資料 5-2　討議議事録 (ドラフトレポートの説明)

Preliminary Study for Reconstruction of Iraq (Phase 4)
Outline Design Study

Minutes of Discussions
on the Preliminary Study (Outline Design Study) on the Project for
Construction of Diesel Power Station in Samawah
in Iraq
(Explanation on Outline Design)

In December 2004 and February 2005, the Japan International Cooperation Agency (hereinafter referred to as "JICA") dispatched the Study Team for the Preliminary Study (Outline Design Study) (hereinafter referred to as "the Study") on the Project for Construction of Diesel Power Station in Samawah in Iraq (hereinafter referred to as "the Project") to Jordan, and through discussions, field survey, and technical examination of the results in Japan, JICA prepared a draft report of the study.

The Iraqi side and the Japanese side have met during the period from May 9 to 10, 2005. The participants of both sides are listed in the attached attendance list. In this meeting, the Japanese side presented the draft of Outline Study Report on the Project.

As a result of discussions, both sides confirmed the items described on the attached sheets.

Amman, May 11, 2005

Kyojin Mima
Leader
Draft Report Explanation Team
Japan International Cooperation Agency

Muhammed Ali Hassani
Governor
Al-Muthana Governorate

Witness;

Hideo Suzuki
Director, Grant Aid Division
Economic Cooperation Bureau
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11th May 2005

Moayed Al-Maayouf
Director General
Planning & Studies Office
Ministry of Electricity

21/5/2005

Abdul Aziz Jabar
Expert
Ministry of Oil

ATTACHMENT

1- Name of the Project

Both sides confirmed that the name of the Project should be "the Project for Construction of Diesel Power Station in Samawah."

2- Components of the Project

The Iraqi side agreed and accepted the components of the Project explained by the Team. Details are shown in Annex-1.

3- Project Site and Layout Plan

The Project site including the fuel oil pipeline from the Samawah Oil Refinery to the site and layout plan for the Diesel Power Station are shown in Annex-2 and 3 respectively.

4- Organizations concerned in Iraqi side

a- The Responsible and Coordinating organization is the Ministry of Electricity (MoE).

b- The Responsible Organization for making available the necessary fuel oil for the operation of the Diesel Power Station is the Ministry of Oil (MoO), it is also Coordinating Agency for the fuel oil pipeline.

c- The Responsible Agency for security is Al-Muthanna Governorate.

The organization charts of MoE, MoO and Al-Muthanna Governorate are shown in Annex-4 to 6.

5- Undertakings to be borne by the Iraqi side

a- Both sides confirmed that the undertakings concerned the Project shown in Annex-7 should be borne by the Iraqi side.

b- The Iraqi side should conduct survey for landmines and unexploded ordnances (UXOs) at the Project site including the site for pipeline and issue the certificate of completion of the survey to the Japanese side within five (5) months from the signature of the Exchange of Letters.

c- The Iraqi side will be responsible for ensuring the safety of all persons, goods and materials related to the Project by taking all necessary measures including patrolling and holding road inspections around the Project site during construction period. In addition to the above, the Iraqi side should take measures necessary for ensuring smooth implementation of the Project requested by relevant parties involved in the Project.

6- Tender and contract

The Japanese side reconfirmed that confirmation of approval of the Iraqi side will be requested for the tender documents and tender evaluation report.

7- Schedule of the Study

JICA will complete the final report taking into considerations the relevant issues shown in 8- Other Relevant Issues and send it to the Iraqi side by the end of June 2005.

8-Technical Comparison

a- The Governor of Al-Muthana requested and expressed his preference to go for 2-stroke low speed engine for the benefit of all Al-Muthana Governorate.

b- Both sides discussed the technical comparison of the 2-stroke (low speed) engine and 4-stroke (medium speed) engine based on the Comparative Table of Diesel Engine (Low Speed & High Speed) shown in Annex-8A

c- According to the Iraqi side request, Japanese side has submitted revised comparison table (Annex-8B)

based on the following;

i) Availability of each type of diesel engine

ii) Revision to the Comparison table to be direct comparison by 15 MW.

d- According to the request of Iraqi side, the Japanese side gave further explanation and illustration (Annex-9) to show the possible chance of participation in both 2-stroke and 4-stroke diesel engine from the Japanese companies. The Japanese side explained that according to Japan's policy for procurement in grant aid projects, it was necessary to ensure competitiveness of the tender.

e- As a conclusion of the above discussions, both sides agreed that the diesel engine type should not be restricted to either 2-stroke (low speed) or 4-stroke (medium speed).

f- Both sides agreed to put down during detailed design, tender documents and tender evaluation the principle and method of evaluation for both types and specify the range of the speed engine respectively.

9- Other Relevant Issues

a- Handover of each component

Both sides confirmed that the Project should be divided into twelve (12) portions as per Annex-10 and each portion would be handed over after completion of the commissioning inspection respectively taking into consideration the integrity and functioning of whole Project.

b- Warranty against defects

The Japanese side explained that the warranty against defects should be excluded from the tender documents and contract form of the Project and the Iraqi side understood that it would be difficult for the Japanese firms/manufacturers to include the clause without dispatching Japanese supervisors/engineers during construction from the technical viewpoints.

In compensation for that, the Iraqi side proposed to include the reliability run for each diesel engine unit from 72 hours to at least one (1) month in the tender documents to detect initial defects caused by miss-erection, miss-matching of equipment. The Japanese side accepted the proposal.

c- Implementation schedule (Table 2-12 of the draft report)

The Iraqi side strongly requested to shorten the implementing schedule for both detailed design stage and construction stage as much as possible. The Iraqi side also mentioned that reducing the execution period as much as possible is essential for the Project and that should be discussed during the detailed design stage.

d- Fuel oil pipeline

Both sides confirmed that the fuel pipeline between the Project site and Samawah Oil Refinery should be installed in underground due to security reason.

e- Other technical matters

Both sides confirmed the technical specifications/matters on the other components as per Annex-11.

f- Configuration of the budget of the Project

The Japanese side explained and Iraqi side understood the configuration of the budget of the Project and concept of the "provisional sum" as shown in Annex-12.

g- JICS participant has submitted the "Outline of Bilateral Grant Aid for the Reconstruction of Iraq by the Government of Japan" as per Annex-13. In this outline flowchart, the main steps and milestones of the implementation of the Project were indicated. The time schedule of the above flowchart is in synchronization with the implementation schedule stated in 9-c above.

ATTENDANCE LIST

JAPANESE SIDE:

	Name	Title & Organization
1	Mr. Hideo Suzuki	Director, Grant Aid Division, Economic Cooperation Bureau, Ministry of Foreign Affairs (MOFA)
2	Mr. Kyojin Mima	Group Director, Project Management Group I, Grant Aid Management Department, JICA
3	Mr. Hiroyuki Hayashi	Transportation and Electric Power Team, Project Management Group I, Grant Aid Management Department,
4	Mr. Noriaki Matsushima	Nippon Koei Co., Ltd.
5	Mr. Masaki Wada	ditto
6	Mr. Akihisa Manita	ditto
7	Mr. Yoshikazu Yamada	Director General, Project Management Department, Japan International Cooperation System (JICS)
8	Mr. Mitsuhiro Kohno	Counseller, Embassy of Japan
9	Mr. Hisatoshi Okubo	Representative, Iraq Unit, JICA Jordan Office
10	Mr. Susumu Yuzurio	Assistant Representative, Iraq Unit, JICA Jordan Office

IRAQI SIDE:

