0.05	0.05	0.05	0.05
19	Arsenic	0.05	0.05	0.05	0.05
20	Copper	0.05	0.05	0.05	0.05

[24] The New Limits of the Regulation of the Protection of Rivers and Public Waters for a Year 1967, Ministry of Health, Directorate General of Human Environment (from Baiji Refinery Upgrading Project – Preliminary Environmental and Social Impact Assessment, 2010)

NO.	Parameter (unit: mg/l)	Water Source			
		A-1 rivers	A-2 streams	A-3 lakes	A-4 springs
21	Nickel	0.1	0.1	0.1	0.1
22	Selenium	0.01	0.01	0.01	0.01
23	Mercury	0.001	0.001	0.001	0.001
24	Cadmium	0.005	0.005	0.005	0.005
25	Zinc	0.5	0.5	0.5	0.5
26	Chromium	0.05	0.05	0.05	0.05
27	Aluminium	0.1	0.1	0.1	-
28	Barium	1.0	1.0	1.0	1.0
29	Boron	1.0	1.0	1.0	1.0
30	Cobalt	0.05	0.05	0.05	0.05
31	Iron	0.3	0.3	0.3	0.5
32	Manganese	0.1	0.1	0.1	0.1
33	Silver	0.01	0.01	0.01	0.01

Water Source Category:
A-1 Rivers, Branches
A-2 Streams, aqua ducts, water courses and their original and secondary branches
A-3 Lakes, Basins and other water bodies
A-4 Springs, wells and underground water
Notes:
*) Quality standard are to be set in the listed value or more according to what is existed naturally in the source.

Table 2-8 Iraqi national wastewater discharge limit standards[25]

No.	Parameter (unit : mg/l)	Wastewater discharged to			
		B-1 any water source	B-2 public sewers	B-3 drainage	B-4 marshes
1	Color (-)	-	-		
2*	Temperature (deg C)	< 35	45		
3*	Suspended Solid	50	750		
4*	pH (-)	6-9.5	6-9.5		
5	Dissolved Oxygen	-	-		
6*	BOD	<40	1,000		
7*	COD (CrO method)	<100	-		
8*	Cyanide CN^-	0.05	0.5		
9	Fluoride F^-	5	10		
10*	Free Chlorine	Trace	100		
11	Chloride Cl^-	*a) <1% *b) < 600 mg/l *c)			
12*	Phenol	0.01-0.05	5-10		
13	Sulphate SO_4^{2-}	**a) <1% **b) < 400 mg/l **c) < 200 mg/l	300		

[25] The New Limits of the Regulation of the Protection of Rivers and Public Waters for a Year 1967, Ministry of Health, Directorate General of Human Environment (from Baiji Refinery Upgrading Project – Preliminary Environmental and Social Impact Assessment, 2010)

No.	Parameter (unit : mg/l)	Wastewater discharged to			
		B-1 any water source	B-2 public sewers	B-3 drainage	B-4 marshes
14	Nitrate NO_3	50	-		
15*	Phosphate PO_4	3	-		
16	Ammonium NH_4^+	-	-		
17	DDT	Nil	-		
18*	Lead	0.1	0.1		
19	Arsenic	0.05	0.05		
20*	Copper	0.2	-		
21*	Nickel	0.2	0.1		
22	Selenium	0.05	-		
23*	Mercury	0.005	0.001		
24*	Cadmium	0.01	0.1		
25	Zinc	2.0	0.1		
26*	Chromium	0.1	0.1		
27	Aluminium	5.0	20		
28	Barium	4.0	0.1		
29	Boron	1.0	1.0		
30	Cobalt	0.5	0.5		
31*	Iron	2.0	15.0		
32	Manganese	0.5	-		
33	Silver	0.05	0.1		
34*	Total Hydrocarbons and its compounds	Note ***	Note ***	Note ***	Note ***
35*	Sulphide S^{2-}	-	3.0		
36	Ammonia	-	10.0		
37	Ammonia gas	-	6.0		
38	Sulphur Dioxide	-	7.0		
39	Petroleum Alcohol	-	Not permissible		
40	Calcium Carbonate	-	Not permissible		
41	Organic Solvent	-	Not permissible		
42*	Benzene	-	0.5		
43	Chlorobenzene	-	0.1		
44	TNT	-	0.5		
45	Bromine	-	1-3		

Wastewater: Category:

B-1 Waste water discharged to any water source

B-2 Waste water discharged to public sewers - Special conditions should be defined taking in consideration the limits mentioned in item B-1.

B-3 Waste water discharged to drainage - Special conditions should be defined taking in consideration the limits mentioned in item B-1.

B-4 Waste water discharged to marshes - Special conditions should be defined taking in consideration the limits mentioned in item B-1.

No.	Parameter (unit : mg/l)	Wastewater discharged to			
		B-1 any water source	B-2 public sewers	B-3 drainage	B-4 marshes

Notes:

* Item 11- Chloride Cl^-

**Item 13- Sulphate SO_4^{2-}

*a) When the ratio of the amount of the discharged water to the source water is (1:1000) or less

*b) When the ratio of the amount of the discharged water to the source water is more than (1:1000)

*c) When the ratio of the amount of the discharged water to the source water isles than 200 mg/l, then each case should be studied by the responsible authority for executing this regulation.

***Item 34- Total Hydrocarbons and its compounds

It is allowed to discharge to the water sources A1 & A2 according to the concentration limits that are shown below.

It is not allowed to discharge any hydrocarbons to water sources A3 & A4.

1) 10 mg/l

a) When the ratio of the amount of the discharged water to the source water is (1:1000) or less

b) The river should be flowing.

2) 5 mg/l

a) When the ratio of the amount of the discharged water to the source water is (1:500) or less

b) The river should be flowing.

3) 3 mg/l

a) When the ratio of the amount of the discharged water to the source water is (1:300) or less

b) The river should be flowing.

(2) International Standards

Since some of Iraqi legislations and standards have not been prepared, the following international standards are applied to the Project (Table 2-9, 2-10, 2-11, 2-12 and 2-13), when necessary.

Table 2-9 Ambient air quality[26]

Parameter		Guideline Value (Unit: μg/m^3)
SO_2	Maximum 24-hour average	Interim target 1: 125 Interim target 2: 50 Guideline: 20
	10 minutes average	500
NO_2	1-year average	40
	1 hour average	200
PM_{10}	1-year average	Interim target 1: 70 Interim target 2: 50 Interim target 3: 30 Guideline: 20
	24-hour average	Interim target 1: 150 Interim target 2: 100 Interim target 3: 75 Guideline: 50
$PM_{2.5}$	1-year average	Interim target 1: 35 Interim target 2: 25 Interim target 3: 15 Guideline: 10
	24-hour average	Interim target 1: 75 Interim target 2: 50 Interim target: 37.5 Guideline: 25
Ozone	8-hour daily maximum	Interim target: 160 Guideline: 100

Notes:

- World Health Organization (WHO). Air Quality Guidelines Global Update, 2005. PM 24-hour value is the 99th percentile.
- Interim targets are provided in recognition of the need for a staged approach to achieving the recommended guidelines

[26] International Finance Corporation (IFC): Environmental, Health, and Safety General Guidelines (2007)

Table 2-10 Air emissions for thermal plant[27]

Pollutant	Emissions guidelines (Unit: mg/Nm^3)	
	Natural gas (all turbine types of Unit > 50MWh)	**Fuel other than natural gas (Unit > 50MWh)**
NOx	50 (25 ppm)	152 (74 ppm)
SOx	N/A	NDA: Use of 1% or less S fuel DA: Use of 0.5% or less S fuel
Particle Matter	N/A	NDA: 50 DA: 30
Dry gas, excess O_2 content (%)	15%	15%

Notes:

- MWth = Megawatt thermal input on HHV basis; N/A = not applicable; NDA = Non-degraded airshed; DA = Degraded airshed (poor air quality); Airshed should be considered as being degraded if nationally legislated air quality standards are exceeded or, in their absence, if WHO Air Quality Guidelines are exceeded significantly; S = sulphur content (expressed as a percent by mass); Nm3 is at one atmospheric pressure, 0 degree Celsius; MWth category is to apply to single units; Guideline limits apply to facilities operating more than 500 hours per year. Emission levels should be evaluated on a one hour average basis and be achieved 95% of annual operating hours.
- If supplemental firing is used in a combined cycle gas turbine mode, the relevant guideline limits for combustion turbines should be achieved including emissions from those supplemental firing units (e.g., duct burners).
- (a) Technological differences (for example the use of Aeroderivatives) may require different emissions values which should be evaluated on a cases-by-case basis through the EA process but which should not exceed 200 mg/Nm^3.

[27] IFC: Environmental, Health, and Safety Guidelines THERMAL POWER PLANTS (2008)

Table 2-11 Effluent guidelines for thermal plant[28]

Pollutant	mg/L, except pH and temperature
pH	6 - 9
TSS	50
Oil & Grease	10
Total residual chlorine	0.2
Chromium – Total (Cr)	0.5
Copper (Cu)	0.5
Iron (Fe)	1.0
Zinc (Zn)	1.0
Lead (Pb)	0.5
Cadmium (Cd)	0.1
Mercury (Hg)	0.005
Arsenic (As)	0.5
Temperature increase by thermal discharge from cooling system	▪ Site specific requirement to be established by the Environmental Assessment (EA). ▪ Elevated temperature areas due to discharge of once-through cooling water (e.g., 1 Celsius above, 2 Celsius above, 3 Celsius above ambient water temperature) should be minimized by adjusting intake and outfall design through the project specific EA depending on the sensitive aquatic ecosystems around the discharge point.
Note: Applicability of heavy metals should be determined in the EA. Guideline limits in the Table are from various references of effluent performance by thermal power plants.	

Table 2-12 Noise level guidelines[29]

Receptor	One hour L_{Aeq} (dBA)	
	Daytime 07:00 - 22:00	Nighttime 22:00 - 07:00
Residential; institutional; educational	55	45
Industrial; commercial	70	70

dBA: decibel A

[28] IFC: Environmental, Health, and Safety Guidelines THERMAL POWER PLANTS (2008)
[29] IFC: Environmental, Health, and Safety General Guidelines (2007)

Table 2-13 British standard of the allowable vibration[30]

Building classification	Maximum acceptable continuous vibration value (PPV) for day and night time
Residential in general good repair	5
Residential where preliminary survey reveals significant defect	2.5
Industrial / commercial – light and flexible structure	15
Industrial / commercial – heavy and stiff structure	15

PPV: Peak Particle Velocity

2.3.4. Key permissions for Nasiryah II

The key permissions required for the construction and operation of Nasiryah II and their current statuses are shown in Table 2-14.

Table 2-14 Key permissions required for the construction and operation of Nasiryah II

Permission	Permitting authority	Relevant legislation	Role of permission	Status
Land Permission	Ministry of Finance Ministry of Environment Ministry of Oil Ministry of Defense Other relevant authorities	-	Authorization and agreements to obtain and to use the land for MOE's planned thermal power plant (TPP) at the designated land. Before the final authorization by the Ministry of Finance, all relevant authorities are consulted to obtain their agreements.	In process.
Construction Permission (for power plant)	Ministry of Electricity Ministry of Planning	-	Authorization of constructing the TPP	In process, and the final decision will be made at the Parliament of GOI.
Construction Permission (for buildings)	Ministry of Electricity	-	Authorization of constructing buildings of the TPP	-
Environmental Permission	Ministry of Environment	Law No. 27 of 2009, Law on Environmental Protection and Improvement	Authorization of the environmental effects and their mitigation measures of development and	To be obtained.

[30] British standard, BS 5228: part 4 (1992)

Permission	Permitting authority	Relevant legislation	Role of permission	Status
			operation of the Power Plant	
Operation Permission	Ministry of Electricity (National Dispatch Center)	-	Authorization of dispatching electricity to the national grid	To be obtained.
Water Allocation Permission	Ministry of Water Resources	-	Allocation of water quota of Euphrates River to Nasiryah II	Obtained on 21 February 2012

GOI: Government of Iraq

3. Project description

3.1. Nasiryah II thermal power plant

3.1.1. Location

The Nasiryah II Thermal Power Plant (TPP) is located in Nasiryah City, Thi Qar Province (Figure 3-1). The smaller scale maps are shown in Figure 6-2 and 6-3.

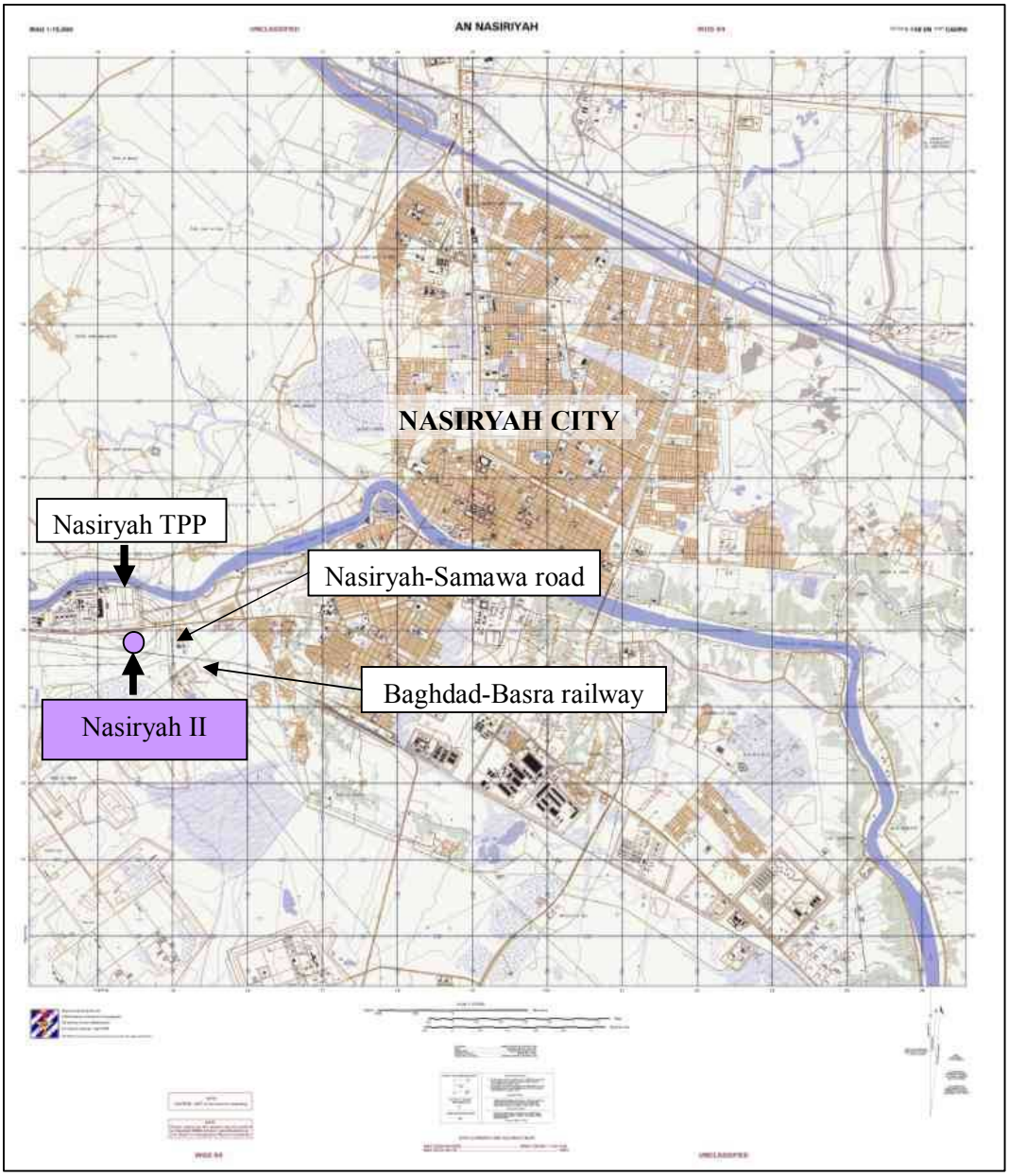


Figure 3-1 Locations of Nasiryah II and the existing Nasiryah TPP in Nasiryah City[31]

[31] The base map is from Inter-Agency Information and Analysis Unit. http://www.iauiraq.org/default.asp

Other information on the site:

- The project site belongs to MOE.
- The area is 50 ha.
- It is located between Nasiryah-Samawa road (north) and Baghdad-Basra railway. Nasiryah-Samawa road will be diverted before the construction of Nasiryah II by the Thi Qar Province.
- It is within an industrial area, and there are no residents within the site.

3.1.2. Profile

The profile of the Nasiryah II is summarized in Table 3-1.

Table 3-1 Profile of Nasiryah II

Nasiryah II (Combined Cycle)	
Capacity	1,800 MW
Main components and specifications	Configuration Two (2) "2-on-1 multi shaft trains": one train has two (2) gas turbines and one (1) steam turbine Gas turbine • Four (4) units (each capacity: 900 MW) Steam Turbine • Two (2) units (each capacity: 900 MW)
	Cooling system Hybrid air cooled condenser (Hybrid ACC) system is introduced. • Weather with less than 40 °C: only ACC • Weather with over 40 °C: ACC with water spray.
	Stacks • Two (2) bypass stacks with height of 60 m: They are used only when the single power generation (gas turbines only) is commissioned. • Two (2) Heat Recovery Steam Generator (HRSG) stacks with height of 60 m: They are used when Combined Cycle power generation is commissioned.
	Switch yard • The switch of Nasiryah I is utilized, and the transmission line is connected to the national grid from Nasiryah I.

Nasiryah II (Combined Cycle)	
	• From Nasiryah II, 400 kV cables are utilized to connect to Nasiryah I. The cables are planned to run in a trench within the plant site.
	Water treatment system • The effluent is treated before discharge to observe the Iraqi and international standards. • pH and Suspended Solid (SS) are treated before discharge. • Domestic water is treated by septic tank. • Oil separator is utilized to separate oil and grease.
	Tanks • Four (4) diesel oil tanks • Four (4) dematerialized water tanks • Two (2) equalization tanks
Fuel types and supply methods	It will be operated by natural gas transferred by a pipeline connected from Nasiryah I.
Completion year (plan)	End of 2018

Figure 3-22 shows the plot design of Nasiryah II.

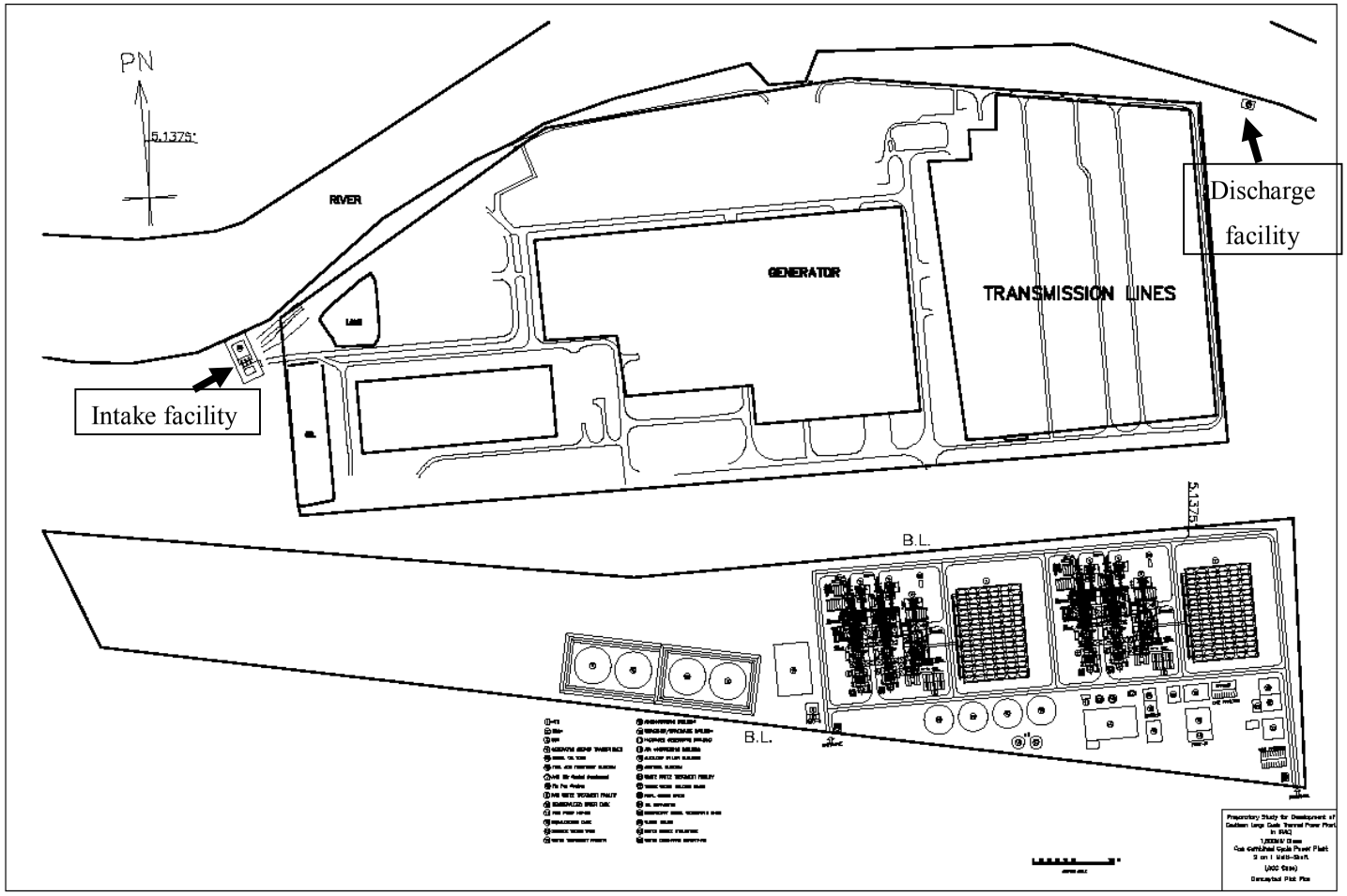


Figure 3-2 Plot design of Nasiryah II (southern part of the figure) and the existing Nasiryah TPP

3.1.3. Envisaged schedule

The envisaged schedule of the Project is shown as Table 3-2.

Table 3-2 Envisaged schedule of Nasiryah II

	2012	2013	2014	2015	2016	2017	2018
Consultant selection							
Basic Design & Preparation of Tender Document							
Selection of EPC Consultant							
Construction & Comissioning							

3.1.4. Civil works

(1) Land reclamation and design ground level

The ground level (GL) of the existing Nasiryah TPP is approximately the elevation level (EL) + 6.0 m. The plant is surrounded EL+7.0 to 8.0 m of the dike of Euphrates River and the west side of Switch yard.

The Project site should be at least the same level as the existing Nasiryah TPP as the following: GL=EL+6.0 m. The current ground of the Project site therefore requires banking to a depth of approximately 2.0 m on average. The borrow pit, selected by MOE, is located at 12 km northwest from the Project site along Nasiryah-Samawa road. The soils from are to be used as the ground filling material. The borrow pit is currently used for excavating sands for road works and other purposes, and according to MOE, it has enough capacity to provide sands to the Project site.

(2) Foundation Structure

Stability and safety of a structure depends upon proper design and performance of its foundation. Considering the site conditions, the soil properties, the type of the structures, the loading distribution and the discussion of test result, it was found that deep foundation (piled) needed to be considered as one of the reliable type of foundation if the applied pressure to the subsoil stratum exceeds the allowable bearing capacity.

The total settlement for structure can be evaluated when the design applied pressure - foundation dimensions and depth of foundation - are provided. However, the differential settlement shall be about 50% of the expected total settlement.

The allowable overall settlement for foundation shall comply with that adopted into the Design Basis Statement suitable for the structural system and materials used.

(3) Intake and screen pump pit (refer to Figure 3-2 for its location)

The intake system adopts surface intake system.

(4) Discharge system (refer to Figure 3-2 for its location)

Discharge water is concentrated salinity by pre-treatment for cooling tower system, and the velocity of the Euphrates River is slow. Therefore the discharge system adopts a system to minimize the impacts on natural environment.

(5) Surface water drainage system

Surface water drain consisting of rain-water within the site is collected in gutter and surrounding check pits. The drain is then discharged into the river.

3.2. Description of other thermal power plants

3.2.1. Existing thermal power plant (Nasiryah TPP)

The profile of the existing thermal power plant (Nasiryah TPP) is summarized as Table 3-3.

Table 3-3 Profile of Nasiryah TPP

Existing TPP (Nasiryah)		
	Steam Turbine TPP	Gas turbine TPP
Capacity	840 MW	42 MW
Main components and specifications	Steam turbine • Four (4) units (each capacity: 210MW). • The construction started in 1975. The first unit of the plant stated its operation in 1978 and the last one in 1980. It produces about 500 MW now.	Gas turbine • One (1) unit of single gas turbine • Frame 6B, GE Gas Turbine
	Cooling system • The plant had been cooled by open	Cooling system • The cooling is for the turbine

Existing TPP (Nasiryah)		
	Steam Turbine TPP	Gas turbine TPP
	cycle cooling system since 1978. But, in 2011, the plant shifted the open cycle system to the closed cycle cooling system (cooling towers) to cool two units of the plant. The original plan was to use the Euphrates River water for makeup water. But there were problems because of the bad water quality. Now the plant plan to use water from Al Garaf River located at Al Badaa town 50 km north of the plant. This is because its quality is better than the water from Euphrates River. • For the open cycle cooling system, water is taken from the Euphrates River by large Circular Water pumps. The water is pumped via a pipeline to the steam turbines condensers and then returns to the river. For the closed cycle cooling system, the makeup water is taken from the river.	lubricating oil system only, and conducted by one (1) induced draft cooling tower. The makeup water is fed from the water treatment system in the existing steam turbine TPP.
	<u>Stacks</u> • One (1) metal stack for 2 unit, and two (2) stacks in the plant. • 100 m height.	<u>Stacks</u> • One (1) stack • 20 m height
	<u>Switch yard</u> • The switch yard is 400 KV and 132 KV connected to the national grid by three (3) 400 KV and three (3) 132 KV transmission lines.	<u>Switch yard</u> • It uses the same switch yard of Steam Turbine TPP.
	<u>Water treatment system</u> • At the first operation stage of the plant, there was a water treatment	<u>Water treatment system</u> • There is no water treatment in this plant. It uses the water from the

Existing TPP (Nasiryah)		
	Steam Turbine TPP	Gas turbine TPP
	system to supply water to the steam turbine units, but recently it has been used to supply makeup water to the cooling towers. • In 2006, a new water treatment system was added to provide Reverse Osmosis (RO) to the steam turbine units. It is consist of five (5) units, and each unit produces 80 m^3/hr. 150 m^3/hr of the RO rejection water is discharged to the Euphrates River. • There are five (5) RO storage tanks. Three (3) of them has 2000 m^3 capacity and two (2) with 5000 m^3.	water treatment system in the Steam Turbine TPP.
	<u>Tanks</u> • Two (2) Crude oil (10000 m^3 each) • Two (2) HFO (1000 m^3 each) • One (1) underground crude oil tank (1000 m^3) • Two (2) HFO underground (600 m^3 each)	<u>Tanks</u> Four (4) Light Diesel Oil (LDO) tanks: three (3)= 50 m^3 and one (1)= 350 m^3
Fuel types and supply methods	The plant uses two types of fuel: crude oil and HFO. The crude oil is from the main national pipeline and HFO from the Nasiryah Oil Refinery 10 km south of the plant by pipeline.	It had been using diesel fuel oil until 2010, and then changed to operate by natural gas. The natural gas is supplied from the national natural gas pipeline comes from the Rumaila Oil Field in Basra and passes at two (2) km south the plant.
Waste disposal method	• Suspended solids such as mud is plugged in the steam condenser tubes are periodically removed. The removed mud is recycled as a gardening material. Other mud is kept in the plant site. • Recycle is promoted. For example, waste oil from separated from oil-contaminated water is sent to a factory owned by Ministry of Oil (MOO) and recycled to miscellaneous oil such as brake oil. Recycling domestic	

Existing TPP (Nasiryah)		
	Steam Turbine TPP	Gas turbine TPP
	waste is under study with a university in Nasiryah. • Waste oil such as separated from the oil contaminated water is sent to a factory of MOO to be recycled as miscellaneous oil such as brake oil. • Other wastes are kept within the plant site.	
Completion year	1978, by TECHNOPROM EXPORT, a Russian company.	2004, BTEC Turbine LP, an American company

3.2.2. Nasiryah I TPP

The profile of the Nasiryah I TPP is summarized as Table 3-4.

Table 3-4 Profile of Nasiryah I TPP

Nasiryah I (Gas turbine)	
Capacity	500 MW
Main components and specifications	<u>Gas turbine</u> • Four (4) units (each capacity: 125 MW). • Frame 9E, GE gas turbine. • In the first stage, the plant will be operated as simple cycle gas turbine generation. The first operation stage is expected to start in the end of 2013. • In the second stage, the plant will be operated as combined cycle turbine generation. The exact time of the operation is not decided.
	<u>Cooling system</u> • For the first stage, it consists of four (4) sets of closed cycle fin fan coolers. • The cooling towers will be used for the steam turbines in the second stage.
	<u>Stacks</u> • Four (4) stacks • Height 40 m.
	<u>Switch yard</u> • The switch yard is Gas Insulated Switchyard type consisting of four (4) bays of 400kv and 12 bays of 132kv.
	<u>Water treatment system</u> • Not designed yet.

Nasiryah I (Gas turbine)	
	Tanks • Four (4) crude oil tanks (10,000 m^3 each). • Three (3) LDO tanks (10,000 m^3 each)
Fuel types and supply methods	It will be operated by crude oil transferred by a pipeline. The pipeline will be constructed and from the Nasiryah Oil Field. The natural gas will be from the national pipeline, which comes from Basra and passes at two (2) km south the plant. LDO will be supplied by tankers.
Completion year (plan)	End of 2013

4. Approach and methodology

4.1. The Project and EIA

According to the Iraqi law, a project subject to EIA is the one categorized as Class A or B. The Project is categorized Class B and requires an EIA study and the EIA report. The Project is a Category A project under the JICA Guidelines (refer to "1.3. EIA study for Nasiryah II and EIA Report").

Because of the Category A project of the JICA Guidelines, the EIA Study of the Project takes a slightly different process from the one required by the Iraqi law (refer to Figure 2-2). After the screening (Class B and Category A), comprehensive site selection is conducted to select the best site for the Project. Alongside the site selection, the facility of the Project is designed to fulfill the Iraqi and international standards. All these analysis of alternatives are conducted comprehensively before the EIA Study on the Feasibility Site of the Project, Nasiryah II. The EIA process of the Project is summarized as Figure 4-1.

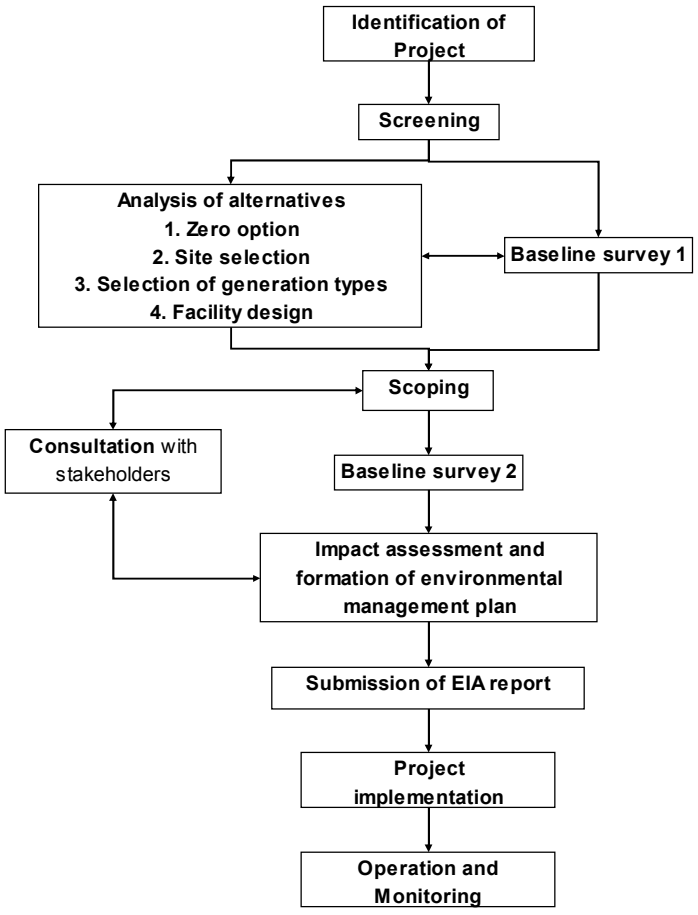


Figure 4-1 EIA process of the Project

Although Figure 4-1 simplified the entire process, from the scoping, the process is the same as the one requested by the Iraqi law (Figure 2-2).

4.2. Process

4.2.1. Screening

(1) Screening methodology

The choice of screening method is usually determined by the decision-makers when an EIA system is established. All screening methods require information about the concerned project and all of them have involved the use of value judgments at some stage during their development. Project screening can be done in a number of different ways including:

- measuring against simple criteria such as size, location or cost;
- comparing the proposal with lists of project types that rarely need an EIA in other jurisdictions (e.g. minor transmission line) or that always need extensive study (e.g. major new generation);
- using lists of resources (e.g. rain forests), environmental problems (e.g. soil erosion, deforestation) and/or areas of special importance or sensitivity (e.g. national parks) so that any activity that affects such areas of concern will be judged to have significant environmental effects and require an EIA;
- estimating the general impacts of a proposed project and comparing these against set thresholds[32].

The Project applies the first one of the above methodologies within both Iraqi and the JICA Guidelines.

(2) Iraqi law

Based on the Law on Environmental Protection and Improvement (No. 27 of 2009), the Project is categorized as Class B which requires EIA study and its report (refer to "2.2. Legislation on Environmental Impact Assessment").

(3) JICA Guidelines[33]

JICA classifies projects into mainly the following three categories according to the extent of environmental and social impacts, taking into account an outline of project, scale, site

[32] Environmental Impact Assessment (Richard Ronchka, 1997).

[33] The description from Japan Bank for International Cooperation (JBIC): Guidelines for Confirmation of Environmental and Social Considerations (2002). Yen Loan activities are now conducted by JICA and the guidelines (2002) is applied for the Project.

condition.

Category A: A proposed project is classified as Category A if it is likely to have significant adverse impact on the environment. A project with complicated impact or unprecedented impact which is difficult to assess is also classified as Category A. The impact of Category A projects may affect an area broader than the sites or facilities subject to physical construction. Category A, in principle, includes projects in sensitive sectors (i.e., sectors that are liable to cause adverse environmental impact) or with sensitive characteristics (i.e., characteristics that are liable to cause adverse environmental impact) and projects located in or near sensitive areas. An illustrative list of sensitive sectors, characteristics and areas is given in Section 3 of Part 2 of the guidelines.

Category B: A proposed project is classified as Category B if its potential adverse environmental impact is less adverse than that of Category A projects. Typically, this is site-specific, few if any are irreversible, and in most cases normal mitigation measures can be designed more readily.

Category C: A proposed project is classified as Category C if it is likely to have minimal or no adverse environmental impact.

4.2.2. Baseline surveys

Collecting baseline data on natural and social environments for both national and the Project site is necessary to identify potential impacts and to propose appropriate mitigation measures including avoidance and minimization of the impacts. For the Project, Baseline survey 1 is conducted to collect information at national level, and Baseline survey 2 is conducted to collect information around the Project site (Figure 4-1). Information on the following items is collected:

- Physical and natural environments such as geographical features, general vegetation status, climate, terrestrial and freshwater ecosystems.
- Social environment such as population, local administrative bodies, industrial activities and infrastructure.

The details are referred to “5. Baseline data”.

4.2.3. Analysis of alternatives

Zero option of the Project (no implementation of the Project), site selection, selection of generation types (including fuel types) and selection of facility design (cooling system) are comprehensively conducted to avoid and minimize the expected impacts as much as reasonably practical. The details are referred to “6. Analysis of alternatives”.

4.2.4. Scoping

A scoping exercise should be carried out soon after the project proposal has been defined. The primary purpose of scoping is to identify concerns and issues which are important to project decisions. Scoping also serves to define EIA study requirements and boundaries. The results of the scoping exercise form the basis for the rest of the EIA process. Through the use of scoping, the issues and concerns of potential stakeholders can be identified early in the planning process, so that a work program can be designed accordingly[34].

Table 4-1 shows the initial results of the scoping exercise of the Feasibility site (Nasiryah II).

Table 4-1 Scoping of Nasiryah II

Item			Construction Stage	Operation Stage
Environmental Pollution	1	Air pollution	✓	✓
	2	Water pollution	✓	✓
	3	Solid waste	✓	✓
	4	Noise/Vibration	✓	✓
	5	Odor		
Natural Environment	6	Climate		
	7	Hydrology		
	8	Flood		
	9	Underground water		
	10	Ground subsidence		
	11	Soil erosion	✓	
	12	Protected areas		
	13	Terrestrial ecosystems		
	14	River ecosystems	✓	
	15	Endangered species		
	16	Global warming		✓
Social Environment	17	Involuntary resettlement		
	18	Employment/livelihood	✓✓	✓
	19	Local economy	✓✓	
	20	Land utilization		
	21	Social infrastructure/service facilities	✓	
	22	River traffic		✓(?)

[34] Environmental Impact Assessment (Richard Ronchka, 1997)

Item			Construction Stage	Operation Stage
	23	Land traffic	✓	
	24	Sanitation	✓	
	25	Risks for infectious diseases such as HIV/AIDS	✓	
	26	Local custom		
	27	Burden on socially vulnerable groups		
	28	Uneven distribution of benefits and losses		
	29	Utilization /Right of water, including groundwater		✓(?)
	30	Cultural heritage		
	31	Landscape		✓
	32	Accident	✓	✓

✓✓: Big impact is expected. ✓Some impact is expected. No mark: No impact. (?) needs more investigation

4.2.5. Consultation

The objectives of the consultation effort should be:

- informing interested groups and individuals about the proposed development, this will minimize misunderstandings about the scope and impacts of the project;
- providing opportunities for timely and meaningful input;
- ensuring decisions have adequately considered the concerns and values of the stakeholders, particularly the affected community(or communities);
- seeking approaches to problem solving and hopefully resolve conflicts;
- obtaining local and traditional knowledge before decision-making; and
- providing better transparency and accountability in decision-making[35].

The JICA Guidelines request to hold two stakeholders' meetings: one at the scoping stage and the other at the EIA Draft Final Report stage. The details are referred to "9. Consultation".

[35] Environmental Impact Assessment (Richard Ronchka, 1997)

4.2.6. Impact assessment and formation of environmental management plan

Impact assessment methodologies range from simple to complex and are also progressively changing from static, piecemeal approach to the one that reflects the dynamism of the nature and the environment. Consequently, the trend is a way from mere listing of potential impacts towards more complex modes whereby the methodology can identify, feedback paths, higher order impacts than merely those apparent, first order ones, and uncertainties[36].

Because of its time constraints and difficulties of information collection at and around the Project site, the Project applies simple checklist methodology. Regarding the emission from the plant during the operation stage, simulation software is utilized to simulate the emissions from the stacks.

The environmental management plan is formulated based on the identified impacts during the construction and operation stages to avoid or minimize or mitigate these adverse impacts. The management plan also includes monitoring during the construction and operation stages.

The details are referred to “7. Environmental impacts” and “8. Environmental management plan”.

[36] Environmental Impact Assessment Methodologies. 2nd Edition (Anjaneyulu, Y. and Valli, M, 2010).

5. Baseline data

5.1. General description of the environments of Iraq

5.1.1. Physical and natural environments

(1) Geographical features and general vegetation status[37]

Iraq is bordered by Iran, Kuwait, Saudi Arabia, Jordan, Syria and Turkey. Its vegetation is roughly described as follows: about the 80 % of the country is desert, about 15 % is steppe, and about 5 % is forest and high mountain scrub. The country can be divided into four main biogeographical regions (Figure 5-1). The vegetations and landscapes are closely related each other.

Lower Mesopotamia: This region is the flat flood plain of the Tigris and Euphrates rivers. In the triangle between Amara, Nasiryah and Basra, there are extensive areas of permanent or seasonal shallow lakes, including the Central Marsh and Al Hawizeh Marsh.

Desert Plateau: This is a vast area of desert south-west of the Euphrates, rising to an elevation of about 1,000 m close to the Syrian border in the west.