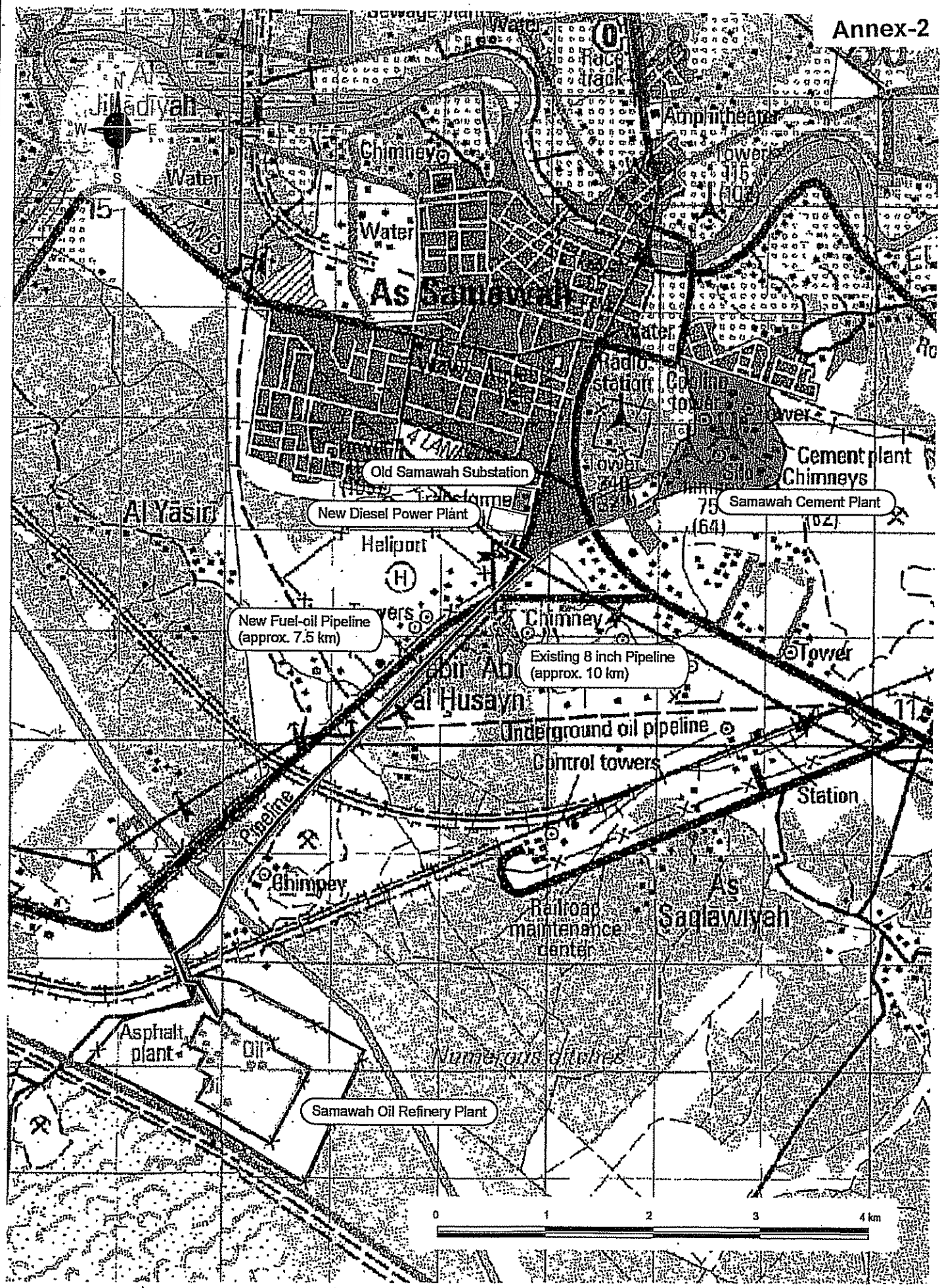
	Name	Title & Organization
1	Mr. Muhammed Ali Hassani	Governor, Al-Muthana Govenorate
2	Dr. Moayed Al-Maayouf	Director General of Planning & Studies Office, Ministry of Electricity
3	Mr. Emil K. Hanna	Expert, Planning & Studies Office, MoE
4	Eng. Laith Hamid	Head of Projects Department, MoE
5	Mr. Hisham Jassam	Engineer, Middle Production, MoE
6	Mr. Anmar Anwor Abdul	Engineer, Middle Production, MoE
7	Mr. Saad Rahem	Chief Engineer, Nassiriyah Generation Governorate
8	Mr. Abdul Aziz Jabar	Expert, Ministry of Oil (MoO)
9	Mr. Fahem Mahmoud	Manager, Directorate of Al-Muthana Electricity Distribution