Upper Plains and Foothills: This region is separated from Lower Mesopotamia by a low range of hills, Jabal Hamrin (up to about 200 m) which extends across the country in a north-westerly direction from Mansuriya (100 km north-east of Baghdad). It is dominated by steppic plains and the, lower mountain slopes. Altitude varies from 200 to 500 m, and rainfall increases towards the northern mountains.

Mountains: The region is bounded by the north and north-eastern border of Iraq with rolling plains intersected by many, deep, well-watered valleys and gorges. Altitude varies from 500 m to over 3,500 m. There is only about 4 % of natural forest left in Iraq, nearly all of them in this region, and mostly over-exploited and overgrazed.

[37] Important Bird Areas in the Middle East (BirdLife International, 1994)

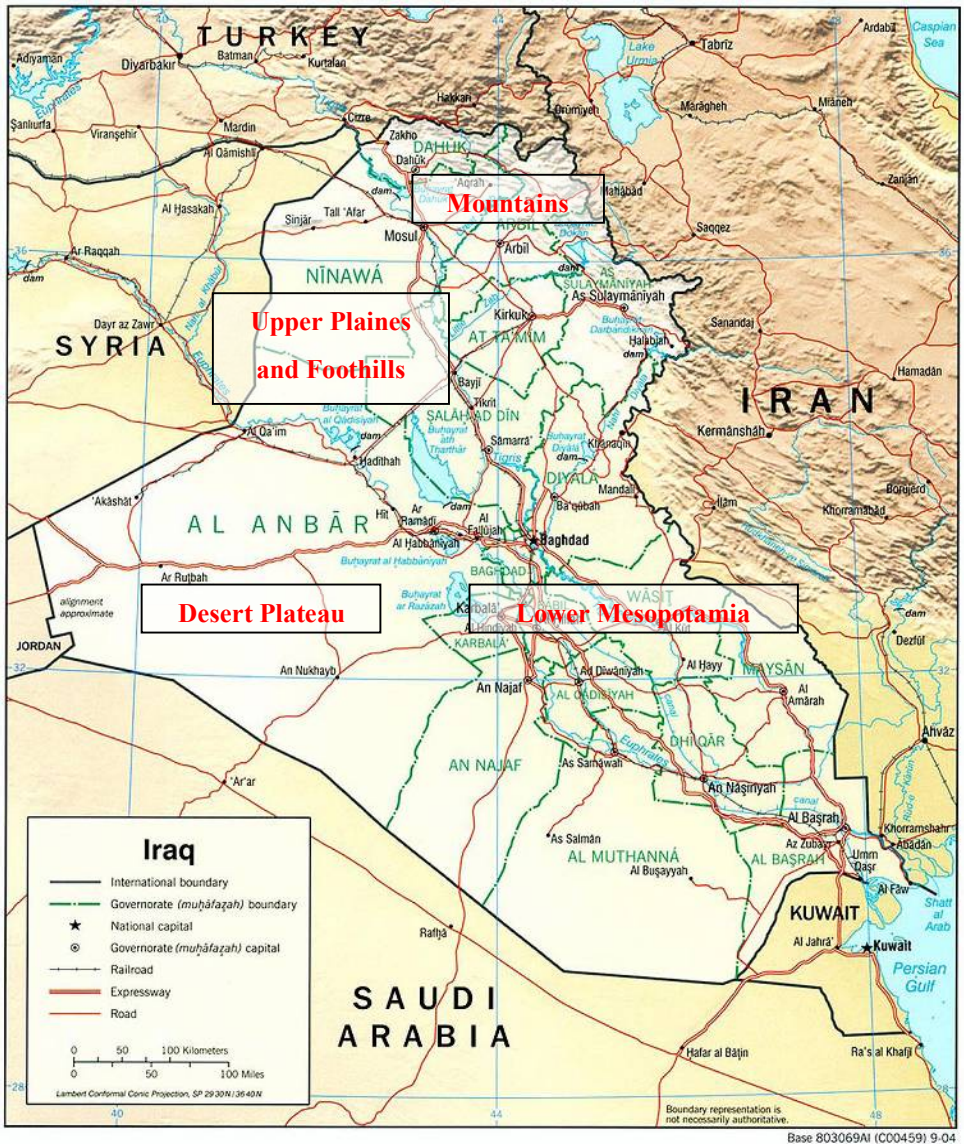


Figure 5-1 Biogeographical regions in Iraq[38]

(2) Climate[39]

Iraq lies within the moderate northern regional system similar to that of Mediterranean where rainfall occurs almost in spring, autumn and winter, and does not in summer. The climate can be categorized into the following three groups:

Mediterranean climate: it covers the mountainous region in the north-eastern part of the country which is characterized by cool winter with snow falls at the top of mountains. Its annual rainfall ranges between 400 – 1,000 mm. Its summer is moderate and the

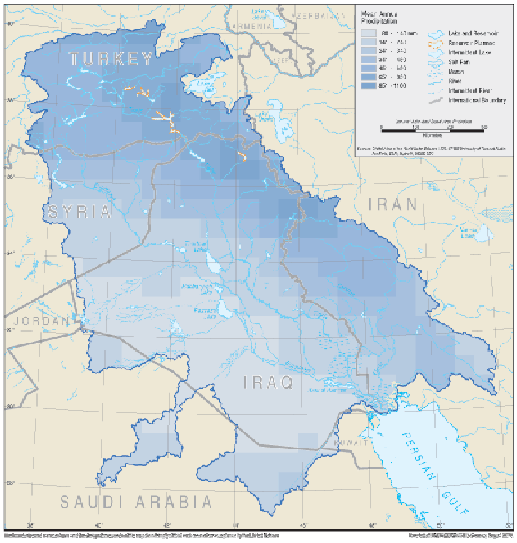
[38] The base map is from "Perry-Castañeda Library (University of Texas, USA)".
[39] Annual Abstract of Statistics 2008-2009 (Central Organization for Statistics and Information Technology, Iraq).

temperature does not exceed 35° C in most of its area.

Steppes climate: It is a transitional climate between the mountainous region in the north and the hot desert in the south. This climate prevails in the terrain area with annual rainfall ranging between 200 - 400 mm.

Hot desert climate: It prevails in the sedimentary plain and western plateau. Annual rainfall ranges between 50 - 200 mm. The maximum temperature reaches at 45 - 50 ° C in summer. In winter, warm weather prevails and the temperature remains above frost point temperature and does not fail below it except for few nights.

Figure 5-2 shows that mean annual precipitation (2000-08) and Figure 5-3 shows that mean annual temperature (2000-08) in Tigris and Euphrates river basins[40].



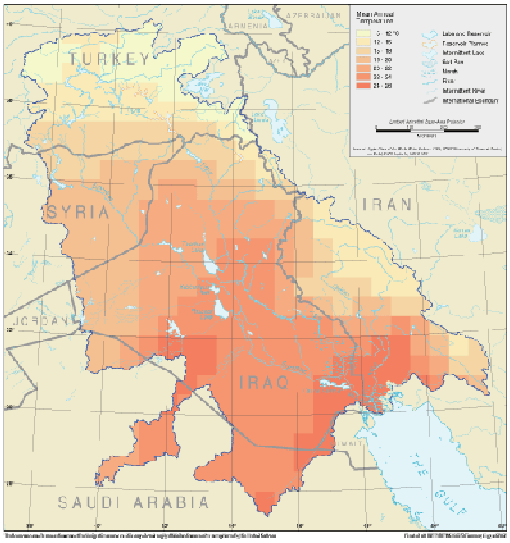


Figure 5-2 (left) Tigris and Euphrates: Mean annual precipitation (2000-08)
Figure 5-3 (right) Tigris and Euphrates: Mean annual temperature (2000-08)

(3) Terrestrial and freshwater ecosystems

The Iraq contains portions of the following five terrestrial eco-regions identified by WWF[41]: Tigris-Euphrates alluvial salt marsh; Arabian Desert and East Sahero-Arabian Xeric Shrublands; Mesopotamian Shrub Desert; Middle East Steppe; and Zagros Mountains Forest Steppe. The Project area is mainly within or close to Tigris-Euphrates alluvial salt marsh

[40] United Nations Environment Programme DEWA/GRID-Geneva: http://www.grid.unep.ch/product/map/index.php
[41] Iraqi Fourth National Report to the Convention on Biological Diversity (2010).

eco-region[42]. The eco-region is part of a former cradle of civilization (Mesopotamia), and it is surrounded by a vast region of desert and xeric shrubland. This complex of shallow freshwater lakes, swamps, marshes, and seasonally inundated plains is among the most important wintering areas for migratory birds in Eurasia[43].

"Lower Tigris & Euphrates" freshwater eco-region is also identified by WWF/TNC[44], and it overlaps the area of "Tigris-Euphrates alluvial salt marsh". The importance of the freshwater eco-region is the same as the one of the terrestrial eco-region.

In this region, Mesopotamian Marshlands forms the core area of the eco-region, which mainly consists of the Central, Hammar and Hawizeh Marshes. MOEN describes that the lower part of the marshland has a strong influence of the tidal intrusion, and several marine fish species which can also live in brackish and fresh water are found in the marshlands (the lower basin) such as the bull shark *Carcharhinus leucas*, which has been seen as far north as Baghdad; Hilsa shad T*enualosa ilisha*, which enters the rivers and marshes of Iraq for spawning; and Yellowfin seabream *Acanthopagrus latus*[45].

Although the statues of 90 % of the wetland was known as deteriorated in 2001, it has been being restored through international support by UNEP and other countries such as Japan and Italy[46]. UNEP and other donors are working closely with MOEN, Ministry of Water Resources and Ministry of Municipalities and Public Works.

(4) Key Biodiversity Areas, Important Bird Areas

International and national efforts have been paid for identification of Key Biodiversity Areas (KBAs) in each country for effective conservation of its biodiversity[47]. This exercise is still in progress based on the information of "Important Bird Areas (IBAs: BirdLife International)". The list of 42 of IBAs is shown in Appendix 1.

(5) Endangered species

IUCN has been updating the data on internationally endangered species of fauna and flora, and the list of them in Iraq is shown in Appendix 2.

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[42] This ecoregion is closely associated with biogeographical region "Lower Mesopotamia" in the "Geographical features and general vegetation status". Some areas belong to other ecoregions but their areas are much smaller than the ones described in the text.

[43] It is extracted from the description from the following site.
http://www.worldwildlife.org/wildworld/profiles/terrestrial/pa/pa0906_full.html

[44] Freshwater Ecoregion of the World: http://www.feow.org/index.php

[45] Iraqi Fourth National Report to the Convention on Biological Diversity (2010).

[46] Support for Environmental Management of the Iraqi Marshlands 2004-2009 (UNEP, 2009)

[47] KBAs are sites of global significance for biodiversity conservation, identified using globally standard criteria and threshold, based on occurrence of species requiring safeguards at the site scale (Identification and Gap Analysis of Key Biodiversity Areas: IUCN, 2007). In Iraq, Nature Iraq, a nature conservation Non-Governmental Organization, has been working on the identification of KBAs.

(6) Natural Protected areas

In Iraq, MOEN is in charge of managing the natural protected area system and there are two main protected areas in southern Iraq: proposed Mesopotamia Marshlands National Park and Hawizeh Ramsar Wetland indicated in Figure 5-4.

MOEN is working with Nature Iraq (NI) and the New Eden Group to designate Iraq's first National Park in the Mesopotamia Marshlands. A draft management plan exists for this park and the site information is currently being updated by NI/New Eden Group. In February 2008, Iraq designated the Hawizeh Marsh located in southern Iraq as a Ramsar site. A draft management plan was prepared and is under review by the National Ramsar Committee. To date no protected areas management actions have taken place in Hawizeh and no national legislation has been passed to strengthen protection of this area[48].

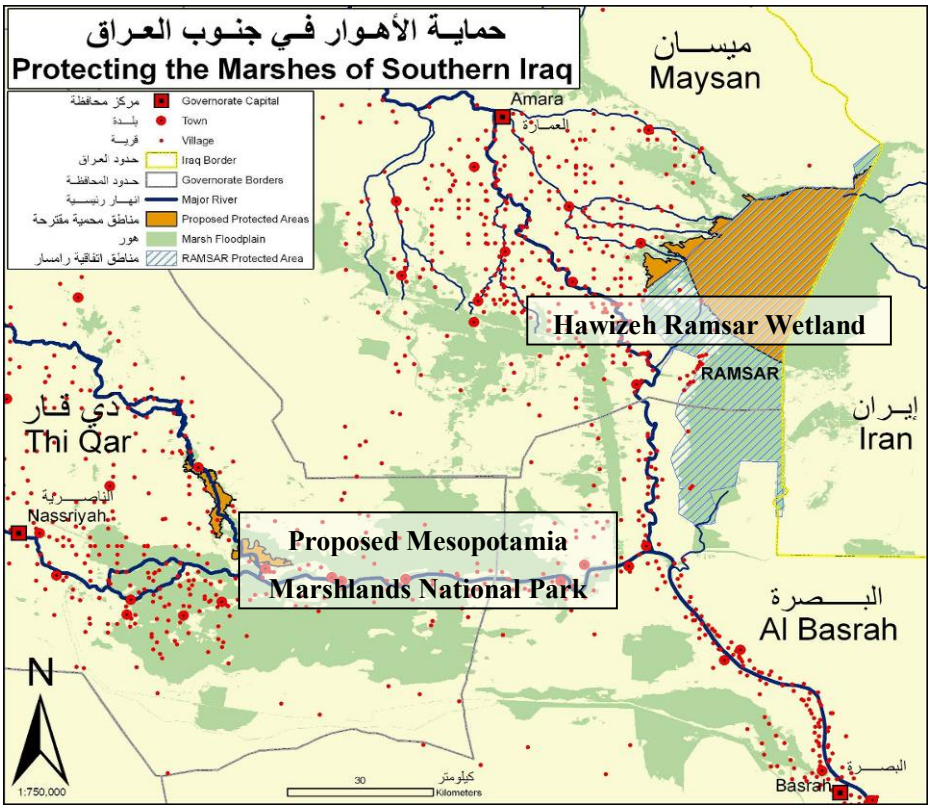

Figure 5-4 Natural protected areas in the southern Iraq[49]

[48] Iraqi Fourth National Report to the Convention on Biological Diversity (2010).
[49] University of Victoria Libraries: https://dspace.library.uvic.ca:8443/handle/1828/2560

(7) Seismic status of the southern part of Iraq

The southern part of Iraq is located at the south-west of Zagros Fold Belt[50] (Figure 5-5) and is identified as a "stable platform". It means that the area is not subject to a large earthquake or under any other unstable seismic activities as shown in Figure 5-6.

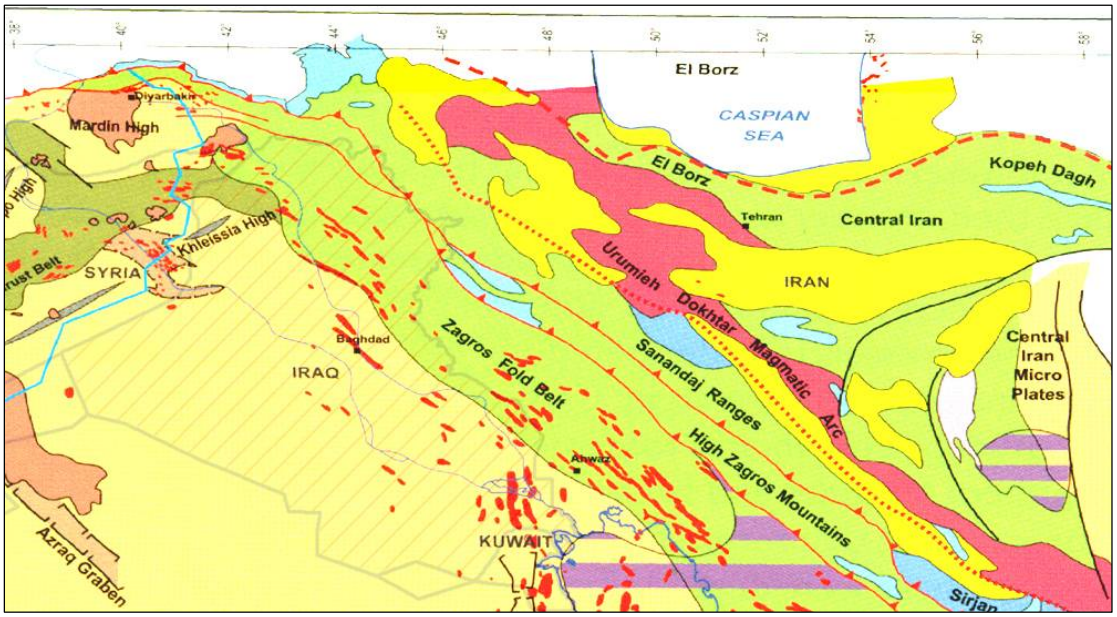

Figure 5-5 Wide area geological map around Iraq

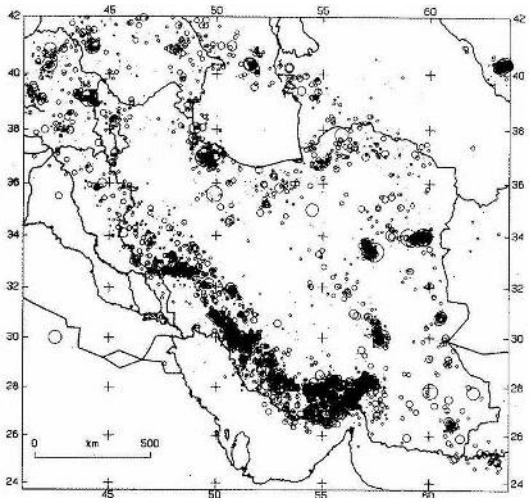

Figure 5-6 Recent seismicity of Iran and its surrounding areas[51]

[50] Part of "Technical element of Arabian Plate and Iran" from "Konert, G., A.M. Afifi, S.A. Al-Hajri, K. de Groot, A.A. Al Naim, and H.J.Droste, Paleozoic stratigraphy and hydrocarbon habitat of the Arabian Plate, *in* Petroleum Provinces of the Twenty First Century: AAPG Memoir 74, p. 483-515". Red dots in the map show oil and gas fields.

[51] http://www.seismo.ethz.ch/static/GSHAP/

(8) Pollution[52]

Air pollution: The various sources have polluted the air in most Iraqi cities and suburbs, with a tendency toward increasing pollution levels as city size and polluting activities increase. These problems are exacerbated by poor environmental legislative deterrents for offenders and weak monitoring and surveillance systems. The leading types of air pollution are lead, floating particles, concentration of carbon dioxide, sulphur, and falling dust. Some pollution concentrations are not measured because of lack of measuring instruments or, to the extent they exist, equipment malfunction. There is also a lack of some analysis equipment.

Water pollution: The main types of water pollutants in Iraq include: liquid industrial pollutants, organic pollutants, effluents from hospitals, sewage water, car washes, lubricants, oil pollutants, and drainage water. Weak environmental oversight of industrial activities has made matters worse, as has noncompliance with environmental requirements.

Soil pollution: Iraq is facing deterioration in the quality of its soil elements and degradation of their physical, chemical, and biological properties. This has caused productive land to become barren (desertification) or to become less productive. The causes are various: human activities such as clearing of trees for agricultural, fuelling, or construction purposes; high soil salinity; an unscientific approach to the use of fertilizers and agricultural pesticides; over-irrigation; the removal of vegetation covers; unsustainable management of solid waste.

Solid waste management: There are no specific data on solid waste management in the National Development Plan, but the Iraq Partners Forum[53] indicates that solid and chemical wastes are poorly managed in the country.

[52] This section is extracted and summarized from "Republic of Iraq: National Development Plan for the Years 2010-2014 (Ministry of Planning, 2010)".
[53] The Iraq Briefing Book (The Iraq Partners Forum, 2010).

5.1.2. Social environment

(1) Population

The basic statistics of the population of Iraq are shown in Table 5-1.

Table 5-1 Basic statistics of population of Iraq[54]

Item	Year	Figure
Surface area (km^2)	2008-2009	435,052
Total population (000)	2009	32,105
Population (male; 000)	2009	16,163
Population (female; 000)	2009	15,942
Population density (/km^2)	2009	73

(2) Local administrative bodies

The constitution of 2005 allots wide powers to the federal government but explicitly stipulates shared powers in customs, health, education, and environmental and natural resource policy and relegates all non-stipulated authority to the sub-national jurisdictions. Governorates are subdivided into districts, which also are administered by elected councils. At the lowest level of sub-national governance are municipalities and townships. In 2006, councils were in place in all 18 governorates, 90 districts, and 427 municipalities and townships[55]. Kurdistan Autonomous Region is not accounted for a governorate.

Basic profiles of 18 governorates are shown in Table 5-2.

Table 5-2 Profile of governorates[56]

No.	Governorate	Capital	Area (km^2)	Population (2007)
1	Anbar	Ramadi	138,228	1,485,985
2	Babil	Hilla	5,119	1,651,565
3	Baghdad	Baghdad	4,555	7,145,470
4	Basra	Basra	19,070	1,912,533

[54] Annual Abstract of Statistics 2008-2009 (Central Organization for Statistics and Information Technology, Iraq).

[55] Extracted from "Country Profile: Iraq (Library of Congress – Federal Research Division, 2006)".

[56] IAU – Iraq Information Portal: http://www.iauiraq.org/gp/

No.	Governorate	Capital	Area (km^2)	Population (2007)
5	Dahuk	Dahuk	6,553	505,491
6	Diyala	Ba'qubah	17,685	1,560,621
7	Erbil	Erbil	15,074	1,542,421
8	Kerbala	Kerbala	5,034	887,859
9	Kirkuk	Kirkuk	9,679	902,019
10	Missan	Amarah	16,072	824,147
11	Muthanna	Samawah	51,740	614,997
12	Najaf	Najaf	28,824	614,997
13	Ninewa	Mosul	37,323	2,811,091
14	Qadissiya	Diwaniya	8,153	990,483
15	Salah al-Din	Tikrit	24,075	1,191,403
16	Sulaymaniyah	Sulaymaniyah	17,023	1,893,617
17	Thi Qar	Nassiriyah	12,900	1,616,226
18	Wassit	Kut	17,153	1,064,950

Note: The names with underlines are the ones where the large thermal plant candidate sites exist.

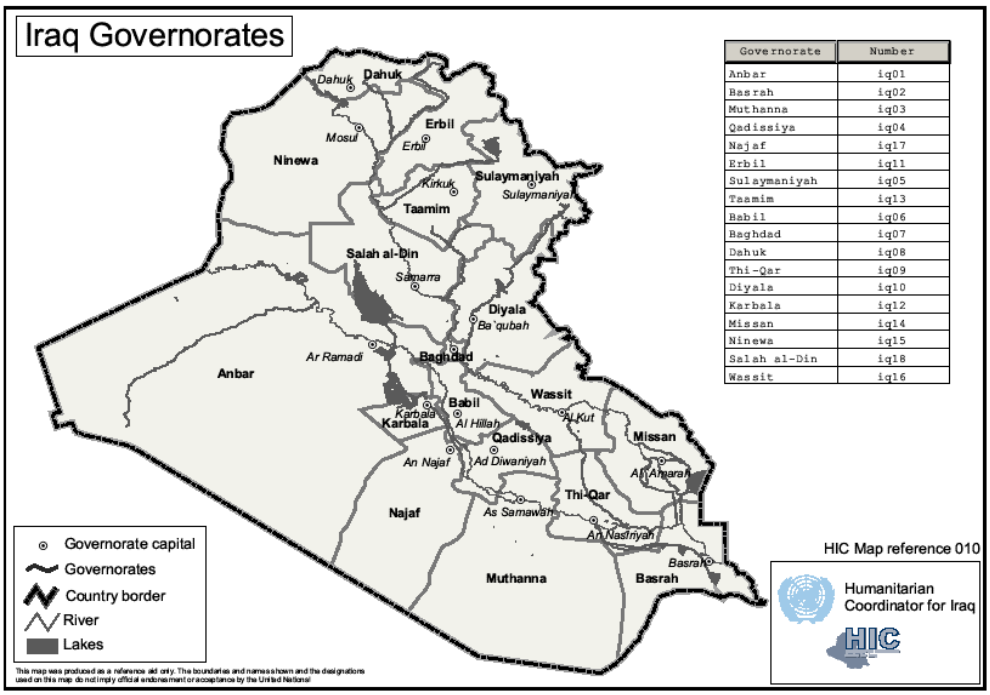

Figure 5-7 Administrative boundaries in Iraq[57]

[57] United Nations Assistance Mission for Iraq - Map Center : http://www.uniraq.org/library/maps.asp

(3) Industrial activities[58]

Agriculture: The total of arable land, irrigated land, and dry land in Iraq is 44.46 million acres (= 179,700 km^2). The total area of that land available for irrigation is 22.86 million acres of which 13.24 million acres are actually irrigated. A large part of the land is in poor condition because of salinity and the fact that it is filled with ground water, especially in the central and southern areas because of bad operational works, poor maintenance, and lack of integrated water logging. Natural factors are still the main influences on determining the production levels and harvests of the main crops in Iraq.
In 2005 the main agricultural crops were wheat, barley, corn, rice, vegetables, dates, and cotton, and the main livestock outputs were cattle and sheep[59].

Forestry: In 2005, forests are almost exclusively confined to the northeastern highlands. Most of the trees found in that region are not suitable for lumbering. In 2003, 113,000 m^3 of wood were harvested, nearly half used as fuel.

Fishing: Despite its many rivers, Iraq's fishing industry has remained relatively small and based largely on marine species in the Persian Gulf. In 2002 the catch was 14,500 tons.

Mining and Minerals: Aside from hydrocarbons, Iraq's mining industry has been confined to the extraction of relatively small amounts of phosphates (at Akashat), salt, and sulphur (near Mosul).

Manufacturing: Traditionally, Iraq's manufacturing activity has been closely connected to the oil industry. The major oil-related industries have been petroleum refining and the manufacture of chemicals and fertilizers. Since 2003, security problems have blocked efforts to establish new enterprises. An exception is the construction industry, which has profited from the need to rebuild after Iraq's several wars.

Oil and Gas: Oil and gas were discovered in Iraq in the early 1900s and have become among the most important sources of energy and a main source of financial resources to the national economy. In 2004, daily crude oil production reached 1.995 million barrels/ day.

[58] This section is extracted and summarized from "Republic of Iraq: National Development Plan for the Years 2010-2014 (Ministry of Planning, 2010)". "Forestry", "Fishing", "Mining and Minerals" and "Manufacturing" are from "Country Profile: Iraq (Library of Congress – Federal Research Division, 2006)".

[59] "Country Profile: Iraq (Library of Congress – Federal Research Division, 2006)".

It rose to 2.285 million barrels/day in 2008. Despite that, it could not reach 1979 production rates, which were at a record high of 3.563 million barrels/day. Export of crude oil increased 1.535 million barrels/day in 2004 to 1.849 million barrels /day in 2008. During some months of 2009, oil exports reached two million barrels/day, despite damage and vandalism to the basic oil export infrastructure. In gas activity, 40.9 % of the gas produced is burned before becoming available for use. This constitutes a significant loss to the national economy and a source of environmental pollution. The vision is set up as follows: to increase production capacity in the fields of oil, gas, and oil products pursuant to international specifications, and to increase oil and gas reserves, thereby ensuring longevity of Iraq's advanced position among producers and exporters worldwide, while utilizing these resources in a sustainable manner to protect the environment.

Electricity: Refer to "1. Introduction".

(4) Infrastructure: roads /bridges, railroads and ports[60]

Roads / bridges: This activity falls within the purview of the General Authority for Roads and Bridges within the Ministry of Construction and Housing. The total length of the external road network (beyond the boundaries of municipalities and the Mayoralty of Baghdad) is approximately 48,000 km, comprising: highways, 1,084 km; arterial roads, 11,000 km; rural roads, 10,000 km; border roads, 11,000 km; and secondary roads:15,200 km. In addition, there are 1,247 concrete and steel bridges and 35 floating bridges scattered throughout the country's provinces. This network does not meet the country's needs, particularly with respect to rural roads.

[60] This section is extracted and summarized from "Republic of Iraq: National Development Plan for the Years 2010-2014 (Ministry of Planning, 2010)".

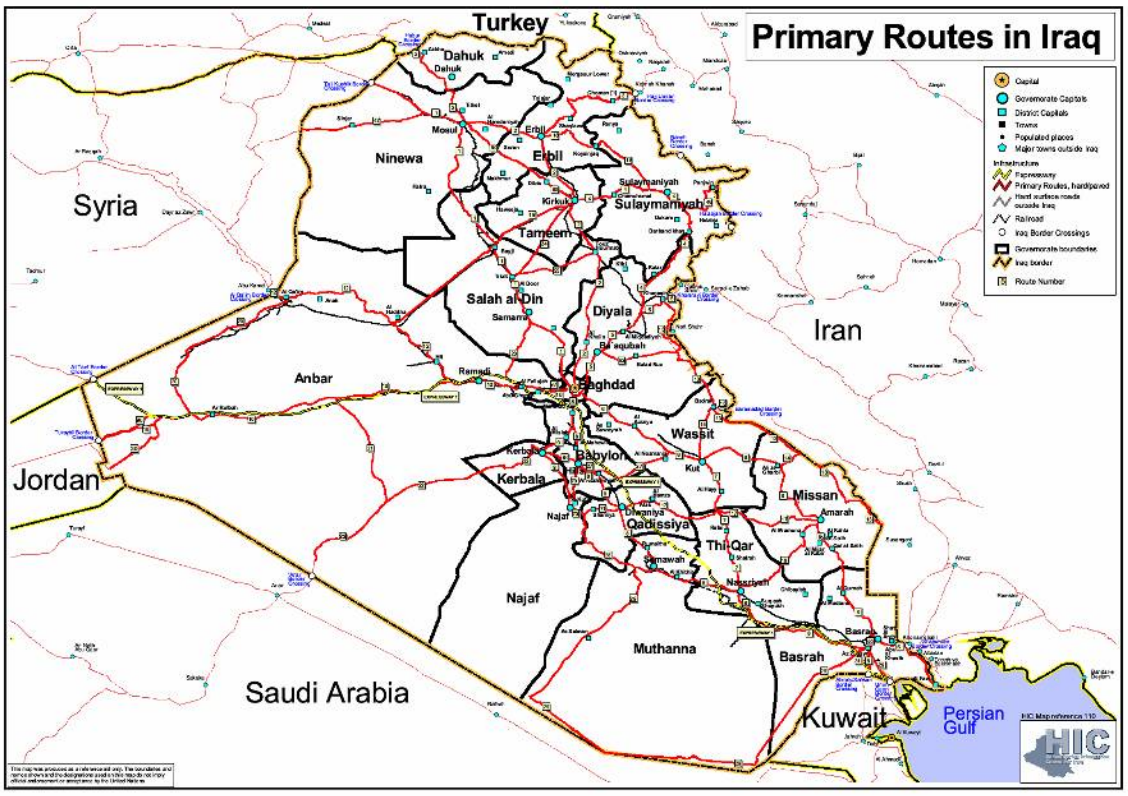

Figure 5-8 Primary road map of Iraq[61]

Railroads: In 2008, Iraq's railroad lines totaled 2,295 km, of which 1,901 km were main lines, and 394 km were secondary lines. The number of locomotives in operation was 106, down from the 494 originally constructed. Lines currently in operation are Baghdad–Basra, Baghdad–Samarra, Mosul–Rabia, and Baghdad–Fallujah. Work is currently being done to double the Baghdad–Basra, the Baghdad–Mosul, and the Hammam Al-Alil–Sabonia–Rabia lines, and to modernize and renovate existing lines to increase their efficiency, increase operating speeds, and improve line capacities.

Ports: Basra is Iraq's only international port and is of vital economic importance in securing a large portion of Iraq's import needs and a key port for exporting crude oil and other Iraqi products. Port activities are funded and managed entirely by the state through the General Company for Iraqi Ports. Currently, Iraq has four commercial ports and two platforms to export oil. There are 48 commercial port docks with a capacity of 17.5 million tons annually, of which 43 are currently operational with a capacity of 15.90 million tons annually.

[61] United Nations Assistance Mission for Iraq - Map Center : http://www.uniraq.org/library/maps.asp

(5) Water resources[62]

The water resources of Iraq are strongly connected with the quantity of rain and snow that fall in the main river basins (Tigris and its tributaries and Euphrates) and the policy of using the dams and reservoirs that are built on upper parts of the mutual rivers in Turkey, Syria, and Iran. Its quality deteriorates because it is kept in reservoirs and polluted water is discharged into them from various industrial agricultural and human activities. Iraq will witness more shortages in water resources and low quality after Turkey completes its irrigation projects and Syria develops its irrigation projects. This will cause a deficiency in revenues from the Tigris and Euphrates of more than 43 % in 2015. The Ministry of Water Resources is updating the water budget of Iraq (comprehensive planning of water and land), and will establish policies related to managing and investing the water resources.

Table 5-3 shows the decline of the discharges of Euphrates and Tigris Rivers.

Table 5-3 Average annual river inflow to Euphrates and Tigris Rivers at the borders[63]

	Until 1989	1990-2005	Until 2014 (planned)
Euphrates River	27.4 BCM	17.4 BCM	8.5 BCM
Tigris River	NA	19.4 BCM	9.2 BCM

BCM = billion cubic meters, NA = not available

A technical report on municipal water supplies[64] estimates that, in Basra Province, a present total peak daily water demand of about 650,000 m^3/day rising to 1,167,400 m^3/day by 2025, assuming that the population of the province is projected to rise from 1,761,000 in 2003 to 3,375,000 in 2025. The water demand includes domestic, commercial and industrial ones.

(6) Socially vulnerable people

Persons with disabilities: Despite the survey by the government, the number and distribution of disabled persons are not available yet.

Widows and Orphans: There are large discrepancies in estimates of the numbers of

[62] The following sections (Water resources, Health, Socially vulnerable people and Poverty) are extracted and summarized from "Republic of Iraq: National Development Plan for the Years 2010-2014 (Ministry of Planning, 2010)", unless otherwise indicated.

[63] The Preparatory Survey on South Jazira Irrigation Project in Republic of Iraq (JICA, 2011)

[64] Strategy For Water and Land Resources in Iraq/ Technical Report Series: Municipal Water Supplies (Ministry of Water Resources, 2006, Preliminary report)

widows and orphans. The report of the United Nations on human rights in Iraq in 2006 has shown that women and children are still paying a high price as a result of domestic disputes, violence, and terrorism and that the number of orphans and widows is increasing continuously.

Displaced Families: Difficulties what Iraqi displaced families are mainly in the countries of emigration as many family's savings are depleted because of the high cost of living and the lack of work opportunities. Those families have lost their main source of support because of circumstances in the countries of emigration.

Children: Children (those under 18) form approximately half of the population of Iraq. Children in Iraq, as in all conflict zones, are the victims mostly liable to violate the law. Despite laws that require children to enroll at schools, the crises have forced many families to work outside the home.

(7) Poverty

The document of the strategy for decreasing poverty that was approved by the cabinet in November 2009 indicated that 22.9 % of citizens, or approximately 6.9 million Iraqis, are below the poverty line (77 thousand dinar/individual/month).

The distribution of poor people differs between rural and urban areas. While 70 % of the citizens live in the urban areas, half of the poor are concentrated in rural areas. This suggests that the economic and social conditions in the rural create an environment that generates poverty.

(8) Ethnic groups

In 2006 an estimated 75 to 80 % of the population was Arab and 15 to 20 %, Kurdish. Other significant minority groups, together constituting less than 5 % of the population, were Assyrians, Chaldeans, and Turkmens[65].

The Marsh Arabs are known as a group in the southern part of Iraq, especially in marshlands, and also know as vulnerable people. According to UNEP[66], in 2003, about 10,000 Marsh Arabs live in the marshlands in southern Iraq, and 10% of them live in their traditional way of life.

[65] Extracted from "Country Profile: Iraq (Library of Congress – Federal Research Division, 2006)".
[66] Environment in Iraq: UNEP Progress Report (2003).

(9) Historical and cultural heritages

Iraq currently has three (3) World Heritages and has proposed 11 archaeological and natural sites for as candidates of the World Heritage as follows. The detailed information such as their locations is shown in Appendix 3.

- World Heritage Sites
  - Hatra (Date of Inscription: 1985)
  - Ashur (Qal'at Sherqat) (Date of Inscription: 2003)
  - Samarra Archaeological City (Date of Inscription: 2007)
- Proposed World Heritage Sites
  - Ur (Date of Submission: 07/07/2000)
  - Nimrud (Date of Submission: 07/07/2000)
  - Ancient City of Nineveh (Date of Submission: 07/07/2000)
  - Fortress of Al-Ukhaidar (Date of Submission: 07/07/2000)
  - Wasit (Date of Submission: 07/07/2000)
  - Sacred Complex of Babylon (Date of Submission: 29/10/2003)
  - Marshlands of Mesopotamia (Date of Submission: 29/10/2003)
  - Erbil Citadel (Date of Submission: 08/01/2010)
  - Site of Thilkifl (Date of Submission: 21/01/2010)
  - Amedy City (Date of Submission: 02/02/2011)
  - Wadi Al-Salam Cemetery in Najaf (Date of Submission: 24/01/2011)

5.2. Description of the environments around Nasiryah II

5.2.1. Physical and natural environments

(1) Geographical features and its vegetation

The site is located in "Lower Mesopotamia" biogeographical region (refer to 5.1.), and Figure 5-9 shows the current status of the site. Some shrubs are observed in the surrounding area.

Figure 5-9 Photograph of the site (provided by MOE)
The thermal power plant behind the site is Nasiryah Thermal Power Plant

(2) Climate

The site is located in "Hot desert climate" (refer to 5.1.) which has low precipitation and high temperature in summer and low temperature in winter.

Air Temperature

Maximum monthly mean air temperature of 40.2°C (July 2000) and minimum monthly mean air temperature of 9.0°C (January 1992) were observed in the Nasiryah meteorological station close to the Project site. Table 5-4 shows the monthly mean air temperature from 1992 to 2008, and Figure 5-10 shows average mean air temperature from 2000 to 2008.

Table 5-4 Monthly mean air temperature (°C) at Nasiryah Meteorological Station

YEAR	JAN	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.
1992	9.0	11.9	15.2	24.0	29.7	34.9	35.7	36.2	33.1	26.1	18.4	12.4
1993	10.7	13.3	19.0	24.3	30.1	35.3	37.4	37.1	33.4	28.1	18.0	15.4
1994	14.9	15.4	20.3	27.2	32.3	35.4	36.4	35.8	34.0	28.2	20.2	11.1
1995	13.4	15.4	19.7	24.9	32.5	35.9	36.4	36.7	32.5	26.5	18.7	13.0
1996	13.4	15.9	19.1	24.7	33.8	36.0	39.2	38.2	33.4	26.7	19.7	16.6
1997	12.9	12.1	16.6	24.4	32.7	36.7	36.7	34.9	33.4	27.8	19.4	13.6
1998	11.3	14.3	18.1	25.9	31.7	37.4	38.3	39.4	34.7	27.2	21.8	16.4
1999	14.0	15.8	19.6	26.9	33.5	37.0	37.9	39.1	34.4	29.2	19.1	13.5
2000	12.0	14.1	19.2	28.9	33.2	36.1	40.2	39.5	33.5	26.2	18.4	13.6
2001	12.3	15.4	21.4	26.9	32.0	35.0	37.2	39.3	34.7	28.8	19.0	15.9
2002	11.6	15.5	21.2	24.7	32.4	36.3	38.9	37.1	34.4	29.4	18.8	13.4
2003	-	-	-	-	-	-	-	-	-	-	-	-
2004	-	15.2	21.6	24.4	31.7	36.2	38.4	37.0	33.8	29.7	20.2	10.9
2005	-	13.9	19.7	26.7	32.8	36.1	38.9	37.8	32.8	26.9	17.5	15.6
2006	12.8	15.4	20.9	26.2	33.3	37.8	38.2	39.0	33.6	29.6	17.6	10.2
2007	10.2	15.8	19.5	25.2	34.0	36.9	38.1	38.4	34.6	29.1	20.1	13.2
2008	9.1	14.4	23	28.1	32.9	36.8	38.4	38.9	35.2	27.6	19.4	13.0

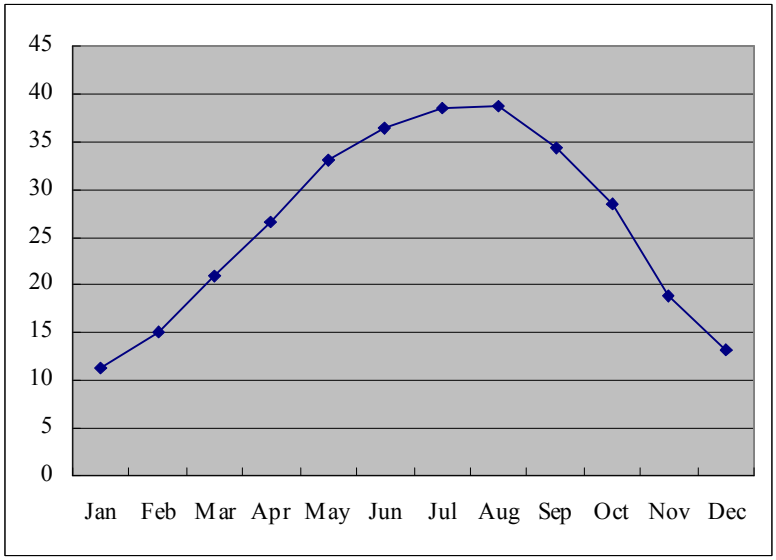

Figure 5-10 Average temperature at Nasiryah Meteorological Station (2000-08, unit: ºC)[67]

Relative Humidity

Maximum monthly mean relative humidity of 81% (December 1997) and minimum monthly mean relative humidity of 19.0% (June 2006, July 2005, 2006 and 2008) were observed. Table 5-5 shows monthly mean relative humidity from 1992 to 2008.