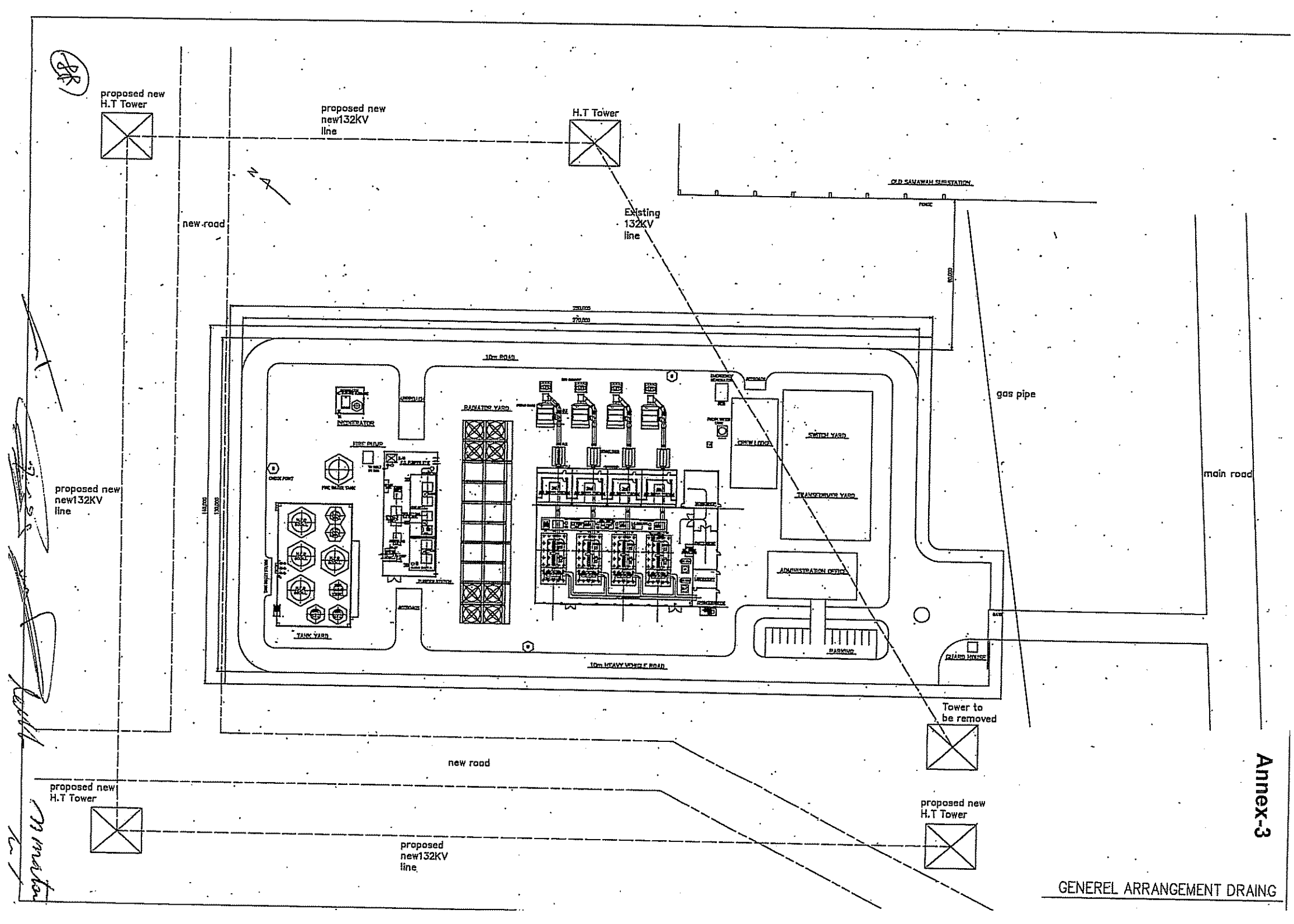
Annex-1

Components of the Project

No.	Item	Specifications	Q'ty	Unit	Remark
Mechanical Facilities	Diesel Engine	2-stroke or 4-stroke Engine Using oil: Heavy Fuel Oil	4	sets	
	Fuel Oil System				
	HFO Storage Tank	500 k L, Cylindrical Type	4	sets	
	HFO Service Tank	120kL, LC(Level Control)/Alarm	2	sets	
	MDO Storage Tank	120kL, Cylindrical Type	1	set	
	HFO Oil Purification System	Pumps, Mortars, Tanks, Duplex Type	1	set	
	Lubricating Oil (LO) System				
	LO Tank	Tanks for System Oil and Cylinder Oil (each 120 k L)	2	sets	
	LO Sump tank	Square Type	4	sets	
	L.O. Centrifugal Separator	Pumps, Mortars, Tanks	1	set	
	Cooling Water System				
	Cooling Water Pump	For High and Low Temperature	4	sets	
	Make-up Water System)	Pumps, Heaters	1	set	
	Radiator	For high and Low Temperature	1	set	
	Air Compressor System				
	Air Compressor for Starting	Air Compressor, Starting Air Tank	2	sets	
	Air Intake and Exhaust Gas System				
	Exhaust Stack	H=40m	4	sets	
	Exhaust Silencer	Less than 70dB	8	sets	
	Intake Silencer	Filter	4	sets	
Electrical Facilities	Generator	11kV, 50HZ, 3Phases	4	sets	
	Main Transformer	3 Phases, 50 HZ, 11kV/132kV, 50MVA	2	sets	
	132KV Switchgear	Circuit breaker, Disconnecting Switch, CT, PT	1	set	
	Protection and Operation Panel	Operation Panel for Generator and Switchgear, Various Protection Panel	1	set	
Building and Civil Facilities	Power House	Steel structure	1	set	
	Other Buildings	Office Crew Lodge, Guard, Oil Purification room, Parking, etc.	1	set	
	Road in the Yard	Width 10m	1	set	
	Drainage System in the yard	Drain, Oil Separator	1	set	
	Boundary Fence		1	set	
132 KV Connecting Cable	132kV Connecting Cable (from Power Station to Substation)	XLPE, Length=200m, Single Core	1	set	
Additional Equipment in Existing Substation	132 kV Switchgear	Circuit breaker, Disconnecting Switch, CT, PT	1	set	
	Protection and Operation Panel	Operation Panel for Switchgear	1	set	
	Bus Conductor	CU Cable 500 mm2, Length=100m	1	set	
	Gantry for Bus Bay	Single Bus, H=8m	1	set	
Pipeline	Pipeline	Carbon Steel Pipe, 4 inch ϕ	1	set	
	Pump (refinery side)	37.5kVA×2	1	set	
	Generator (ditto)	50kVA×2	1	set	
Relocation of the existing transmission line	Tower (New)	SS14 Tower, H30m×3sets	1	set	
	132kV Transmission Line (2 circuits)	ACSR 240 mm2 (3×800m)	1	set	

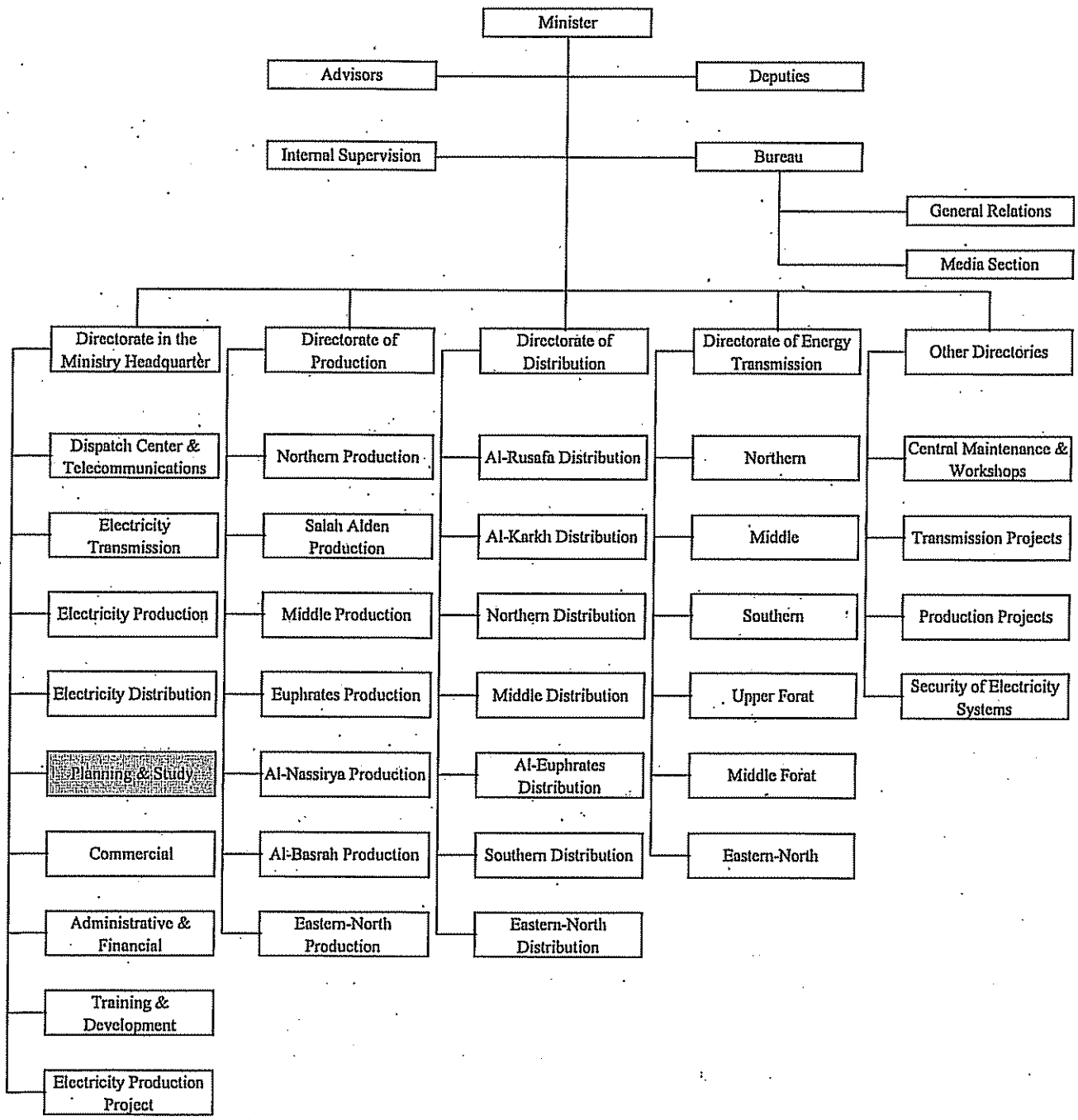
Annex-2


Old Samawah Substation
New Diesel Power Plant
Samawah Cement Plant
New Fuel-oil Pipeline (approx. 7.5 km)
Existing 8 inch Pipeline (approx. 10 km)
Underground oil pipeline
Control towers
Railroad maintenance center
Samawah Oil Refinery Plant
Heliport
Cement plant Chimneys
Asphalt plant
Numerous ditches
Pipeline
Station
0 1 2 3 4 km