Table 5-5 Monthly mean relative humidity (%) at Nasiryah Meteorological Station

YEAR	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.
1992	64	61	60	43	38	27	23	26	30	36	63	75
1993	74	66	50	60	38	25	21	25	28	38	58	65
1994	71	53	45	39	27	22	22	23	29	46	63	70
1995	76	66	50	44	28	23	23	25	32	34	43	65
1996	76	71	64	46	35	21	20	22	27	35	53	62
1997	67	48	56	47	31	25	22	26	29	46	71	81
1998	77	67	63	47	34	26	26	25	32	38	50	55
1999	73	69	58	44	27	21	21	21	29	37	55	72
2000	68	56	42	38	30	23	23	25	27	40	58	80

[67] Figure 5-10 and 5-11 are prepared by the JICA Study Team based on the data from Nasiryah Meteorological Station.

YEAR	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.
2001	-	-	-	-	-	-	-	-	-	-	-	-
2002	68	57	45	49	31	24	22	24	27	36	52	-
2003	-	-	-	-	-	-	-	-	-	-	-	-
2004		61	42	39	32	26	21	23	25	37	59	68
2005	67	61	52	43	30	23	19	23	28	37	52	62
2006	67	67	45	44	29	19	19	22	27	39	57	73
2007	69	58	46	45	28	20	20	22	24	36	43	60
2008	65	49	35	28	25	20	19	22	30	45	56	56

Rainfall

Maximum monthly rainfall of 105.7 mm (April 2002) and minimum monthly rainfall of 0 mm (from June to October every year) were observed. Table 5-6 shows monthly rainfall from 2000 to 2008, and Figure 5-11 shows average monthly rainfall from 2000 to 2008.

Table 5-6 Monthly rainfall (mm) at Nasiryah Meteorological Station

YEAR	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	TOTAL
2000	21.5	4.1	1.5	1.0	1.3	0.0	0.0	0.0	0.0	4.0	7.6	67.0	108.
2001	5.0	3.1	9.1	0.001	0.2	0.0	0.0	0.0	0.0	0.1	3.0	42.0	62.9
2002	10.4	7.4	11.4	105.7	1.0	0.0	0.0	0.0	0.0	1.0	8.7	5.4	151.0
2003	-	-	-	-	-	-	-	-	-	-	-	-	-
3004	28.5	0.3	0.8	25.9	0.0	0.0	0.0	0.0	0.0	0.0	26.5	16.6	98.6
2005	45.2	0.9	33.7	3.9	0.001	0.0	0.0	0.0	0.0	0.0	0.2	21.8	105.7
2006	27.5	59.5	6.1	25.2	1.9	0.0	0.0	0.0	0.0	26.9	17.7	81.0	245.8
2007	9.2	0.1	75.8	5.5	0.001	0.0	0.0	0.0	0.0	0.0	0.001	21.9	112.5
2008	19.4	10.8	0.4	1.4	0.2	0.2	0.001	0.0	0.2	32.2	0.7	0.0	65.5
2009	0.3	7.1	18.6	4.8	1.5	0.0	0.0	0.0	0.0	0.2	1.7	22.3	56.9
2010	2.6	2.7	0.5	29.2	14.8	0.0	0.0	0.0	0.0	0.1	0.4	7.3	57.6

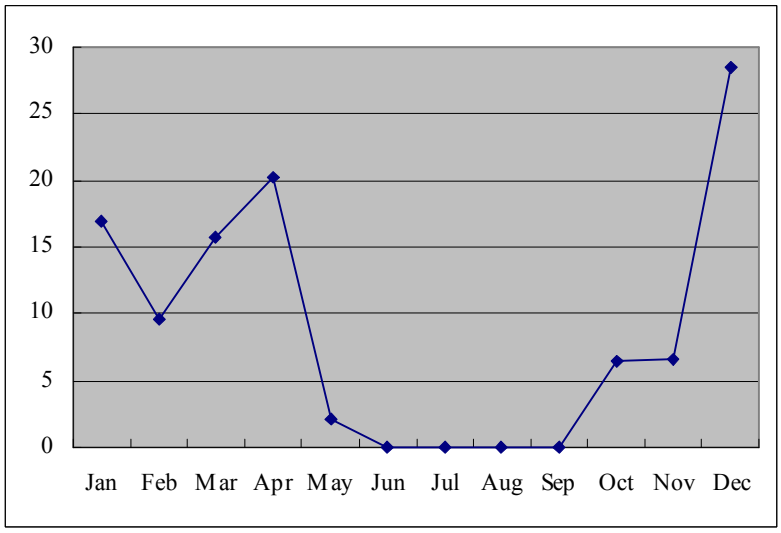

Figure 5-11 Average rainfall at Nasiryah Meteorological Station (2000-08, unit: mm)

Wind

Maximum monthly mean wind velocity of 9.3m/s (July 1992) and minimum monthly mean wind velocity of 1.3m/s (November 2000) were observed. The wind bellows mainly from the north, northwest and west. Table 5-7 shows monthly wind velocity and direction.

Table 5-7 Monthly wind velocity and direction at Nasiryah Meteorological Station

[Upper: Wind Velocity (m/s) Lower: Wind direction]

YEAR	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.
1992	3.9	5.2	4.6	5.5	5.5	6.5	9.3	5.6	4.0	3.7	4.0	4.5
	NW	NW	NW	NW	NW	N/NW	N/NW	NW	N	N/NW	NW	NW
1993	2.9	4.7	4.7	4.4	5.4	6.6	7.6	4.6	5.0	2.6	4.3	2.9
	NW	NW	N	SE	N	N	N/NW	N	N	N	N	N
1994	3.7	4.2	5.1	4.9	5.7	6.4	4.7	4.3	1.9	2.8	3.9	2.6
	NW	NW	NW	NW	NW	NW	NW	NW	NW	NW	NW	NW
1995	2.5	3.3	3.9	5.1	4.3	5.5	8.2	6.4	3.5	2.7	3.7	1.8
	NW	NW	NW	E	W	NW	NW	NW	NW	NW	NW	NW
1996	3.4	3.8	4.3	5.1	3.7	5.7	5.1	4.9	5.9	3.7	2.5	3.7
	SE/NW	NW	NW	NW	NW	NW	NW	NW	NW	NW	W/NW	E
1997	3.2	3.0	3.7	3.5	3.3	3.7	6.9	6.3	2.5	2.6	2.4	2.6
	NW	NW	NW	NW	NW	NW	NW	N/NW	N/NW	W/NW	W/NW	W/NW
1998	3.0	2.9	4.4	3.9	3.7	4.8	4.5	4.0	4.9	2.6	2.0	2.8
	NW	NW	NW	NW	NW	NW	NW	NW	NW	NW	NW/W	NW
1999	3.2	2.4	3.3	3.9	4.4	5.2	6.2	5.4	4.5	2.5	2.4	1.4
	W	W	W	NW	NW	NW	NW	NW	NW	NW	W	W
2000	2.7	3.5	4.7	3.7	4.6	6.2	4.3	3.6	3.6	3.0	1.3	2.6
	N/NW	NW	NW/W	NW	NW	W/NW	W/NW	NW	NW/W	NW	NW/W	NW
2001												
	W	W	W	NW	NW	W/NW	W	NW	NW	NW	W	NW

YEAR	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.
2002	3.1	3.7	3.8	3.9	3.3	4.2	3.8	5.2	4.2	2.5	3.1	
	W	W	W	NW	NW	NW	NW	NW	NW	NW	W/NW	
2003												
2004		2.4	2.6	4.8	2.9	4.1	3.3	3.7	2.1	1.6	3.2	2.1
		NW	NW	NW	NW	NW	NW	NW	NW	NW	NW	NW
2005	2.7	2.5	3.2	3.6	2.6	6.2	4.0	3.4	3.6	2.1	1.9	1.9
	NW	NW	NW	NW	NW	NW	NW	NW	NW	NW	NW	NW
2006	2.2	2.8	3.6	3.3	3.3	4.5	5.2	3.8	3.3	3.0	2.5	2.2
	NW	NW	NW	NW	NW	NW	NW	NW	NW/W	NW/W	NW/W	W
2007	2.4	2.8	3.1	3.4	2.9	4.3	3.4	3.6	4.0	2.4	2.4	2.8
	W	W/NW	W	E	NW	NW/W	W	W	NW/W	NW	NW/W	W
2008	1.9	3.9	2.2	3.2	3.2	5.1	3.6	3.3	3.0	3.1	2.3	2.7
	NW/W	NW	NW	NW	NW	NW	NW	NW	NW/W	NW	W	W

(3) Terrestrial and freshwater ecosystems

The site and its surrounding area belong to Tigris-Euphrates alluvial salt marsh eco-region and "Lower Tigris & Euphrates" freshwater eco-region (refer to 5.1.).

The site has been prepared for an industrial area and its vegetation is very poor (Figure 5-8). Euphrates River runs along the Nasiryah Thermal Power Plant. 47 fish species are listed as freshwater fish in Iraq[68] (Appendix 4) but the detailed data of the river around the site is not available.

(4) Important Bird Areas

There are not any IBAs in the close vicinity of the site (refer to Figure 6-3 and Appendix 1).

(5) Endangered species

It is assumed that endangered species categorized by IUCN (refer to Appendix 2) do not occur in the site and its close vicinity because of the following reasons: the site is not a suitable habitat (e.g. large mammals such as Asiatic Wild Ass, waterbirds such as Lesser White- fronted Goose); it is out of original distribution area (e.g. Iraqi Keel-scaled Gecko); and it is in the vicinity of a large city (Nasiryah) and the existing thermal power plant.

[68] Fishbase: http://www.fishbase.org/home.htm

(6) Natural Protected areas

Proposed Mesopotamia Marshlands National Park (Figure 5-4) is located downstream of Euphrates River. The boundary of the above-mentioned proposed national park has not been drawn but the distance from Nasiryah II is about 50 km.

(7) Seismic status

The site is not located in an area prone to earthquake (refer to 5.1.).

(8) Historical record of flood of Euphrates River

It is clear from the historical average discharge for the period (1950-1997) collected from National Commission for Water Resources Management that the years of 1950, 1967, 1968, 1969 witnessed a flood where the monthly average discharge exceeded 1,400 m3/s but unfortunately there is no records found for the water level in these years. The only recorded data obtained from Ministry of Water Resources for the flood of 1988 is in Table 5-8:

Table 5-8 Historical record of flood of Euphrates River

Date of flood	Level of Euphrates(m)	Measured discharge (m^3)
27 June 1988	6.3	1,514

(9) Geological survey

A geological survey was conducted to investigate the subsoil conditions of the site.

The subsoil strata at the site which explored by five (5) boreholes at 30 m depth consist mainly of major stratums; medium, stiff to very stiff grayish brown to greenish gray and other color appearances differs from borehole to another, fat silty clay, inter-bedded by loose, medium dense to very dense fine grained silty sand layers at various depths throughout the boreholes.

Lots of white shiny traces of soluble salts and black spots and/or lines of organic matter together with red rusty brown traces of iron oxide compound and white crystal pieces of mica mineral compound intervened within the strata.

The clay and sand fractions in certain cases were high in amount to the extent where the description of the layers altered to clayey silty sand and sandy silty clay consequently.

The water table was encountered, as observed during the time of exploration at a level in the wide range of 1.0-2.0 m, below the existing natural ground level.

(10)Baseline data on air, water, noise, vibration and river water conditions

The Environmental baseline survey was conducted from 26 to 28 September 2011 at the sites indicated in Figure 5-11; E1 and E2 for ambient air quality, noise and vibration surveys, and H1 and H2 for ambient water quality survey. Regarding the standard in each survey field, refer to "2.3.3 Standards".

Figure 5-12 shows the measurement points.

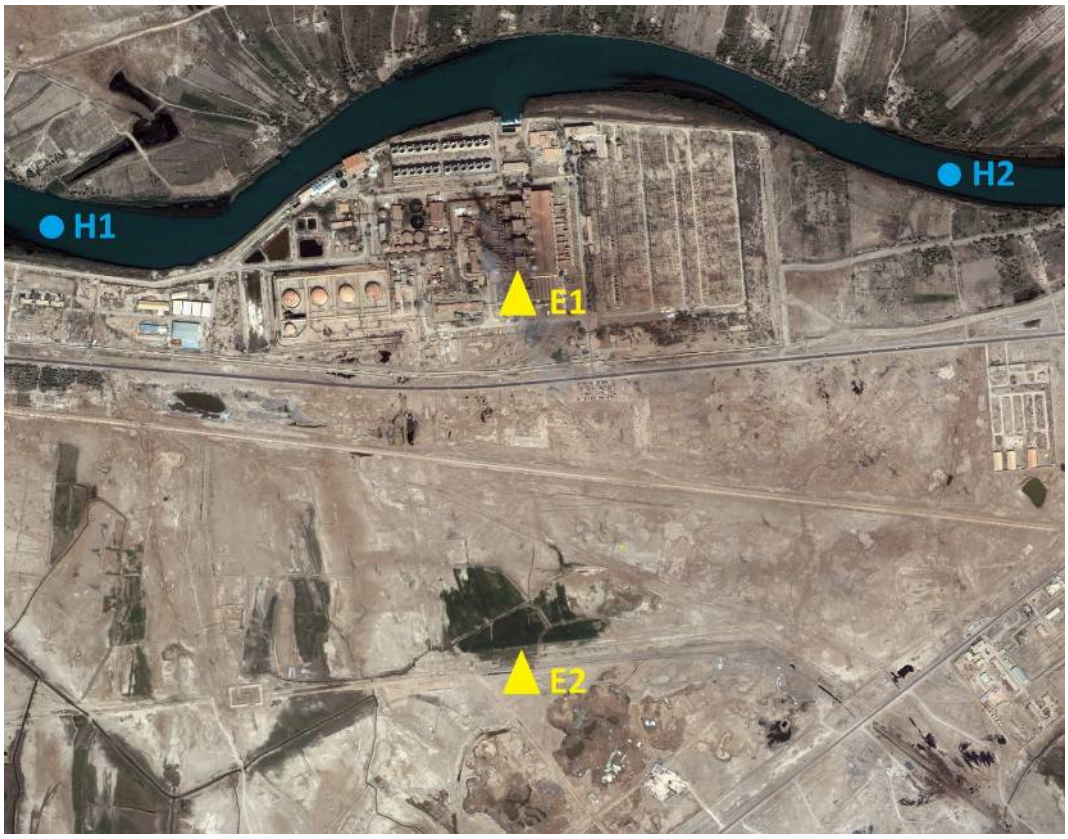

Figure 5-12 Sampling sites for the Environmental Baseline Survey

Table 5-9 shows the dates and the field works of the survey.

Table 5-9 Survey schedule

Date	Field works
26 September 2011	Collecting river water samples
27 September 2011	1. Collecting air samples 2. Noise and vibration measurements
28 September 2011	Continuation of noise and vibration measurements

The result of each survey is described in the following sections.

Ambient air quality

Ambient air quality was measured at the sampling points (E1 and E2 in Figure 5-12). The measured items are SPM, PM_{10}, CO, NOx and SOx.

In order to undertake the field work for air quality study different field devices and equipments had been used for this investigation. These devices have been prepared and calibrated are:

- Low volume air sampler for the collection of SPM from the air.
- Temperature and relative humidity device, Lutron-HT-301SAA, Taiwan, for the (temperature ºC) and (relative humidity: RH %) measurements.
- Wind speed device, Meteo Digit, type 916, Germany, for wind speed measurements.
- Full computerized light microscope, type Nikon Eclipse- model ME600, with very high resolution for determining the characterization of particle morphology, type, and size diameter of the suspended particulate matter have been used.
- Other devices for gas concentration measurements, gas analyzers have been used for the measurements: gas analyzer TSI Model 8762 (made in USA) for CO and CO_2; and gas analyzer MultiRAE Plus (made in USA) for SOx and NOx.

The result of the survey is summarized in Table 5-10 and Table 5-11.

Table 5-10 Ambient air quality (E1)

Air pollutants	Time of sampling			Iraqi Standards
	9:45 AM	3:00 PM	5:30 PM	
SPM ($\mu g/m^3$)	4,076.18	3,107.71	3,252.68	-
PM_{10} ($\mu g/m^3$)	1,019.04	776.93	813.17	350$\mu g/m^3$/24 hr
CO (ppm)	47.6	23.7	61.5	35 ppm/hr
CO_2(ppm)	316	320	303	-
NO_2 (ppm)	4.7	0	0	0.04 ppm/hr
SO_2 (ppm)	0	0	0	0.1 ppm/hr
Meteorological measurements				
Temperature (°C)	46.4	46.8	40.3	
RH (%)	17.2	21.4	19.1	
Wind speed (m/s)	0.1	0.3	0.1	
Wind Direction	NW-SE	NW-SE	NW-SE	

Table 5-11 Ambient air quality (E2)

Air pollutants	Time of sampling			Iraqi Standards
	12:30 PM	5:00 PM	6:30 PM	
SPM ($\mu g/m^3$)	3,514.48	3,254.50	3,326.76	-
PM_{10} ($\mu g/m^3$)	880.52	813.62	830.69	350$\mu g/m^3$/24 hr
CO (ppm)	44.5	70	37.3	35 ppm/hr
CO_2(ppm)	316	320	303	-
NO_2 (ppm)	0	0	0	0.04 ppm/hr
SO_2 (ppm)	1.0	0	0	0.1 ppm/hr
Meteorological measurements				
Temperature (°C)	47.5	44.2	37.8	
RH (%)	15.3	18.0	20.0	
Wind speed (m/s)	0.4	0.3	0.3	
Wind Direction	NW-SE	NW-SE	NW-SE	

Ambient water quality

Ambient water quality was measured at the sampling points (H1 and H2 in Figure 5-12). The measured items are temperature (surface, upper and lower layers), pH, EC, TDS, TSS, Total Hardness, DO, BOD5, COD, TOC, Ca, Mg, Na, K, Cl, NO_3, SO_4, Cl2, NH_4 (as ammonia), P, Al, Fe, Cd, Cr, Cu, Mn, Ni, Pb, Zn, B, Si, As, Hg and Oil & Grease.

One litter of surface water sample was collected from each of sample location with a clean water container. Some items such as water temperature, pH, were measured during water sampling at the sample locations, using portable devices. These field work devices have been calibrated before and after the measurements.

Other items were analyzed at IWW[69] in Mülheim, Germany, according to ISO standard methods.

[69] Rheinisch-Westfälisches Institut für Wasserforschhung gemeinnützige GmbH (IWW Water Research Insitute), Germany

The result of the survey is summarized in Table 5-12.