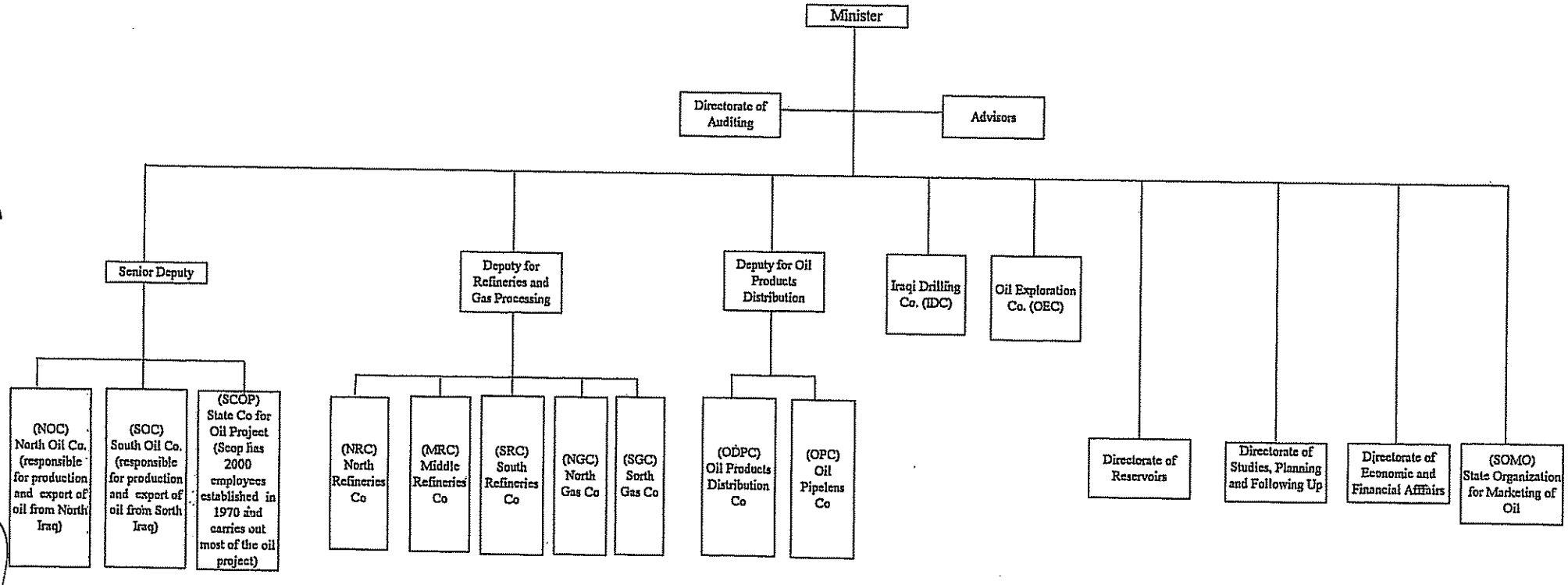


Annex-3

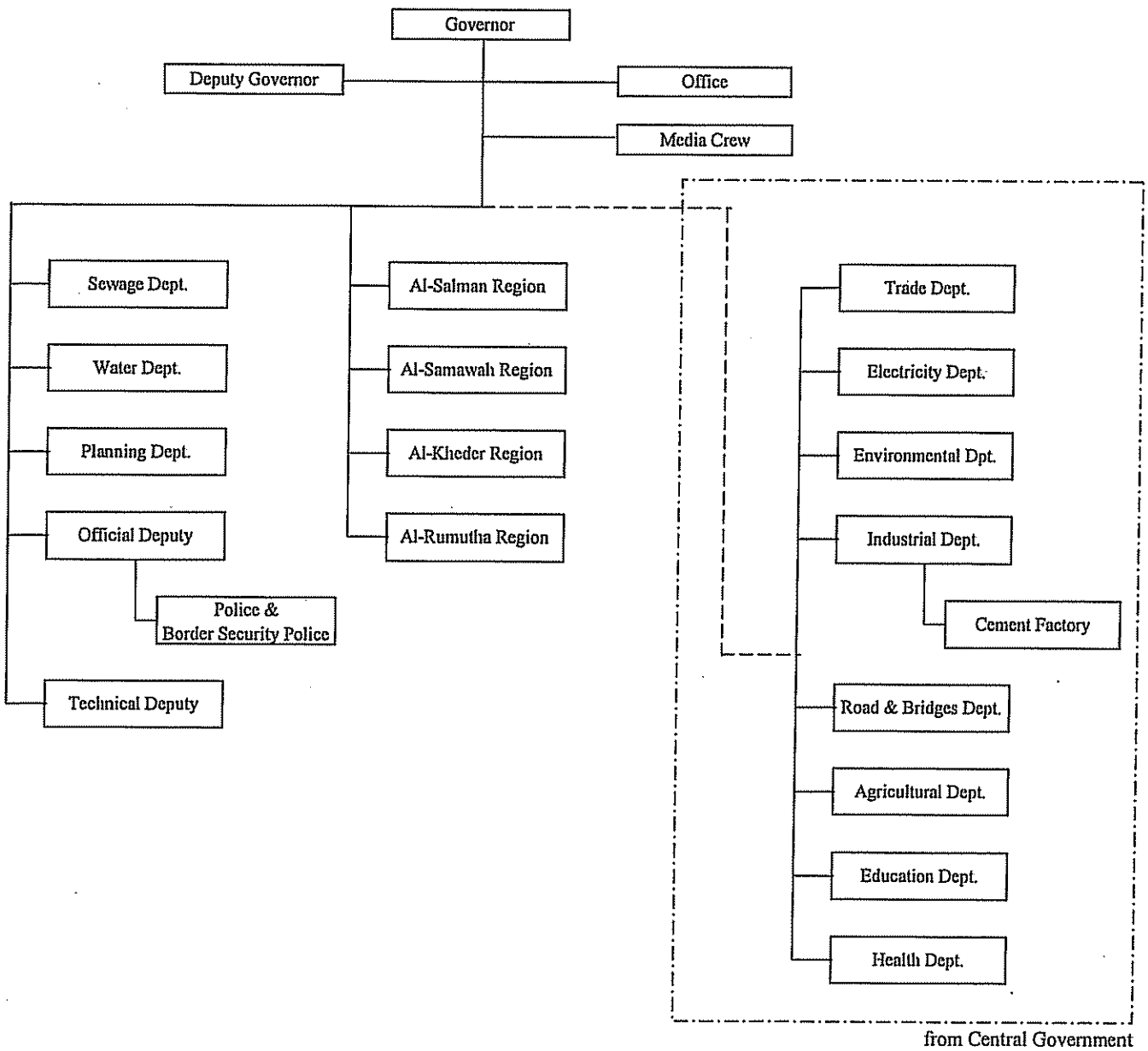
GENEREL ARRANGEMENT DRAING



Organization of MoE



Organization of MoO



Organization of Muthanna Governorate

Undertaking to be done by Iraqi side

Items to be executed by the Iraq authorities in case that a grant aid project from Japan is executed are as follows:

(a) Assisting customs clearance at ports of entry into iraq

(b) Getting clearance from relevant authorities which may be necessary within Iraq for the execution of the Project

(c) Allowing Japanese nationals and other nationals involved in the Project entry into Iraq

(d) Exempting customs duties, internal taxes and other fiscal levies which may be imposed in Iraq with respect to the supply of products and services under the Project

(e) Exempting Japanese nationals involved in the Project from customs duties, internal taxes and other fiscal levies which may be imposed in Iraq

(f) Permitting contractors to utilize non-Iraqi insurance companies as necessary

(g) Acquisition of land necessary for the project

(h) The Iraqi side should conduct survey for landmines and unexploded ordinances (UXOs) at the Project site including the site for pipeline and issue the certificate of completion of the survey to the Japanese side within five (5) months from the signature of the Exchange of Letters.

(i) The Iraqi side will responsible for ensuring the safety of all persons, goods and materials related to the Project by taking all necessary measures including patrolling and holding road inspections around the Project site during construction period. In addition to the above, the Iraqi side should take measures necessary for ensuring smooth implementation of the Project requested by relevant parties involved in the Project.

(j) Providing terminal points for public services, such as water supply, telephone, electricity

Table 4-2. Comparative Table of Diesel Engine (Low Speed & Medium Speed)

No.	Item		Low Speed (2-stroke) Engine	Medium Speed (4-stroke) Engine
1	Stroke		There are 2-stroke (compression and combustion) per a rotation of crank shaft.	There are 4-stroke (inhalation, compression, combustion and exhausting) per two rotation of crank shaft.
2	Usable Oil		It is possible to use the H.F.O including extremely poor-quality oil.	It is possible to use the H.F.O including poor-quality oil.
3	Lowering Rate of Generating Output (at air temperature 55°C)		Approx. 3%	Approx. 4%
4	Cooling System		Large	Small
5	Dimension (Incl. Auxiliary System)		Large 2.0～2.5	Small 1.0
6	Dimension (Engine Foundation)		Large Vibration of engine is larger than medium speed engine.	Small -
7	Weight (Engine Body)		Large 2.0	Small 1.0
8	Price (Incl. Auxiliary System)		High 1.2～1.5	Low 1.0
9	Life Time (Past Record)		More than 30 years	More than 30 years
10	Supply Experiences as Land Type Power Plant (using oil is H.F.O.)		Around 100 units	Around 3,000 units
11	O/M	1) Difficulty of Operation	No difference (Both engines have any experiences of operation at developing country)	
		2) Service Network	Few (difficult to arrange the spare parts)	Many
		3) Maintenance Frequency	Few (the number of combustion is fewer than medium speed engine)	More than low engine
		4) Difficulty of Maintenance	Regular inspection is easier than medium speed, because the number of cylinder is fewer. But, it is difficult to repair as breakdown and to overhaul of engine, because the length of cylinder is longer and heavier than medium speed engine.	Regular inspection is more difficult than low speed, because the number of cylinder is more. But, it is easy to repair as breakdown and to overhaul of engine, because the length of cylinder is shorter and lighter than low speed engine.
		5) Maintenance Cost	Cost of regular inspection is lower than medium speed engine, but cost of repair as breakdown and overhaul of engine is higher. ※If the engines are normal operated for 30 years, the maintenance cost of both engines is almost same.	Cost of regular inspection is higher than low speed engine, but cost of repair as breakdown and overhaul of engine is lower.
12	Conversion to Gas Fuel in the Future		Possible (Both engines have supply record)	
13	Others		(1) Unit generating capacity is max. 80 MW.	(1) Unit generating capacity is max. 21 MW.
			(2) Load following capability is not adapted.	(2) Load following capability is adapted.

Comparative Table of 15 MW Diesel Engine (Low Speed & Medium Speed)

No.	Item		Low Speed (2-stroke) Engine	Medium Speed (4-stroke) Engine
1	Stroke		There are 2-stroke (compression and combustion) per a rotation of crank shaft.	There are 4-stroke (inhalation, compression, combustion and exhausting) per two rotation of crank shaft.
2	Usable Oil		It is possible to use the H.F.O including extremely poor-quality oil.	It is possible to use the H.F.O including poor-quality oil.
3	Lowering Rate of Generating Output (at air temperature 55℃)		Approx. 3%	Approx. 4%
4	Cooling System		Large	Small
5	Dimension (Incl. Auxiliary System)		Large 2.0～2.5	Small 1.0
6	Dimension (Engine Foundation)		Large Vibration of engine is larger than medium speed engine.	Small -
7	Weight (Engine Body)		Large 2.0	Small 1.0
8	Life Time (Past Record)		More than 30 years	More than 30 years
9	Supply Experiences of 15 MW class as Land Type Power Plant (using oil is H.F.O.)		Around 20 units	Around 500 units
10	O／M	1) Difficulty of Operation	No difference (Both engines have any experiences of operation at developing country)	
		2) Service Network	Few (difficult to arrange the spare parts)	Many
		3) Maintenance Frequency	Few (the number of combustion is fewer than medium speed engine)	More than low engine
		4) Difficulty of Maintenance	Regular inspection is easier than medium speed, because the number of cylinder is fewer. But, it is difficult to repair as breakdown and to overhaul of engine, because the length of cylinder is longer and heavier than medium speed engine.	Regular inspection is more difficult than low speed, because the number of cylinder is more. But, it is easy to repair as breakdown and to overhaul of engine, because the length of cylinder is shorter and lighter than low speed engine.
		5) Maintenance Cost	Cost of regular inspection is lower than medium speed engine, but cost of repair as breakdown and overhaul of engine is higher. ※If the engines are normal operated for 30 years, the maintenance cost of both engines is almost same.	Cost of regular inspection is higher than low speed engine, but cost of repair as breakdown and overhaul of engine is lower.
11	Availability		328 (365-37) days/year/unit	
12	Conversion to Gas Fuel in the Future		Possible (Both engines have supply record)	
13	Other		Load following capability is not adapted.	Load following capability is adapted.

Survey Result on Diesel Engine Manufacturers in Japan

Japanese Manufacturer	Experience of 15 MW		Expected Participation in the Project
	2-stroke	4-stroke	
A	○(51MW)	×	○
B	×	×	×
C	×	○(15 MW)	○
D	–	○(21 MW)	×
E	–	×	×

Note: X: experience with smaller engines than 15 MW
–: not produce

Component Division Plan for Partial Taking Over

ID	Component	Details	Conditions for T/O	Timing of T/O after award of the contract
1	Relocation of Existing Transmission Line	Construction of the new supporting structures for transmission, Removal and lay of conductor	After completion of inspection for transmission line	about 8 months
2	Various Tank Facilities	Oil tanks in tank yard (total 9), Tank for fire fighting (x1)	After completion of construction & inspection for all tanks	about 16 months
3	Oil Pipe Line	Construction of oil pipe line (about 8 km), Installation of the pumps in Samawah oil refinery	After confirmation of oil transfer from oil refinery to new power station	about 16 months
4	Office		After completion of interior finishing	about 17 months
5	Crew Lodge		After completion of interior finishing	about 17 months
6	Diesel Engine Generator – Unit No.1	Engine, Generator, Incidental facilities	After commissioning test as whole generating system of unit No.1 (grounding resistance test, dielectric strength test, governor test, interlock test and load test, etc)	about 18 months
7	Radiators, Oil Purification System, Other Mechanical and Electrical Facilities in Power Station	Radiator facilities, Oil Purification facilities, Various pumps (for fuel oil, cooling water, and sludge, etc.), Air compressor, Intake and exhaust facilities, Incinerator for waste oil	After commissioning test of unit No.1 (enforcement of inspection for each facility as commissioning test of unit No.1)	about 18 months
8	132 kV Switchgear in the Old Samawah Substation	Step-up transformer, 132kV Switchgear and conductor, Expansion of bus facilities (incl. gantry) in Old Samawah substation	After commissioning test of unit No.1 (enforcement of inspection for transmission as commissioning test for unit No.1)	about 18 months
9	Power House	Power House, Various control and operation panels	After commissioning test of unit No.1 and completion of interior finishing	about 18 months
10	Diesel Engine Generator – Unit No.2	Engine, Generator, Incidental facilities	After commissioning test as whole generating system of unit No.2	about 19 months
11	Diesel Engine Generator – Unit No.3	Ditto	After commissioning test as whole generating system of unit No.3	about 20 months
12	Diesel Engine Generator – Unit No.4	Ditto	After commissioning test as whole generating system of unit No.4	about 21 months

Specifications of Diesel Engine Generating Plant (for 15 MW x 4 sets)

	Category			Specification	Q'ty	Unit	Remarks
1	Diesel Engine Generator						
		1-1	Diesel Engine	Type:Two or Four-stroke Diesel Engine Output:15MW Class (Unit generating output should be guaranteed on condition that maximum ambient temperature is 55℃.) Heavy Fuel Oil Specific Gravity=0.957(at 15.6℃) Sulfur Content=4%、Vanadium=64ppm Pour Point=+25℃、Flash Point=+210℃	4	sets	
		1-2	Generator	Horizontal shaft, revolving field, air cooled, compound winding, 3-phase AC synchronous generator, 11kV、50HZ、3Phase	4	sets	
		1-3	Foundation Bolt ・Setting Plate	R.C.Foundation	4	sets	
2	Fuel Oil System						
		2-1	H.F.O. Storage Tank	500kL Cylinder Type、Valves、Gauges Steam Heating Pipe(45℃)	4	sets	
		2-2	H.F.O. Service Tank	LC/ALARM、ST Heating Pipe(65℃)	2	sets	
		2-3	H.F.O. Buffer Tank 1	LC(and ALARM)、ST Heating Pipe(75℃)	1	set	
		2-4	H.F.O. Buffer Tank 2 (and Service Tank)	Square Type with LC/ALARM、ST Heating Pipe(80~85℃)	1	set	
		2-5	H.F.O Transfer Pump 1	Carry Oil to Storage Tank、Strainer、Valves 100m3/H×3kg/cm2	1	set	
		2-6	H.F.O Transfer Pump 2	Carry Oil from Storage Tank to Buffer Tank 20m3/H、Strainer×1、2.5kg/cm2	2	sets	
		2-7	M.D.O. Storage Tank (and Service Tank)	120KL Cylinder Type、Valves、Gauges Maintenance Materials、ST Heating Pipe 45℃	1	set	
		2-8	M.D.O. Transfer Pump		2	sets	