Table 5-12 Ambient water quality

Parameter	Unit	Location		Testing method	Iraqi Standard
		H1	H2		
Temperature	°C			Electrometric	-
Surface		28.7	28.8		
10 cm depth		28.9	28.8		
20 cm depth		28.9	28.9		
pH		8.05	8.14	Electrometric	6.5-8.5
EC	microsiem./cm	4,474	4,533	DIN EN 27888	-
TDS	mg/l	2,860	2,900	Calc. accord. to EC	-
TSS	mg/l	55	60	Standard method	-
Total Hardness	mg/l	1,111.0	1,103	Calc. accord to Ca and Mg ions.	-
DO	mg/l	9.1	9.4	Electrometric	< 5.0
BOD_5	mg/l	3.8	3.3	Azide Modific. at 20 °C, 5 days.	> 5.0
COD	mg/l	42	31	Standard method	-
TOC	mg/L	3.1	3.3	DIN EN ISO 1484	-
Ca	mg/l	199	198	DIN EN ISO 10304-1	-
Mg	mg/l	147	146	DIN EN ISO 10304-1	-
Na	mg/l	577	576	DIN EN ISO 10304-1	-
K	mg/l	10.9	11.9	DIN EN ISO 10304-1	-
Cl	mg/l	769	784	DIN EN ISO 10304-1	200
NO_3	mg/l	< 5.0	< 5.0	DIN EN ISO 10304-1	15
SO_4	mg/l	963	981	DIN EN ISO 10304-1	200
Free Cl_2	mg/l	0.1	0.02	EPA 334.0	-
NH_4	mg/l	3.0	3.5	EPA 350.3	-
P	mg/l	< 0.10	< 0.10	DIN EN ISO 10304-1	0.4
Al	mg/l	< 0.10	< 0.10	DIN EN ISO 11885	0.1
Fe	mg/l	0.41	0.58	DIN EN ISO 11885	0.3

Parameter	Unit	Location		Testing method	Iraqi Standard
		H1	H2		
Cd	mg/l	< 0.002	< 0.002	DIN EN ISO 11885	0.05
Cr	mg/l	< 0.010	< 0.010	DIN EN ISO 11885	0.05
Cu	mg/l	0.012	0.005	DIN EN ISO 11885	0.05
Mn	mg/l	< 0.010	< 0.010	DIN EN ISO 11885	0.1
Ni	mg/l	< 0.020	< 0.020	DIN EN ISO 11885	0.1
Pb	mg/l	< 0.02	< 0.02	DIN EN ISO 11885	0.05
Zn	mg/l	< 0.10	< 0.10	DIN EN ISO 11885	0.5
B	mg/l	0.68	0.68	DIN EN ISO 11885	1.0
Si	mg/l	5.39	5.34	DIN EN ISO 11885	-
As	mg/l	0.0024	0.0025	DIN EN ISO 11969	0.05
Hg	mg/l	< 0.00010	< 0.00010	DIN EN ISO 1483	0.001
Oil & grease	mg/l	17.9	14.0	EPA 418.1	-

Regarding the salinity, the figures of TDS show high value (2,860 mg/l at H1 and 2,900 mg/l at H2), which indicates the river water around the Nasiryah Power Plant is brackish (i.e. the salinity is high).

Noise

Noise survey was carried out at the sampling points (E1 and E2 in Figure 5-12) for 24 hours. The measurements were conducted using a sound level meter (Noise meter) type Lutron, SL-4012. The sound level meter was oriented towards the dominant noise source (i.e. Nasiryah TPP) during the measurements at a height of 1.5 meter above ground level.

The result of the survey is summarized in Table 5-13.

Table 5-13 Noise level at E1 and E2

Location				Standard (dBA): Industrial and commercial area
E1		E2		
Time	Noise (dBA)	Time	Noise (dBA)	
10:00 AM	68.0	11:00 AM	59.0	70
12:00 PM	63.5	1:00 PM	47.0	70
2:00 PM	65.0	3:00 PM	50.0	70
4:00 PM	68.0	5:00 PM	47.0	70

Location				Standard (dBA): Industrial and commercial area
E1		E2		
Time	Noise (dBA)	Time	Noise (dBA)	
6:00 PM	67.0	7:00 PM	53.0	70
8:00 PM	64.0	9:00 PM	48.0	70
10:00 PM	62.0	11:00 PM	46.0	70
12:00 AM	64.0	1:00 AM	45.0	70
2:00 AM	65.0	3:00 AM	45.0	70
4:00 AM	66.0	5:00 AM	45.0	70
6:00 AM	69.0	7:00 AM	50.0	70
8:00 AM	70.0	9:00 AM	49.0	70

The weather condition around the site is summarized in Table 5-14. The wind speed is low, which indicates that the weather conditions did not affect the measurement of the noise.

Table 5-14 Weather conditions at the noise sampling site (E1)

Time	Temperature (°C)	Relative humidity (%)	Wind speed (m/s)
10:00 AM	46.6	17.2	0.3
12:00 PM	47	15.5	0.3
2:00 PM	46	18	0.2
4:00 PM	44	21	0.2
6:00 PM	41	22	0.2
8:00 PM	33	24	0.2
10:00 PM	31	27	0.3
12:00 AM	28	28	0.4
2:00 AM	22	30	0.3
4:00 AM	27	31	0.3
6:00 AM	32.5	24	0.3
8:00 AM	33	26	0.3

The noise levels at the points do not exceed the limitation in an industrial site of the IFC.

Vibration

Vibration survey was carried out at the sampling points (E1 and E2 in Figure 5-12) for 24 hours. The measurements were conducted using a vibration meter type Lutron, VB-8200. The vibration values are expressed as velocity vibration (PPV in the unit of mm/s). The measurement took place as the sensor was put on flat surface on the ground at the points.

The result of the survey is summarized in Table 5-15.

Table 5-15 Vibration level at E1 and E2

Location				Standard (PPV) mm/s
E1		E2		
Time	Vibration (PPV) mm/s	Time	Vibration (PPV) mm/s	
10:00 AM	0.2	11:00 AM	1.0	15
12:00 PM	1.2	1:00 PM	0.9	15
2:00 PM	0.5	3:00 PM	0.8	15
4:00 PM	0.3	5:00 PM	0.6	15
6:00 PM	1.1	7:00 PM	0.3	15
8:00 PM	0.7	9:00 PM	0.6	15
10:00 PM	0.6	11:00 PM	0.7	15
12:00 AM	0.5	1:00 AM	0.7	15
2:00 AM	0.6	3:00 AM	0.6	15
4:00 AM	0.7	5:00 AM	0.4	15
6:00 AM	1.0	7:00 AM	0.6	15
8:00 AM	0.8	9:00 AM	0.7	15

The vibration levels at the points do not exceed the limitation for an industrial / commercial building under the British standard.

River water conditions

The conditions of Euphrates River in 2011 are shown in Table 5-16. The measurement was conducted at the river water monitoring station of the Ministry of Water Resources in Nasiryah, which is located at approximately 7 km east of Nasiryah II site (Al Nasser Bridge, Albadha town).

Table 5-16 Conditions of Euphrates River

Date (2011)	Level (m)	Velocity (m/s)	Discharge (m3/s)
05 January	2.72	0.10	61.52
16 January	2.75	0.11	67.60
01 February	2.85	0.11	70.64
14 February	3.00	0.05	43.67
26 February	2.65	0.04	24.44
05 March	2.48	0.03	14.92
12 March	2.65	0.03	19.67
11 April	2.98	0.08	54.96
19 April	2.98	0.05	27.62
02 May	2.98	0.13	81.50
12 May	2.88	0.09	57.80
24 May	2.80	0.07	41.30
01 June	2.68	0.06	37.52
07 June	2.79	0.07	46.13
20 June	2.69	0.06	38.31
27 June	2.95	0.13	81.36
04 July	3.00	0.13	88.78
11 July	3.10	-	103.00
27 July	3.21	-	134.00
24 August	2.90	0.10	63.44
18 September	3.03	0.17	107.98
04 October	3.05	0.15	97.82
12 October	3.00	0.12	78.75
31 October	2.90	0.10	63.39
05 November	2.70	0.09	52.16
15 November	2.60	0.06	36.14
04 December	2.80	0.11	68.71
15 December	2.90	0.11	70.27

Figure 5-13 shows the monitoring results of the same station above from January 2003 to September 2011, and it is understood that decline of the water discharge of the river.

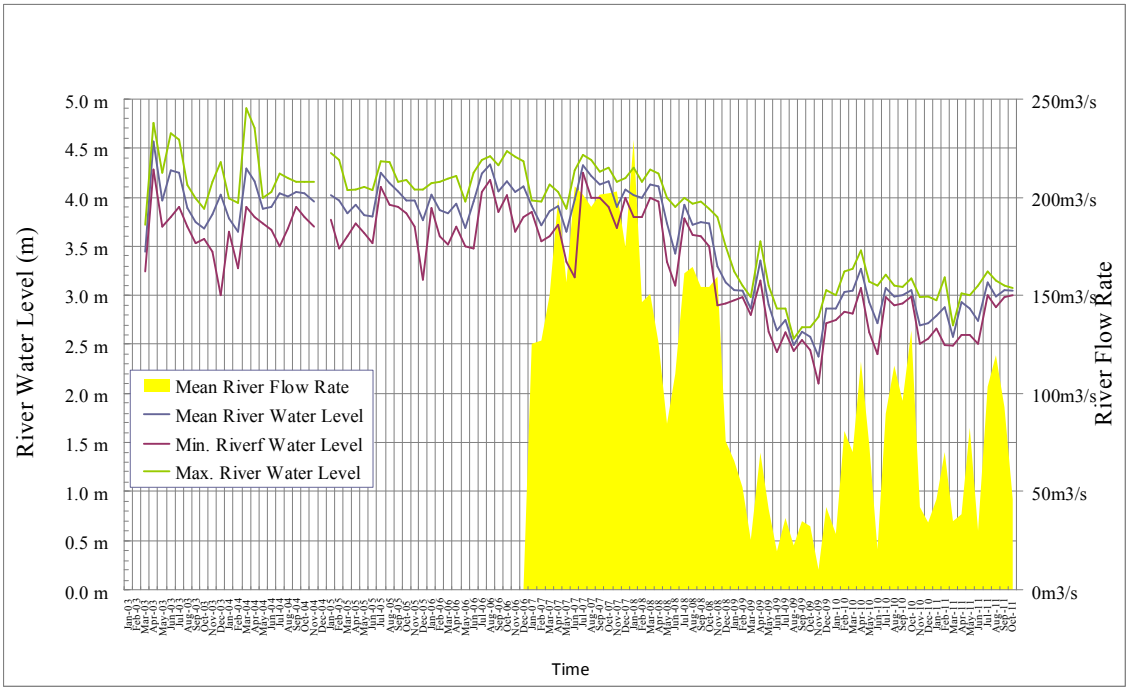

Figure 5-13 Euphrates River water monitoring (2003-2011)

5.2.2. Social environment

(1) Administration[70]

Thi Qar Province (or governorate) is located in the south east of Iraq, north-west of Basra. The area of the province is 12,900 km^2 (3% of the area of Iraq).

The Province is divided into 25 administrative units made up of:

- 5 counties (Qadha in Arabic) including (Nasiryah, Al Rifa'i, Suq Al-Shoyokh, Al-Chibayish and Al-Shatra. Figure 5-14 shows these counties.
- 5 county centers (cities)
- 15 districts (Hay in Arabic)

Nasiryah county consists of one city and four districts: Nasiryah City, Al Islah, Al Bathaa, Sayid-dakhil and Awr districts. There many settlements called Hay (in Arabic) under district and city. In the area of the project site, there are Hay namely Ur, Sumer 1, Sumer 2, Al Tadhyah, Al Askarei, Al Hussaien,Aredo, Al Sader, Al Shuhada, Al Edarah Al Mahaliyah, Al

[70] The information of this section is from the following two sources: Development Strategy of the Thi Qar Province-Thi Qar Strategic Plan 2007-2009 (Thi Qar Provincial Council), and Statistics Directorate of Thi Qar Governorate (Ministry of Planning, 2010).

Salhiyah, Al Mansoriyah, Thermal Power Plant 1 residential area, Al Emarat, Aluminum residential area, Al Iskan Al Sina'aei, Al Saiednawiyah, Al Shualah and Al Dhubat.

Nasiryah City is the capital city of the Thi Qar Province, and was founded in the middle of the 19th century to serve as a center for the province. It was named after its founder sheikh Nasser El-Ashkar, a leader of El-Muntafik tribe.

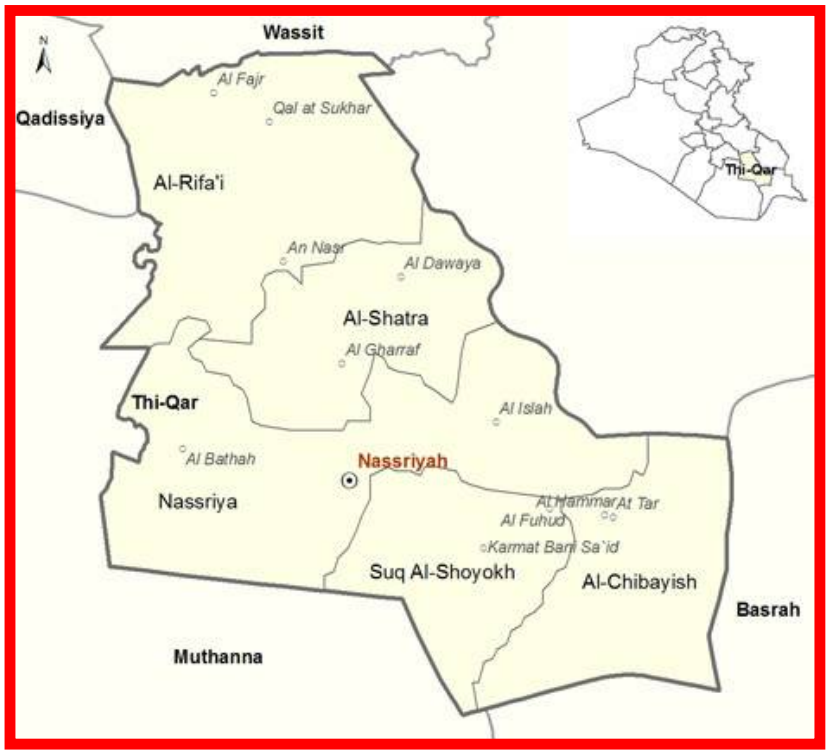

Figure 5-14 Thi Qar counties including Nasiryah county[71]

The project site is located in Al Awejah in Al Saiednawiyah Hay of Nasiryah City. There are two small settlements ("Qaryat" in Arabic) such as Al Sakheieen and Al Almeieen close to the project site. They are located in the opposite side of the Euphrates River (Figure 5-15).

Thermal power plant 1 residential area for the existing power plant employers is located at about one (1) km east of the Project site and has the population of about 3,000[72].

[71] The map is from Inter-Agency Information and Analysis Unit. http://www.iauiraq.org/default.asp
[72] Statistics Directorate of Thi Qar Governorate (Ministry of Planning, 2010).

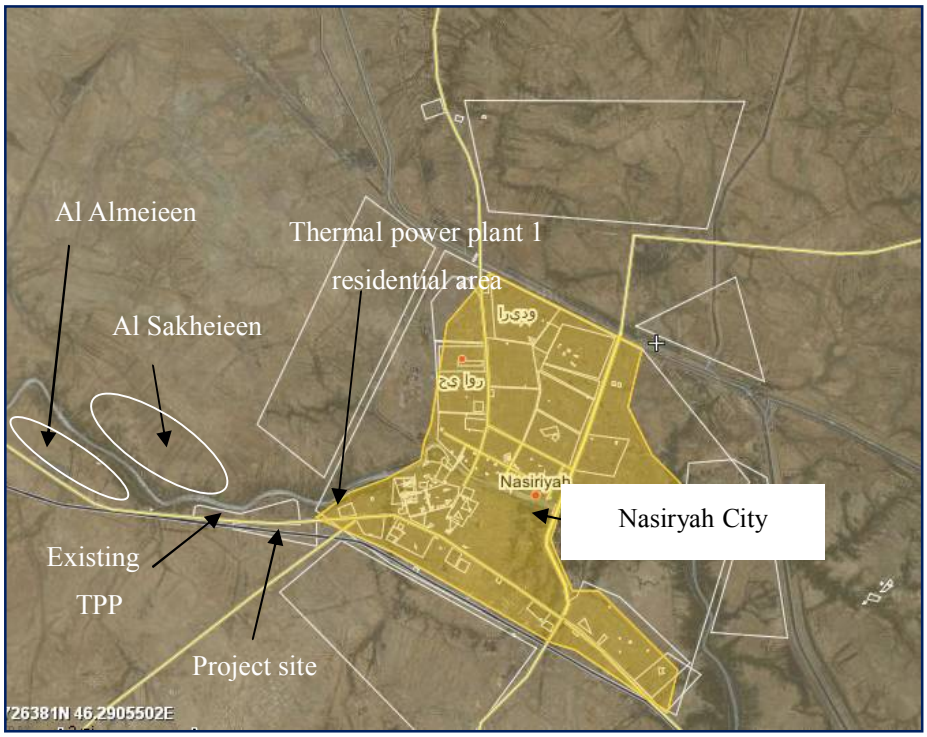

Figure 5-15 Settlements around the Project site

(2) Population and demography[73]

The population of Nasiryah City is 478,889, represents 70.2 % of Nasiryah county and 26.5 % of Thi Qar Province. The mean household size is 7.5 persons.

The age and gender structure of Nasiryah City is a typical type of population with a historically high fertility. It is broadly based, with many children relative to adults. 42% of the population is aged less than 15 years. The dependency ratio, i.e. the ratio of the population aged below 15 and above 65 to the population aged 15 to 65, is 0.75. The gender ratio in the population, i.e. the ratio of males to females, shows a close to equal number of the two genders. There are a rather low number of men aged between 35 and 49-the year groups that were affected by losses during the Iran-Iraq war, and also by selective migration of males. The gender ratio drops with increasing age, a trait found in most populations, because women generally live longer than men.

The province is made up of rural and urban classes, each with its own intrinsic features. Family in the rural areas is sizeable and demonstrates tremendous help in farming labor. The family size in the city varies from one district to another: some include large families while some with specific features are home to smaller ones. The province is characterized by a

[73] Information of this section is from Statistics Directorate of Thi Qar Governorate (Ministry of Planning, 2010).

tribal system. In the cities, a great deal of citizens' life is primarily regulated by a mix of modern law and other traditions.

(3) Livelihoods[74]

Although the economy of some provinces such as Basra is mainly based on the refining and export of oil and chemicals and the commerce of merchants through the ports, construction and trade in electrical goods have been considered growth sectors for employment in Thi Qar Province since 2003.

Economic performance is weak due to the lack of advanced means of production and public services, as well as the absence of paved roads connecting regions in the province. Although the aluminum, textiles, electrical cables factories and the existing power plant in the Province are functioning, the regional economy of the province has been affected by the closure of state-owned enterprises and reduction in public sector employment.

Agriculture also forms another important employment sector. The province is famous for the cultivation of cereals, vegetables, rice and oases of palm trees. It has also significant livestock, including sheep, cattle, goats, camels, cows and other herds.

Unemployment in the province is estimated by local officials to be 31% (15%, national average). The shortage of employment opportunities in the province as well as the large number of unemployed men has meant that Ministry of Labor and Social Affairs is unable to find jobs for the majority of people registered. Although salaries have generally increased since 2003, the disposable income has not increased to the same extent, because benefits have been cut in some sectors and living costs have increased.

25% of the households in Nasiryah City are unemployed while the rest of 75% relies on one or two sources of income. 50% of the households with employment derive the livelihood by wage income in form of work in electricity, gas, water supply and oil industry respectively public administration, defense, education, health and social work. The other 25% of the households derive their income by self-employment like construction, wholesale and retail trade, repairs and transport. The unemployed households, depend for their living on food ratios, fishing for own consumption[75], in kind assistance in form of food ratios. Beside the above mentioned, all households receive food ratios such as rice, sugar, flour, tea, detergents and oil from the Ministry of Trade.

The province performs poorly according to many humanitarian and developmental indicators. 32% of the population lives below the national poverty line (US$ 2.2 per day).

[74] The information of this section is from the following two sources: Development Strategy of the Thi Qar Province-Thi Qar Strategic Plan 2007-2009 (Thi Qar Provincial Council), and Statistics Directorate of Thi Qar Governorate (Ministry of Planning, 2010).

[75] The information from MOE also indicates that there is no commercial fishery around Nasiryah II.

Since low education levels are a major problem among women: outside Nasiryah City, 6% of rural women aged 15-64 years are economically active.