	Category			Specification	Q'ty	Unit	Remarks
		2-9	H.F.O. Purifier System	Pump × 3, Motor × 3, Preheater × 3, Control Panel × 1, Sludge Tank × 1, Sludge Carry Pump × 2, Hot Water Tank × 1, Working Table (Overhaul & Cleaning) × 3	2	sets	
		2-10	H.F.O. Supply Pump	Filter、Flow Meter From H.F.O Service Tank to Engine	4	sets	
		2-11	H.F.O. Injection Booster Pump Unit	Depend on the Manufacture of Diesel Engine	4	sets	
		2-12	H.F.O. Purifier System Recirculating Pump	L.C/Start & Stop (Automatic)、Filter, Valves	2	sets	
		2-13	H.F.O. Drainage Tank	Square Type、Valves、Liquid Level Meter、Heating Pipe	2	sets	
		2-14	Scavenging Drainage Tank	Valves、Level Meter	4	sets	
		2-15	Scavenging Drainage Pump	Filter	4	sets	
		2-16	Piston Staffing Box (Oil Supply System)		4	sets	2-stroke engine only
		2-17	Fuel Oil Flow Meter		4	sets	
		2-18	Fuel Oil Strainer (1st level)		4	sets	
		2-19	Fuel Oil Strainer (2nd level)		4	sets	
		2-20	Fuel Oil Strainer (3rd level)		4	sets	
		2-21	Fuel Oil Adjustment Valve	Viscosity Control Equipment	4	sets	
3	Lubricating Oil System						
		3-1	L.O.Tank (for System Oil)	Cylinder Type、120KL LC／ALARM、SPOT ST Heating	1	set	※ L.O. tank (for system oil) is required 2 sets for 4-stroke engine.
		3-2	L.O.Tank (for Cylinder Oil) ※ only for 2-stroke engine	Cylinder Type、120KL LC／ALARM、SPOT ST Heating	1	set	
		3-3	System Oil Transfer Pump	Filter、L.C/Start & Stop (Auto)、Valves、Flow Meter	1	set	
		3-4	Cylinder Oil Transfer Pump	Filter、L.C/Automatic Starting/Stop、Valves、Flow Meter	1	set	
		3-5	L.O. Sump Tank	Square Type L.C Valves, Gauges, Alarm, Heating Coil	4	sets	

	Category			Specification	Q'ty	Unit	Remarks
		3-6	Cylinder Oil Service Tank	Filter, Valves, L.C/Start & Stop (Automatic)、Alarm	4	sets	
		3-7	L.O.Drainage Tank/Sludge Tank	Square Type、Valves、Liquid Level Meter、Heating Pipe(50℃)	4	sets	
		3-8	Engine Cam Shaft L.O. Pump (Driving Oil for Exhaust Valve)	Valves, Filter, Adjustment Valves	4	sets	
		3-9	L.O. Sludge Transfer Pump	from Purifier System to Sludge Tank of Incinerator	1	set	
		3-10	L.O. Centrifugal Separator	Pump, Motor, Preheater(ST)、, Control Panel, Sludge Tank, Wiring/Piping, Valves, Alarm Foundation of Tank and Systems, Supply Pump , Sludge Shift Pump	4	set	
		3-11	Engine L.O. Strainer, Self Cleaning Type		4	sets	
		3-12	L.O. By-pass for Engine		4	sets	
		3-13	L.O.Cooler for Engine		4	sets	
		3-14	Indication Strainer		4	sets	
		3-15	L.O. Relief Valve		4	sets	
		3-16	L.O. Pump for Turbo Charger		8	sets	
		3-17	L.O. Tank for Turbo Charger		8	sets	
		3-18	L.O. Cooler for Turbo Charger		8	sets	
		3-19	L.O. Strainer for Turbo Charger		8	sets	
4	Cooling Water System						
		4-1	Cooling Water Pump(for Low Temperature)		4	sets	
		4-2	Cooling Water Pump(for High Temperature)		4	sets	
		4-3	Make-up Water System	Service Pump , Raw Water Pump, Pressure Water Tank, Double Sand Filter, Double Soft Filter	1	set	
		4-4	Radiator (for Low Temperature)		1	set	
		4-5	Radiator (for High Temperature)		1	set	

	Category			Specification	Q'ty	Unit	Remarks
		4-6	Preheating Pump & HT Heater		4	sets	
		4-7	Warming Heater (HT Preheater)		4	sets	
		4-8	Cooling Water Tank (for Low Temperature)		1	set	
		4-9	Cooling Water Tank (for High Temperature)		1	set	
5	Air Starting System						
		5-1	Starting Air Compressor (Automatic)	Cooling Water Type、with Foundation, Safety Valve, Reducting Valve, Alarm	2	sets	
		5-2	Air Tank	Pressure Gauge, Safety Valves, Alarm	2	sets	
		5-3	Cont.Air Compressor (Automatic)	Air Tank, Air Cooled Type, Pressure Control Valve、Safety Valve, Alarm	2	sets	
		5-4	Air Filter(for Main Strainer)		4	sets	
6	Air Intake and Exhaust Gas System						
		6-1	Exhaust Silencer	Less than 70dB	4	sets	
		6-2	Exhaust Stack	Separate Stack	4	sets	
		6-3	Intake Silencer, Filter		8	sets	
		6-4	Exhaust Gas Steam Generator	Condensate Cooler、Condensate Pump、Supply Water Pump, Heat Exchanger、Circulation Pump、Separate Tank of Oil/Water, Control Panel, Alarm, Pressure Meter, Safety Valve, Steam Separator	4	sets	
7	132 kV Switchyard in DG Plant	7-1	Step-up transformers	3 phase, 50HZ, 11/132kV, 50MVA	2	sets	
		7-2	Cable heads	Single phase	3	sets	
		7-3	120 kV Surge arresters	Single phase, 120 kV, 10 kA	9	sets	
		7-4	145 kV circuit breakers	3 phase, 40 kA, 1600 A	3	sets	
		7-5	145 kV disconnectors with earthing switch	3 phase, 40 kA, 1600 A	3	sets	
		7-6	145 kV current transformers	Single phase, 600-1200/1A, 3 cores	6	sets	
		7-7	145 kV current transformers	Single phase, 1500/1A, 3 cores	3	sets	
		7-8	145 kV voltage transformer	Single phase, 100 VA, class 0.5/3	3	sets	

	Category			Specification	Q'ty	Unit	Remarks
		7-9	Gantry for 132 kV bus\bay	for single bus, 8m height	2	sets	
		7-10	132 kV bus conductor	Cu 500 sqmm (100 m), with insulator sets	1	lot	
8	MV & LV switchgear and Control Panel	8-1	11 kV generator panel		4	sets	
		8-2	11 kV main TR secondary panel		2	sets	
		8-3	11 kV Aux. TR panel		2	sets	
		8-4	11 kV bus-tie panel		1	set	
		8-5	Auxiliary transformers	3 phase, 50HZ, 11/0.4kV, 250kVA, indoor	2	sets	
		8-6	132 kV control and protection panel		1	set	
		8-7	Exciter Panel		4	sets	
		8-8	Automatic Synchronizing Panel		1	set	
		8-9	Control Panel for Generator		1	set	
		8-10	Feeder Control Panel		1	set	
		8-11	Neutral Grounding Panel		1	set	
		8-12	Surge Absorber Panel		1	set	
		8-13	Low Voltage Enclosed Switchboard		1	set	
		8-14	Control Center		1	set	
		8-15	DC Power Panel		1	set	
		8-16	Auxiliary Mortar		1	set	
		8-17	Fire Alarm System		1	set	
9	Switchyard in Old Samawah S/S	9-1	Cable heads	Single phase	3	sets	
		9-2	120 kV Surge arresters	Single phase, 120 kV, 10 kA	3	sets	
		9-3	145 kV circuit breakers	3 phase, 40 kA, 1600 A	1	set	
		9-4	145 kV disconnectors with earthing switch	3 phase, 40 kA, 1600 A	2	set	
		9-5	145 kV current transformers	Single phase, 1500/1A, 3 cores	3	sets	
		9-6	Gantry for 132 kV bus\bay	for single bus, 8m height	2	sets	
		9-7	132 kV bus conductor	Cu 500 sqmm (100 m), with insulator sets	1	lot	
		9-8	Protection and control panel		1	set	
10	132 kV XLPE Cable between DG Plant and S/S	10-1	132 kV XLPE 240 sqmm cable	approx. 200 m, single core, with accessories	1	set	

	Category			Specification	Q'ty	Unit	Remarks
11	Relocation of 132 kV Transmission Line	11-1	Supports (towers)	Heavy angle tower (SS14), approx 30m height	3	sets	
		11-2	132 kV power conductors	ACSR LARK (240 sqmm) (approx. 3x800m)	1	lot	
		11-3	Overhead earthing wire	GSW 50 sqmm, single (approx. 1x800m)	1	lot	
		11-4	Insulator sets	tension insulator sets with necessary hardware	1	lot	
12	Fuel Oil Pipe-line between Oil Refinery and DG Plant	12-1	Carbon steel pipe	4-inch dia	7.5	km	Oil heating system is required at the oil refinery by Iraqi side to keep the oil temperature more than 40°C.
		12-2	Pumps at Oil Refinery	37.5 kVA	2	sets	
		12-3	Generators at Oil Refinery	50 kVA	2	sets	
13	Others	13-1	Fire Water Tank	Water Tank, Valves、Water Level Meter、Pipes、Accessories for Maintenance	1	set	
		13-2	Fire Pump System	Fire Fighting Pump, Cart Type (with Hand Cart)、Gasoline Engine	1	set	
		13-3	Waste Oil Incinerator (Steam Generator for Cold Start)	Steam Boiler (with Tank), Steam Dram、Water Supply System、Safety Valve、Gauge、Burner Fan、Ventilation Fan, Stack(with Arrester)、Tank、Fire Extinguisher、Water／Steam Pipes, Power Source and Control Panel	1	set	
		13-4	Hot Water Tank	SUS TANK, ST, Heating Coil (with Pressure Pump)	1	set	
		13-5	Emergency Generator	Generating Output: 250～300kW Voltage:415V Marine Diesel Oil、Radiator Type, with Tank	1	set	

Comparative Table of Main Component's Specifications for Low & Medium Speed Engine

No.	Category	Required Specifications	Low Speed Engine (2-stroke)	Medium Speed Engine (4-stroke)
1	Diesel Engine Generator	1.1 Unit generating output is 15MW class. (Unit generating output should be guaranteed on condition that maximum ambient temperature is 55°C.)	16,580 kW (=less than 45 °C) 16,080 kW (=55 °C) ※1	17,025 kW (=less than 45 °C) 16,340 kW (=55 °C) ※2
		1.2 The following heavy fuel oil should be used for normal operation of engine. ・Specific Gravity=0.957(at 15.6°C) ・Sulfur Content=4%、Vanadium=64ppm ・Pour Point=+25°C、Flash Point=+210°C	Possible	Possible
		1.3 Land transport regulation (H=5m) should be cleared.	Possible (to be divided the engine body)	Possible (to be divided partially)
4	Cooling Water System	4.1 Cooling water pump (for low temperature)	Approx. 500 m3/h ※1	Approx. 380 m3/h ※2
		4.2 Cooling water pump (for high temperature)	Approx. 300 m3/h ※1	Approx. 220 m3/h ※2

※1: example by one low speed engine manufacturer

※2: example by one medium speed engine manufacturer

Technical Matters

1. Water Source for Fire Fighting

Water for fire fighting system for the Project is planned to be taken from a pipeline which is under installation for the Samawah Oil Refinery. Branch for divergence shall be provided on such pipeline at the nearest point from the power station site by MoE. Additional pipeline will be extended up to the power station as the scope of this Project.

2. Fuel Pipeline

The following specifications of oil pipeline facilities are designed based on the oil temperature of 40℃.

1. Carbon Steel Pipe : 4-inch dia.
2. Pumps at Oil Refinery : 75 kVA (2 x 37.5 kVA)
3. Generator at Oil Refinery : 100 kVA (2 x 50 kVA)

Heavy fuel oil temperature is required to maintain at more than 40℃ for smooth oil flow in pipeline ,although flow point of heavy fuel oil is +25℃.
Accordingly, heating system which can keep the oil temperature more than 40℃ shall be prepared by Iraqi side at the oil refinery.

The pipeline is constructed under the ground.

[FORM B]

TENDER PRICE SCHEDULE

(Item)	(Japanese Yen)
A. Equipment Price	_____
B. Installation Work Price	_____
Total Tender Price (A. + B.)	_____
C. Inland Transportation and Security Price	**xxx,xxx,xxx (ceiling amount)**
D. Provisional Sum (xx % of (A. + B. + C.))	_____

(Signature) _____
(Name of the Signer)
(Title of the Signer)
(Name of the Tenderer)

Equipment from Japan shall include marine transportation and insurance to unloading port(s).

OUTLINE OF BILATERAL GRANT AID FOR THE RECONSTRUCTION OF IRAQ BY THE GOVERNMENT OF JAPAN

I. Project Planning

1. Project Finding & Building
- 1) Project Finding & Screening
- 2) Preliminary Survey by JICA through Japanese Consultant
- 3) Basic Estimation of Project Cost based on JICA's Preliminary Survey
- 4) Reporting to Japan's Gov't

↓

2. Approval of the Project & Budget Allocation
- 1) Draft Reporting and Approvals by Iraqi Side
- 2) Examination of the Project by Japan's Gov't
- 3) Approval of the Project Outline by Japan's Gov't
- 4) Allocation of Budget for the Project

II. Document Preparation for the Project and Design of the Project

3. Exchange of Letter
- 1) Letter Exchange between Japan's Gov't and Iraqi Gov't (Ministry of Foreign Affairs : MoFA) (coordinated by
- 2) Banking Arrangement between Iraqi Gov't and a Bank in Japan
- 3) Notification of Open Account by Iraqi Gov't to Japan's Gov't

↓

4. Agent Agreement
- 1) Agent Agreement between Iraqi Gov't and JICS
- 2) Payment Order to a Bank through JICS

↓

5. Consulting Agreement
- 1) Recommendation of the Consultant by MoFA to Iraqi Gov't and JICS
- 2) Consulting Agreement between the Consultant and JICS on behalf of Iraqi Gov't

↓

6. Detailed Design of the Project by the Consultant consulted with the Iraqi-side
- **1) Kick-off Meeting among all of concerned organizations related with the Project**
- 2) Detailed Design of the Project (Survey, Collecting and Analyzing data/information)
- 3) Preparation of Technical Specification of the Products, and Tender/Procurement Conditions by the Consultant
- 4) Determination of Tender and Procurement conditions for the Project
- 5) Confirmation of the Project-Details with Iraqi Gov't and MoFA through JICA and JICS
- 6) Confirmation of the Ceiling Price for the Tender

III. Tender and Contract

7. Tendering & Purchase Contract
- 1) Tender Notice
- 2) Distribution of Tender Documents
- 3) Tender Opening & Evaluation
- 4) Reporting to Japan's Gov't and Iraqi Gov't on the Tender result for Confirmation
- 5) Conclusion of Contract with Successful tenderer by JICS on behalf of Iraqi Gov't

IV. Delivery and Installation

8. Manufacturing & Transportation
- 1) Manufacturing of the Products
- 2) Inspection of the Products
- 3) Shipment of the Products
- 4) Transportation of the Products to Iraq

↓

9. Installation & Hand-Over of the Products
- 1) Installation of the Products
- 2) Final Inspection of the Installed Products
- 3) Hand-over of the Products to Iraqi-side

Japan International Cooperation System (JICS)

案件概要表（プロジェクトサマリー）

分野	電力
案件名	**サマーワ大型発電所建設計画**
背景（現状、緊急性、必要性）	イラクにおいて、電力供給の改善は喫緊の課題であり、わが国のイラク復興支援の重点地域であるサマーワ市及びムサンナ県においても同様である。 イラク電力省によると、今年度の電力需要として夏のピーク時において発電出力ベースで７，７５０MWと見積もられている。一方、電力供給については、１９９１年の湾岸戦争による電力設備の破壊、その後の経済制裁期間中の保守不良・スペアパーツ不足、イラク戦争に伴う破損・略奪行為により、発電可能出力は２００３年夏時点で最大発電可能出力は３，３００MWに低下していたが、その後の復旧作業により２００４年には５，１００MWまで回復した。しかし、２００５年夏のピーク需要に対応するためには、２，６５０MWの発電出力が不足している状況にある。 イラク側によれば、南部全体で約１４４５MWの電力需要があるのに対し、供給量は約９１５MW、したがって、約５３０MWの電力供給不足が生じている。 またムサンナ県によると、ムサンナ県全体では約２００MWの電力需要が存在し、そのうち現在供給されている電力は約４０～５０MWにすぎないとされている。 こうした電力事情を背景に、ムサンナ県側から、電力分野における大規模な支援について、わが国に対し繰り返し要請が出されている。
窓口機関名・実施機関名	イラク電力省（Ministry of Electricity）
協力内容	1. 新規発電所の建設（ディーゼル発電機：総発電出力 60MW） 2. 新規発電所と既存オールドサマーワ変電所を連係するための送電線の布設および既設サマーワ変電所の一部設備の増設 3. 新規発電所と既存サマーワ製油所をつなぐパイプラインの整備 4. 既設 132kV 送電線の切り回し 5. 発電施設の運転・保守要員のトレーニング
協力対象サイト	添付参照
事業効果（裨益地域・人口）	1. 裨益地域 サマーワ市及び近郊 本案件により、ムサンナー県の電力供給力が現時点の４０MW～５０MWより１００～１１０MWへと改善され、同県の電力需要の半分以上を満たすこととなる。 2. 裨益人口 約 10～12 万人（2 万世帯） （概略算出根拠） • 発電量：60MW（＝15MW×4） • 一世帯当りの消費電力：3 k W • 一世帯当りの人数：5～6 人 • 電力供給対象世帯数：60,000 k W/3 k W=20,000 世帯 10～12 万人（＝2 万×5～6 人）
想定工期	20 ヶ月
想定契約形態（一般競争・随意契約）	一般競争入札
想定輸送方法、ルート、問題点	海上はばら積み輸送、内陸はトレーラー輸送を想定。日本からの経路は、ヨルダン経由もしくはクウェート経由が一般的。イラク国内の輸送リスクに対処するため、保険の戦争特約付加及び武装警護サービスの利用が推奨される。