(4) Transportation[76]

The roads in the province are well used, even though most are damaged or in disrepair. Roads in rural areas are predominantly unpaved (90%) and maintenance usually falls to local communities or district councils who have limited funds for repairs. Two major road pass through Nasiryah City: Basra-Bagdad Highway and Nasiryah-Samawah road.

(5) Communication systems

The national Iraqi telephone land lines are operating in the province for calls across Iraq but not for international calls. Mobile phones are the preferred form of telephone communication because these have the ability to make international calls. Internet service providers offer private internet connections in Nasiryah City, leading to the development of numerous Internet Cafés there. Mobile phone subscribers per 100 residents is 73.2 and the ratio of household owning a personal computer is 5.7%.

(6) Water supply

In the province, the main water source to supply water drinking treatment plants is rivers and streams especially Euphrates and Al Bada'a rivers.

The most of Nasiryah's households have a connection to the existing water network. However, the piped water is unsafe and not useable as drinking water due to the high percentage of salinity. Thus, the some of the Nasiryah's households rely on small RO units for drinking water. Some of the rural areas have small package units installed in the Euphrates River to supply water to these small settlements (Qaryat), while other Qaryat use trucks to bring water to them. The access to water supply is extremely poor outside Nasiryah City.

(7) Electricity supply[77]

The electricity supply is generally very good in the province, with the exception of Rifa'i county.

(8) Sanitation facilities

While 80% of all households in Nasiryah City own toilets located in their accommodations,

[76] Information of (4), (5) and (6) is from Statistics Directorate of Thi Qar Governorate (Ministry of Planning, 2010).

[77] Information is from Inter-Agency Information and Analysis Unit. http://www.iauiraq.org/default.asp

the other 20% use outdoor toilets. The city government has two wastewater treatment plants. One has 18,000 m^3/day design capacity, and the other one has 4,000 m^3/day capacity. There are 11 pump sewer stations, and 41 storm water pump stations[78].

The province sustains a shortage of sewerage networks, especially in the counties and districts. In Nasiryah City, areas benefiting from a sewerage system do not exceed 6%, and areas served by with a water treatment system (rain water) constitute 10%[79].

(9) Waste disposal system

The province suffers an increase in the quantity of waste accumulated in the streets and squares. Additionally, dumps violate environmental standards, and used equipment is old and insufficient. The province and Nasiryah City have no system for waste disposal[80].

At the existing Nasiryah TPP, suspended solid in the river water such as mud is plugged the condenser tubes and therefore periodically removed. The removed mud is recycled as a gardening material (i.e. fertilizer). Treated oil from oil contaminated water is sent to MOO factory to be recycled as miscellaneous oil such as brake oil[81].

(10)Health status and medical centers

The southern region of Iraq is adversely affected by water pollution, air pollution (burning oil wells) and by depleted uranium contamination (warheads), representing the most serious impact on people's health. Also, the region suffers from airborne lead and soil contamination due to the negligent use of chemical fertilization.[82]

People in Nasiryah City suffer from chronic health problems, dermatitis and respiratory system disease due to worsened living and sanitation conditions. The under-five mortality rate is 41 for every 1,000 births, and the ratio of tuberculosis is 12.4 for every 100,000 of the population[83].

Three major medical centers exist in Nasiryah City: namely Al Husain Educational Hospital, Bint Al Huda Hospital for Children and Women and Al Nasiryah Center for Heart Surgery. They are about 5 km from the project site. Also there is small medical center in

[78] Statistics of water in Iraq (Central Organization for Statistics and Information Technology, Ministry of Planning, 2008).
[79] Development Strategy of the Thi Qar Province-Thi Qar Strategic Plan 2007-2009 (Thi Qar Provincial Council).
[80] The information of this section is from the following two sources: Development Strategy of the Thi Qar Province-Thi Qar Strategic Plan 2007-2009 (Thi Qar Provincial Council), and Statistics Directorate of Thi Qar Governorate (Ministry of Planning, 2010).
[81] Information from General Manager of the existing Nasiryah TPP.
[82] Statistics Directorate of Thi Qar Governorate (Ministry of Planning, 2010).
[83] Inter-Agency Information and Analysis Unit. http://www.iauiraq.org/default.asp

each Hay of the city. The health system in the city is affected by a lack of health personnel, lack of medicines, non-functioning medical equipment, damaged facilities, disrupted electricity supply, lack of adequate sanitation, and lack of communication systems[84].

(11)Education

The primary indicators of educational conditions of Nasiryah City are summarized in Table 5-17.

Table 5-17 Primary indicators of educational conditions of Nasiryah City[85]

Indicator	Percentage
Net enrollment ratio in primary education	77.9
Net enrollment ratio in secondary education	15.8
Enrollment ration females to males in primary education	81.7
Prevalence of illiteracy (aged 10 years and above)	16.5

(12)Ethnicity

The predominant religion in Thi Qar Province is Islam, with more than 97% of the population in the province constituting the Shii branch of Islam. Additionally the province has Sunni, Mandaean, Chaldean and Assyrian Christian communities making out about 3%. All contribute to the province's rich cultural history.

Tribes from across Mesopotamia and the Middle East have migrated through the area over the centuries, creating a diverse tribal ancestry. Tribes currently present in the province are summarized in Table 5-18. In 1991, a large number of residents in Kuwait immigrated to the province to join their fellow clansmen.

Table 5-18 Tribes in the province and the most predominant ones in Nasiryah City

Tribes		Tribes	
1	Beni Malek	14	Al Ajwed
2	Albu Salih	15	Ghazyah
3	Alaliat	16	Khafagah
4	Al Hasan	17	Al Sharefat
5	Hejam	18	Al Badoor
6	Beni Asad	19	Al Zhaeeryah
7	Ibadah	20	Al Hosenat

[84] Statistics Directorate of Thi Qar Governorate (Ministry of Planning, 2010).
[85] Inter-Agency Information and Analysis Unit. http://www.iauiraq.org/default.asp

Tribes		Tribes	
8	Beni Saeid	21	Aboodah
9	Al Azereg	22	Al Masoom
10	Albu Nasir	23	Al Sadoon
11	Albu Awaed	24	Al Imara
12	Albu Awafey	25	Al Shamar
13	Albu Hameedah	26	Zairaj

* Names with underline are the predominant tribes in Nasiryah City

6. Analysis of alternatives

6.1. Zero option

Considering that the electricity supply currently only meets about 70 % of the demand in Iraq (refer to "1.Introduction"), the Project has a role to fill the gap (30 %) for the development of the country. "Zero options" of the Project need to fill the above-mentioned gap and there are a) to develop other electric energy sources: renewable and/or nuclear energy sources; b) to purchase electricity from neighbouring countries.

(1) Other electric energy sources

Regarding the renewable energy source such as hydroelectric power generation, its development potential is very small in Iraq. The scarcity of water lowers the potential of development of hydroelectric power generation, and it also gives difficulty of operating hydroelectric stations[86]. Wind and solar power generations generally are unstable and cannot supply base load of the electricity. There is no development plan for nuclear power station[87].

(2) Import of electricity from the neighboring countries

Iraq Electricity Master Plan (2011) states that total of 1,000 MW can be imported from the neighbouring countries after 2012, and other than that there is no plan of importing electricity.

Regarding generation types in the neighbouring countries, they also depend on thermal power generation to meet their electricity demands since the potential of hydroelectricity development is basically low in the Middle East. It means that, even if Iraq imports the electricity, environmental impact from the global point of view (mainly CO_2 emission) would be similar to the one of thermal power generation development in Iraq.

If either "Zero option" is selected, Iraq will continuously face electricity power shortage. Thermal power plant is, therefore, the only electricity power source which can supply almost all electricity to the country.

Regarding CO_2 emission from the plant, it is inevitable that the total CO_2 emission increases. The Project optimizes generation types to reduce its emission as much as possible.

[86] Republic of Iraq: National Development Plan for the Years 2010-2014 (Ministry of Planning, 2010)
[87] Iraq Electricity Master Plan (Ministry of Electricity, 2011)

6.2. Site selection

6.2.1. Process and the result

"Large Scale Thermal Power Plant Site Selection Study in Southern Iraq (2008)" identified 17 sites of the development of a large scale thermal plant to meet the power demand of Iraq. Based on the information, the Study Team conducts the following site selection exercise (refer to 6.2.).

The most important objective of the site selection is to select the most feasible site for the Project from environmental point of view as well as technical and financial ones. The process of the exercise is described in the following diagram (Figure 6-1).

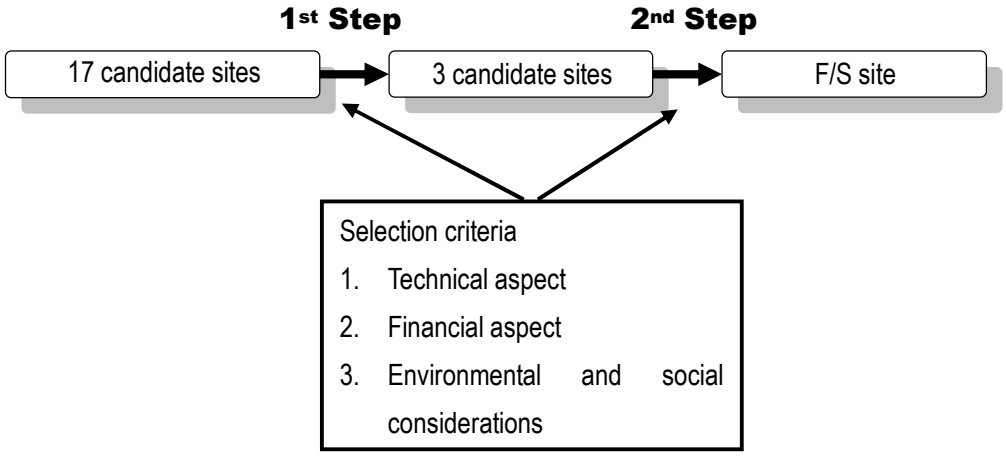

Figure 6-1 Site selection process

As a result of the examination, Nasiryah II is selected as the F/S site of the Project. Nasiryah II is identified as having the least expected negative impacts in the 17 candidate sites in "Large Scale Thermal Power Plant Site Selection Study in Southern Iraq (2008)".

6.2.2. 1st step of the site selection[88]

(1) Review procedure

Firstly the conditions of the 16 candidate sites identified by the Pre-Feasibility Study (Pre-FS) are reviewed. Although 17 sites were nominated in the Pre-FS, Shat Al-Basra 2 is excluded because it was decided to develop as an IPP project. The JICA Study Team collects related information in Japan as much as possible such as wide range geological map, Google-Earth topographical map, information on Ramsar site and proposed protected area in

[88] It is conducted in June 2011, and the main conditions are establishment of a 1,200 MW class thermal plant with one through cooling system based on the master plan (2010).

addition to the information obtained through the Pre-FS.

Secondly the JICA Study Team comprehensively evaluates the 16 sites based on the evaluation criteria of economical efficiency (available fuel type and cooling system), geology, hydrology and environmental considerations. The JICA Study Team selects three likely candidate sites based on the above evaluation and decides finally the ones through the close consultation with MOE.

(2) Ranking of candidate sites of Southern Large Scale Thermal Power Plant

(a) First ranking

The JICA Study Team excludes the sites which could not secure the necessary site area of 1,200MW thermal power plant, are located in wadi area and covered hidden lake deposited layer from the geological viewpoints, and are located within protected area and Ramsar site from environmental viewpoints. However, in practice there are no exclusions from the geological and environmental viewpoints, since the JICA Study Team does not obtain conclusive information for making a decision regarding geological and environmental criteria. Therefore, the JICA Study Team makes notes on the geological and environmental issues for on each candidate site, if any.

- Criterion of site area

The JICA Study Team sets up the site area criterion as the area of more than 50 ha based on the past experiences. The following points are considered: output of 1,200MW class, configuration of power system, cooling system facilities such as cooling tower and water treatment system for service water.

- Geological criterion

The subsurface geology around Basra located along the Shatt Al-Arab River is also assumed to be floodplain sediment which was brought by floods from the upper basin. Despite the presence of floodplain sediments which overlays the lower stratum, the canals were constructed and the land was filled in the past in the Basra city area. Therefore, the topographical and geological features such as the “wadi” area and hidden lake deposited layer which locally formed by flooding are unfit for foundation of thermal power plant and should be avoided.

- Environmental considerations’ criteria

The Ministry of Environment has been processing the application for approval to establish

"Mesopotamian Marshlands National Park", and the Government of Iraq registered "Hawizeh Wetland" under the Ramsar Convention in 2008 (refer to Figure 5-4). It is critical to verify that the candidate sites for the large scale thermal power plant are not located in these protected areas and other areas for conserving cultural heritages. Figure 6-2 shows the proposed World Heritage sites and the TPP candidate sites.

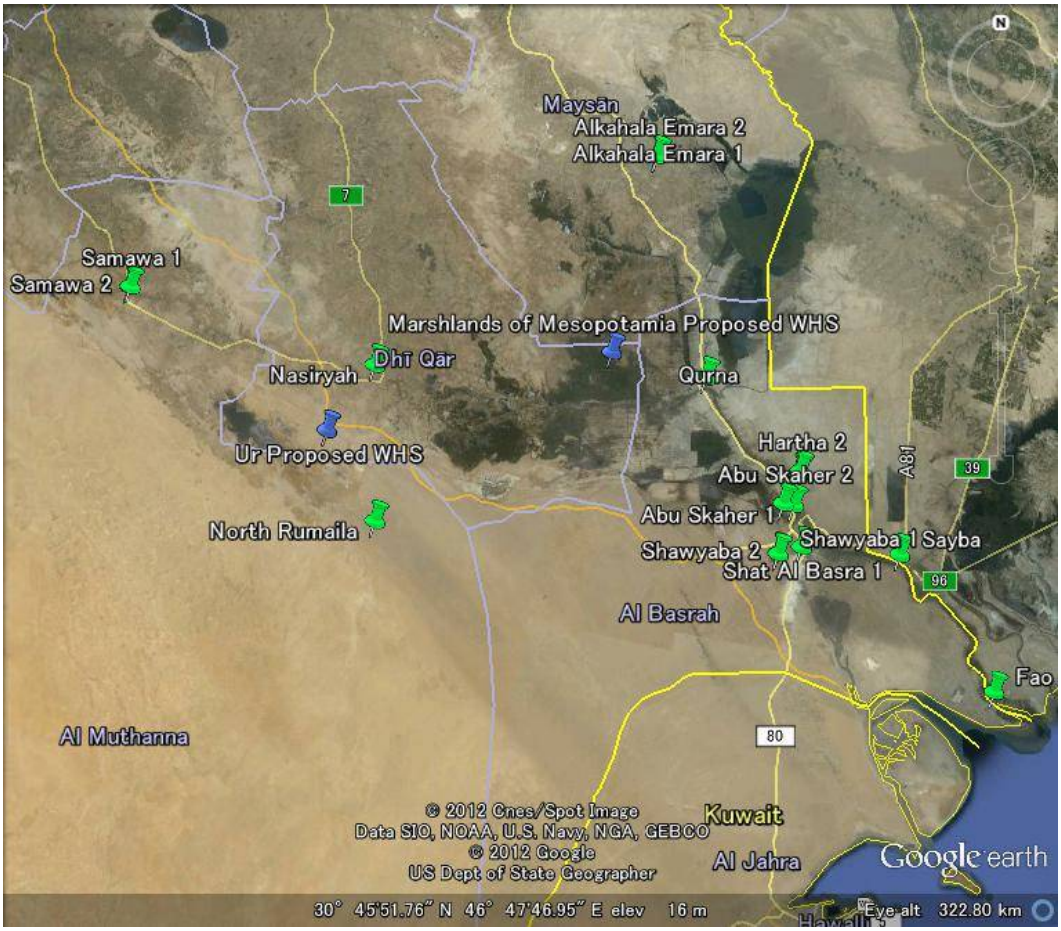

Figure 6-2 Proposed World Heritage Sites and 16 TPP candidate sites

(Blue pins are proposed WHSs. Green pins are the TPP candidate sites)

Regarding the IBAs, all IBAs are some distances from the 16 candidate sites as shown in Figure 6-3.

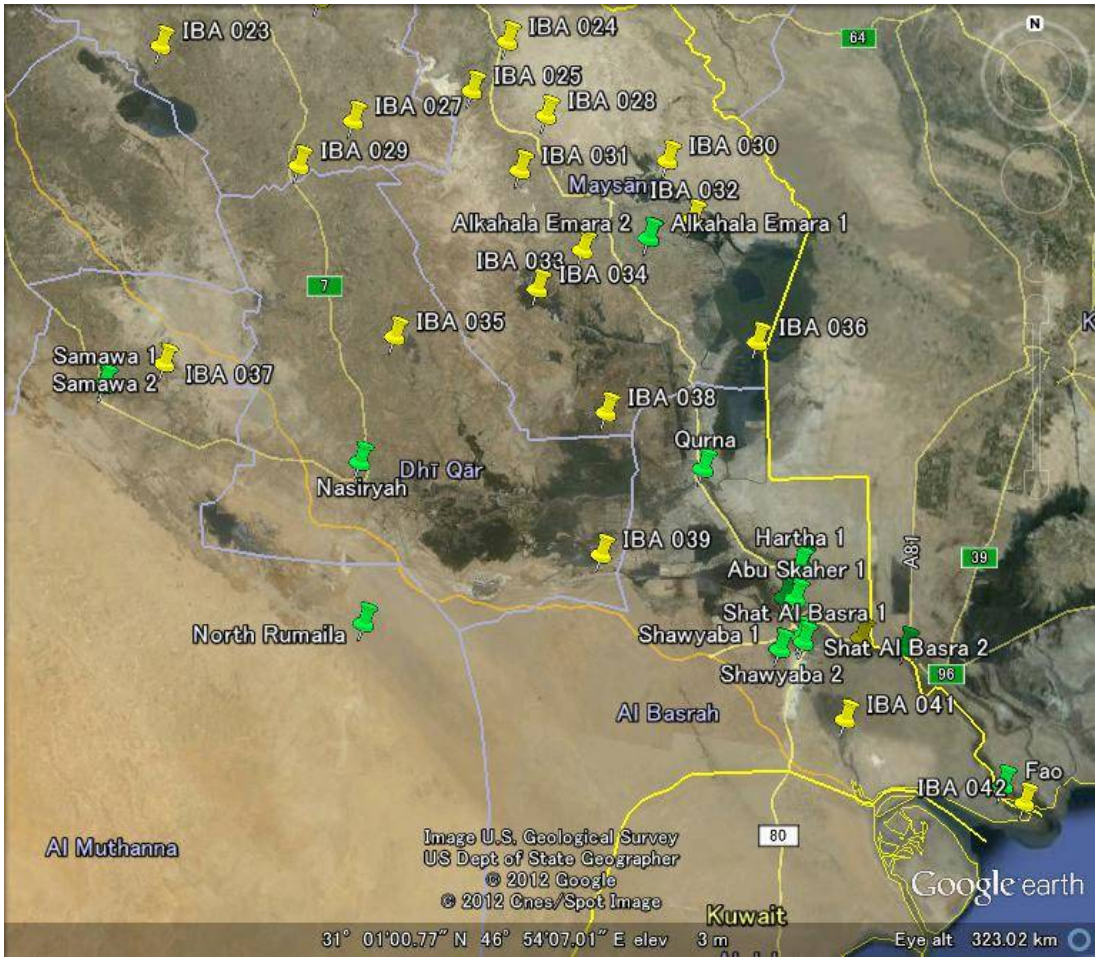

Figure 6-3 IBAs and 16 TPP candidate sites

(Yellow pins are IBAs and their numbers should be referred to Appendix 1. Green pins are the TPP candidate sites)

(b) Second ranking

The JICA Study Team evaluates the all sites from the viewpoints of economical efficiency such as fuel type, cooling system, civil design according to the geological condition, and environmental considerations. The JICA Study Team ranked 16 candidate sites comprehensively based on the above-mentioned evaluation results.

- Fuel Type

Since it is more beneficial to export crude oil from the country rather than to use it for power generation in general, candidate sites which can use only crude oil are ranked low.

- Cooling system

In the case of one through cooling system, the cooling water flow of 1,200MW of around 30~40m^3/s depending on fuel type is required. In the case of the cooling tower system, cooling water flow of 1,200MW of around 1 m^3/s depending on fuel type is required. Meanwhile, if the intake flow accounts for more than 10% of low flow discharge of the river, it is concerned that cooling water intake might affect the other water user, river flow regime, and biogeocenosis surrounding environment in the downstream area.

The discharge in the drought year of Euphrates and Tigris Rivers is around 20 billion m^3/year (630m^3/sec) and 10 billion m^3/year (315m^3/sec) respectively[89], even Euphrates and Tigris Rivers flowed only several hundred m^3/sec. Since water developments as hydro power plant development and industrial and irrigation water development in the upstream areas of these rivers have been being carried out recently, the river flow has been reducing. Therefore, if a water cooling system is to be adopted, 1,200MW TPP should be located near Euphrates, Tigris and Shatt Al-Basra Rivers (Confluent River of Euphrates and Tigris River).

- Civil design according to geological condition

Many of candidate sites are located in the vicinity of Euphrates River, Tigris River and Shatt Al-Arab River, and in the former marsh area. Topographical and geological condition change significantly even by a little away from river, lake, and marsh. Therefore, the JICA Study Team evaluates the need of soil improvement of each candidate site based on the information of flood risk and loose layer obtained from topographical and geological literatures. Figure 6-4 shows distribution of Mesopotamian Marshlands in 1973 and 2000.

[89] Assessment of Surface Water and Groundwater Quality of Haur Al-Hammar after Restoration /Southern Iraq

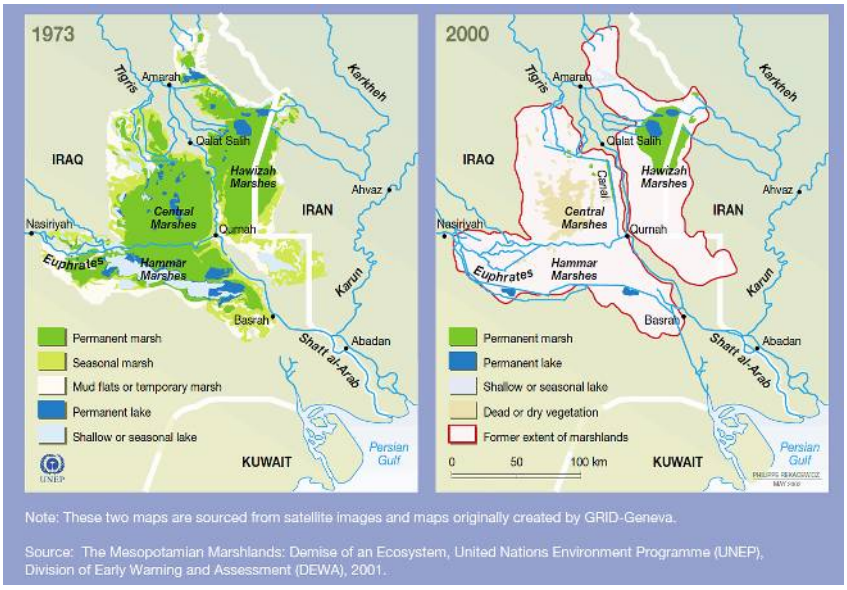

Figure 6-4 Mesopotamian marshlands (1973 and 2000)

➢ Social environmental conditions

The JICA Study Team evaluates the possibility of a large scale of resettlement by confirming land use, land tenure and existing structures using the Google earth satellite imagery.

(c) Evaluation Results and Additional Site Reconnaissance

Among the 16 candidate sites, seven (7) sites are excluded because of too small site area. The rest of the sites, nine (9) sites, are evaluated from the viewpoints of economical efficiency such as distance from the river, available fuel type and geological conditions. The results are shown in Table 6-1. Nasiryah, Hartha 2 and Alkahala Emara 1&2 sites are ranked as "A" which means there is no critical issues and more economical than other sites.

The JICA Study Team selected three candidate sites namely Nasiryah, Hartha 2 and Alkahala Emara 1&2 as likely candidate sites. Furthermore, the JICA Study Team specifies issues on each likely candidate sites to be studied as follows:

Nasiryah site:

- There is no space for construction site on the same side (on the right bank of Euphrates River) of the existing power plant.
- On the left bank of Euphrates River, it may be within the proposed national park.
- The existing power plant intakes cooling water of 44m^3/sec.

Hartha 2 site:

- The existing power plant which is located on the opposite side of Hartha 2 site intakes cooling water of 28m^3/sec from the river.

Alkahala Emara 1&2 sites:

- There are no specific issues.

Table 6-1 Evaluation results (1/3)

No.		1	2	3	4	5	6
Name		Abu Skaher 1	Shat Al Basra 1	Shat Al Basra 2	Alkahala Emara 1	Alkahala Emara 2	Fao
Latitude North		30° 34' 41.1"	30° 26' 41.0"	30° 27' 36.6"	31° 41' 50.7"	31° 41' 53.1"	29° 58' 26.0"
Longitude East		47° 44' 13.9"	47° 45' 39.1"	47° 45' 11.0"	47° 15' 20.6"	47° 15' 30.4"	48° 27' 26.1"
Area		Basra	Basra	Basra	Maysan	Maysan	Basra
Map No.							
1/500,000 Geologic Quadrangle							
Land Area (by GPS)		50m x 500m (50m×500m)	500m x 500m (500m×500m)	1500m x 5000m (1500m×2000m)	4000m x 5000m (2000m×2000m)	4000m x 5000m (1000m×1500m)	1000m x 5000m (500m×1500m)
Accessibility	From main road	1.5 km	0.25 km	0.25 km	5 km	5 km	0.5 km
	Means	Road / River	Road / River	Road / River	Road	Road	Road
	Condition	Bad	Good	Good	Fair	Fair	Good
Topography		Flat, Gentle slope	Flat	Flat	Flat, Gentle slope	Flat, Gentle slope	Flat
Geology		Clay mix	Clay mix	Clay mix	Clay mix	Clay mix	Clay mix
Vegetation		Grass, Trees	N/A	N/A	N/A	Grass	N/A
Water resource	River name	Euphrates	Basra	Basra	Alkahala	Alkahala	Alarab
	From river (by GPS)	0.1 km	0.2 km	0.2 km	5 km (0.2km)	5 km (0.2km)	2km (1km)
	Width	400m	60m	60m	50m	50m	500m
	Depth	20-25 m	5-10 m	5-10 m	10 m	10 m	20 m
	From Pump Sta.	5 km	N/A	N/A	N/A (Water Gate 20km upstream)	N/A (Water Gate 20km upstream)	2km
Fuel	Fuel	Dry Gas	1) Kerosene, Gas Oil, HFO 2) Raw Gas / Dry Gas	1) Kerosene, Gas Oil, HFO 2) Raw Gas / Dry Gas	Raw Gas / Dry Gas	Raw Gas / Dry Gas	Crude Oil
	From fuel source	50 km	15km: 1) Basra Refinery 2) Gas Field	15km: 1) Basra Refinery 2) Gas Field	5 km: Halfya Oil Field Pipeline to Buzergan Located Next to Site	5 km: Halfya Oil Field Pipeline to Buzergan Located Next to Site	1 km: Transported through Crude Oil Tanks in the Port
	From fuel process	New Majnoon Gas Plant	Ditto	Ditto	Majnoon Gas Plant	Majnoon Gas Plant	N/A
	Note				Gas Oil Used Currently	Gas Oil Used Currently	
From 400kV sub-sta.		5 km	10 km	10 km	0.1 km	0.1 km	0.1km (132kV)
Enviroment observation	From protected area (including Ramsar Site)	Far	Far	Far	Far	Far	Far
	Fauna & flora	N/A	N/A	N/A	N/A	N/A	N/A
	World Heritage Site (including Proposed site)	Far	Far	Far	Far	Far	Far
	Resettlement (SAPROF Report and Google Map)	Yes	No	No	No	No	No
Primary Evaluation Criteria							
Land Area (by GPS)		Unsuitable (2.5ha)	Need careful layout (25ha)	No Problem (300ha)	No Problem (400ha)	No Problem (150ha)	No Problem (75ha)
Fuel type		Gas	Gas / Oil / HFO	Gas / Oil / HFO	Gas	Gas	Crude Oil
Cooling System (by GPS) A type : Once- through Cooling System B type : Cooling Tower system C type : Air Cooled Condenser System		Cooling system[1] : A,B,C type Distance Intake-Site : No Problem	Cooling system[1] : B,C type Distance Intake-Site : No Problem	Cooling system[1] : B,C type Distance Intake-Site : No Problem	Cooling system[1] : B,C type Distance Intake-Site : No Problem	Cooling system[1] : B,C type Distance Intake-Site : No problem	Cooling system[1] : A,B,C type Distance Intake-Site : No Problem
Civil design		Upper layer : Soil Improvement	Upper layer : Soil Improvement	Upper layer : Soil Improvement	Upper layer : Soil Improvement (depend on detail Geo survey)	Upper layer : Soil Improvement (depend on detail Geo survey)	Upper layer : Soil Improvement
Geological condition		Risk attacked by flood Deep flood plain sediments South-eastern end of "Hawr al-Hammar" swampy area.	Expected on a natural levee Expected loose layer 1.9km downstream from Shat Al Basra 2 site	Expected on a natural levee Flood plain sediments. Expected loose layer	Flood plain sediments. Braided (inferred) original Tigris river to retarding basin "Umm An Ni aj".	Flood plain sediments. Similar condition as Alkahala Emara 1	Alluvial clay layer as a flood plain sediments Risk attacked by flood Risk attacked loose and thick layer
Environmental condition		Many houses are observed around the site	Nil	Nil	Nil	Nil	Nil
Primary Evaluation		C	C	A	A	A	B
Remark		Land area : Unsuitable Resselement:many houses Geological Risk	Land area : Unsuitable	IPP Project			Fuel : CO Geologocal Risk
Potential F/S site					○		

Table 6-2 Evaluation results (2/3)

No.		7	8	9	10	11	12
Name		Qurna	Hartha 1	Hartha 2	Nasirya	North Rumaila	Sayba
Latitude North		30° 59' 09.2"	30° 40' 31.4"	30° 41' 03.1"	31° 02' 07.7"	30° 32' 30.3"	30° 24' 53.4"
Longitude East		47° 25' 22.7"	47° 45' 16.2"	47° 45' 47.1"	46° 11' 51.8"	46° 11' 51.8"	48° 07' 24.6"
Area		Basra	Basra	Basra	Thi Qar	Basra	Basra
Map No.							
1/500,000 Geologic Quadrangle							
Land Area (by GPS)		1000m x 2000m (500m × 1000m)	400m x 500m (200m × 200m)	2000m x 5000m (700m × 1500m)	500m x 1000m (Indefinite by fuzzy)	4000m x 5000m (1000m × 7000m)	4000m x 5000m (6000m × 7000m)
Accessibility	From main road	1.0 km	2.0 km	2.5 km	0.1 km	0.5 km	1.0 km
	Means	Road	Road / River	Road / River	Road	Road	Road
	Condition	Fair	Good	Fair	Good	Good	Good
Topography		Flat, Gentle slope	Flat	Flat	Flat	Flat	Flat
Geology		Clay mix	Clay mix	Clay mix	Clay mix	Desert / Sandy	Clay mix
Vegetation		Some Grass	N/A	Grass, Trees	N/A	N/A	N/A
Water resource	River name	Tigars	Euphrates	Euphrates	Euphrates	Euphrates	Shat Alarab
	From river (by GPS)	7 km (1.4km)	0.25 km	0.25 km	0.1 km	10 km	2 km
	Width	150m	500m	500m	100m	300m	500m
	Depth	20 m	20-25 m	20-25 m	20 m	15-20 m	20 m
	From Pump Sta.	5 km	5 km (nearby existing TPS Intake)	5 km (nearby existing TPS Intake)	0.1 km (nearby existing TPS Intake)	5 km	N/A
Fuel	Fuel	N/A	HFO	HFO	Dry Gas	Dry Gas	Dry Gas
	From fuel source	N/A	70 km: Basra Refinery	70 km: Basra Refinery	20 km: National Gas Pipeline	2 km: The Strategic Gas Pipeline Functioned	New Pipeline
	From fuel process	N/A	35 km	35 km	New West Qurna Gas Plant	South Gas Plant	New Majnoon Gas Plant
	Note		Crude Oil & Dry Gas Used Currently	Crude Oil & Dry Gas Used Currently	Crude Oil & FO Used Currently	SAPROF writes that liquid fuel will be used.	SAPROF writes that liquid fuel will be used.
From 400kV sub-sta.		0.1 km	N/A	N/A	0.1 km	7 km	N/A
Enviroment observation	From protected area (including Ramsar Site)	Nearby (Ramsar Site)	Far	Far	Nearby (proposed National Park)	Far	Far
	Fauna & flora	N/A	N/A	N/A	N/A	N/A	N/A
	World Heritage Site (including Proposed site)	Far	Far	Far	Middle	Far	Far
	Resettlement (SAPROF Report and Google Map)	Yes	No	Yes	No	N/A	N/A
Primary Evaluation Criteria							
Land Area (by GPS)		No Problem (50ha)	Unsuitable (4ha)	No Problem (100ha)	No Problem (50ha)	No Problem (2000ha) [Extensible]	No Problem (2000ha) [Extensible]
Fuel type		N/A	Gas / Crude Oil / HFO	Gas / Crude Oil / HFO	Gas / Crude Oil / HFO	Gas / Crude Oil / HFO	Gas / Crude Oil / HFO
Cooling System (by GPS) A type : Once-through Cooling System B type : Cooling Tower system C type : Air Cooled Condenser System		Cooling system [1] : B,C type Distance Intake – Site : No Problem	Cooling system [1] : (A),B,C type Distance Intake – Site : No Problem	Cooling system [1] : (A),B,C type Distance Intake – Site : No Problem	Cooling system [1] : B,C type Distance Intake – Site : No Problem	Cooling system [1] : A,B,C type Distance Intake – Site : Faraway	Cooling system [1] : A,B,C type Distance Intake – Site : No Problem
Civil design		Upper layer : Soil Improvement	Upper layer : Soil Improvement	Upper layer : Soil Improvement (depend on detail Geo survey)	Upper layer : Soil Improvement (depend on detail Geo survey)	Upper layer : No need Soil Improvement	Upper layer : Soil Improvement
Geological condition		Flood plain sediments. Expected on a natural levee. Northern edge of "Hawr al-Hammar" swampy area. Seasonal marsh area Risk attacked by flood	Flood plain sediments. Seasonal marsh area Risk attacked by flood	Flood plain sediments. Expected on a natural levee.	Flood plain sandy sediments Expected on a natural levee.	On a hilly environment in the NE foot of the low hill trending to NW-SE. Very preferable, but no rivers for water supply are seen around the site.	Flood plain sediments. Expected loose and thick layer. Risk attacked by flood
Environmental condition		SAPROF found that some houses needed to be resettled. Houses are observed between the site and the river, and it is necessary to confirm the situation by further survey.	Nil	SAPROF found that a school needed to be relocated. Houses are observed around the site, and it is necessary to confirm the situation by further survey.	The distance from the proposed National Park is not clear and it is necessary to confirm the boundary of the proposed National Park. A proposed WH site (Ur) is located at 17 km south-east of the Nasirya city.	There may be houses between the site and the river. Further survey is needed.	There may be houses between the site and the river. Further survey is needed.
Primary Evaluation		C	C	A	A	C	B
Remark		Fuel : N/A Nearby Ramsar site Geological Risk	Land area : Unsuitable Geological Risk		Land Area(Need careful Layout) Confirm Nearby proposed National Park	Intake system length	Intake system length Geological Risk
Potential F/S site				○	○		

Table 6-3 Evaluation results (3/3)

No.		13	14	15	16	17	18
Name		Samawa 1	Samawa 2	Shawyaba 1	Shawyaba 2	Abu Skaher 2	
Latitude North		31° 17' 19.4"	31° 17' 15.1"	30° 25' 29.1"	30° 25' 33.7"	30° 34' 57.7"	
Longitude East		45° 16' 45.6"	45° 16' 31.1"	47° 40' 29.7"	47° 40' 25.7"	47° 41' 53.2"	
Area		Muthana	Muthana	Basra	Basra	Basra	
Map No.							
1/500,000 Geologic Quadrangle							
Land Area (by GPS)		500m x 1000m (250m×250m)	2000m x 4000m (450m×450m)	100m x 400m (100m×150m)	250m x 400m (100m×150m)	No Information (500m×1300m)	
Accessibility	From main road	2.0 km	2.0 km	11 km	11 km	1.5 km	
	Means	Road	Road	Road	Road	Road / River	
	Condition	Good	Good	Good	Good	Bad	
Topography		Flat	Flat	Flat	Flat	Flat, Gentle slope	
Geology		Clay mix	Clay mix	Sandy	Sandy	Clay mix	
Vegetation		N/A	N/A	N/A	N/A	Grass, Trees	
Water resource	River name	Alkadisia (branch Euphtates)	Alkadisia (branch Euphtates)	Shatt Albasra	Shatt Albasra	Euphrates	
	From river (by GPS)	3 km	3 km	1 km	1 km	0.1 km	
	Width	15-20 m	15-20 m	70m	70m	400m	
	Depth	10 m	10 m	15-20 m	15-20 m	20-25 m	
	From Pump Sta.	N/A	N/A	1 km	1 km	5 km (Nearby existing Intake)	
Fuel	Fuel	1) HFO: 50% + Crude Oil: 50% 2) Dry Gas	1) HFO: 50% + Crude Oil: 50% 2) Dry Gas	Dry Gas	Dry Gas	Dry Gas	
	From fuel source	5 km: Strategic Pipeline	5 km: Strategic Pipeline	3 km: New Pipeline	3 km: New Pipeline	50 km: New Pipeline	
	From fuel process	2) South Gas Plant	2) South Gas Plant	New Majnoon Gas Plant	New Majnoon Gas Plant	New Majnoon Gas Plant	
	Note						
From 400kV sub-sta.		0.1 km (132kV)	0.1 km (132kV)	0.1 km	0.1 km	5 km	
Enviroment observation	From protected area (including Ramsar Site)	Far	Far	Far	Far	Far	
	Fauna & flora	N/A	N/A	N/A	N/A	N/A	
	World Heritage Site (including Proposed site)	Far	Far	Far	Far	Far	
	Resettlement (SAPROF Report and Google Map)	N/A	N/A	Yes	Yes	N/A	
Primary Evaluation Criteria							
Land Area (by GPS)		Unsuitable (7ha)	Need careful layout (20ha)	Unsuitable (2ha)	Unsuitable (2ha)	No Problem (65ha)	
Fuel type		Gas / Crude Oil	Gas / Crude Oil	Gas	Gas	Gas	
Cooling System (by GPS) A type : Once-through Cooling System B type : Cooling Tower system C type : Air Cooled Condenser System		Cooling system[1] : B,C type Distance Intake – Site : No Problem	Cooling system[1] : B,C type Distance Intake – Site : No Problem	Cooling system[1] : B,C type Distance Intake – Site : No Problem	Cooling system[1] : B,C type Distance Intake – Site : No Problem	Cooling system[1] : A,B,C type Distance Intake – Site : No Problem	
Civil design		Upper layer : Soil Improvement (depend on detail Geo survey)	Upper layer : Soil Improvement (depend on detail Geo survey)	Upper layer : Soil Improvement (depend on detail Geo survey)	Upper layer : Soil Improvement (depend on detail Geo survey)	Upper layer : Soil Improvement	
Geological condition		Inferred preferable Expected on a spur of diluvial upland or natural levee	Almost similar condition as Samawa 1	Inferred preferable Expected on a diluvial upland or natural levee	Almost similar condition as Shawyaba 1	Flood plain sediments. Expected loose and thick layer South-eastern end of "Hawr al-Hammar" swampy area. Seasonal marsh area Risk attacked by flood	
Environmental condition		There may be houses between the site and the river. Further survey is needed.	There may be houses between the site and the river. Further survey is needed.	SAPROF found that some employees' houses inside the existing power plant site might have to be relocated. There may be houses between the site and the river. Further survey is needed.	SAPROF found that some employees' houses inside the existing power plant site might have to be relocated. There may be houses between the site and the river. Further survey is needed.	Information is limited.	
Primary Evaluation		C	C	C	C	B	
Remark		Land area:Unsuitable Intake system length	Land area:Unsuitable Intake system length	Land area:Unsuitable	Land area:Unsuitable	Geological Risk	
Potential F/S site							