機材据付の有無	有
・想定される据付担当技術者の概要（国籍、技術力）	大規模ディーゼル発電機の据付では、エンジンの分解輸送後の現地組立、精緻な基礎据付精度の確保、複雑な配線・配管工事を伴い、これらのいずれかにミスが生じれば機器の破損のみならず、大きな事故の発生につながる可能性がある。そのため本設備の機器据付けを実施するには、各メーカーの機器に通じた日本人（自社）技術者もしくは同等の知識・経験を有する第三国要員による現地での管理が不可欠である。
維持管理体制	MOE には発・送配電を管轄する部門があり、その下部組織として全国各地域別（北部・中央部・南部）の担当部署が設置されている。MOE は蒸気タービンやガスタービンといった火力発電所について豊富な維持管理経験を有している。しかしながらイラクにおいて本プロジェクトで計画しているような大型ディーゼル発電所は未経験であることから、新設発電所の運転保守業務のためには要員の教育・管理体制の構築が重要である。
・維持管理に関するトレーニングの要否	要
・トレーニングの内容	案件の遂行とその後の維持管理を確実にするため、メーカーでトレーニングを実施する。 メーカーにおけるトレーニング（場所：イラク及び日本を想定）
・その他維持管理上の留意点	MOE が舶用ディーゼルエンジンの経験者等を積極的に維持管理要員として採用することが望まれる。
他ドナーの関与	CPA がサマワのオールドサマワ変電所敷地内に 38MW の定置式ガスタービン発電プラントを建設した。しかしながら石油省によるガス供給のコミットメントがなされておらず、運転開始に至っていない。
その他配慮事項（環境、ジェンダー等）	既設の変電所敷地付近は広大な空き地であり、環境に対する負荷は小さいと判断される。

案件位置図

Map No. 3835 Rev. 3 UNITED NATIONS
December 2002

Department of Public Information
Cartographic Section

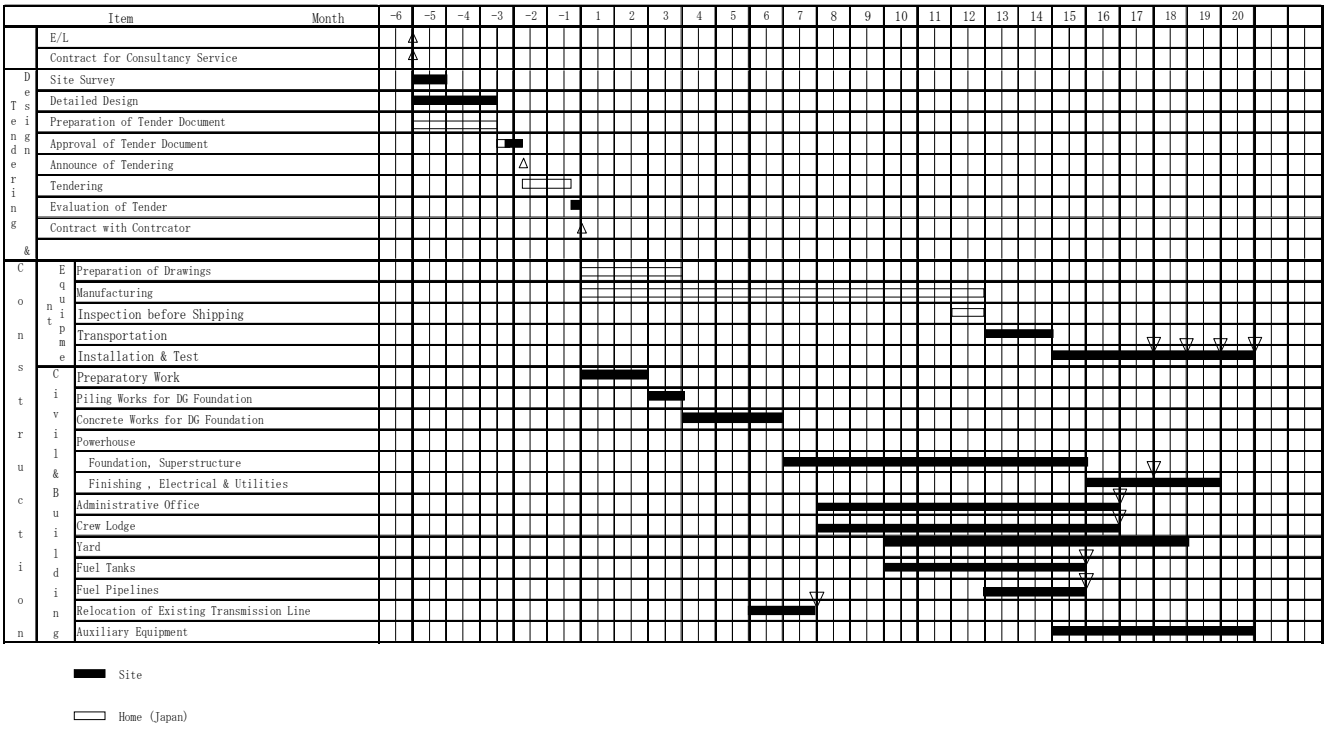
概略事業費算出表

（単位：千円）

区分		概略事業費
機材調達費		**8,435,150**
	1. 機材費、輸送梱包費	5,317,358
	2. 据付工事費、調達管理費、一般管理費	3,117,792
設計監理費		**668,216**
暫定価格（内陸輸送費、輸送警護費、輸送保険料、現場警護費）		**1,784,769**
予備的費用 *		**1,813,743**
事業費　合計		**12,701,878**

*　予備的費用はプロジェクト実施中の不測の事態に備えて確保された費用であり、その使用に際しては日本国政府の事前の了解が必要となる。

案件実施工程表



資料 7 参考資料/入手リスト

様　式

主管部長	文書管理課長	主管課長

情報管理課長	図書資料室受付印

収集資料リスト

平成 17 年　6 月　30 日　作成

地域	中近東	調査団等名称	イラク国復興支援予備調査（第 4 次/電力分野（発電）概略設計調査）	調査の種類	概略設計調査	作成部課	
国名	イラク国			現地調査期間	2004 年 11 月 8 日～2005 年 6 月 30 日	担当者氏名	

番号	資料の名称	形態	版型	ページ数	オリジナルコピーの別	部数	収集先名称又は発行機関	寄贈・購入（価格）の	取扱区分	利用表示	利用者所属氏名	納入予定日	納入確認欄
1	現地再委託成果品　（モト・マクドナルド社作成）	書類	A4		オリジナル	1	モト・マクドナルド社	委託成果品					
2	現地再委託成果品（追加）　（モト・マクドナルド社作成）	書類	A4		オリジナル	1	モト・マクドナルド社	委託成果品					

資料 8-1　地質調査結果
Soil Survey Data

Record of Test Results

ABBREVIATIONS

U	Undisturbed Sample.
D	Disturbed Sample.
SS	Samples From Standard Split Spoon
SPT (N-Value)	Standard Penetration Test Value.
CPT	Dynamic Cone Penetration Test
W.T.	Water Table.
M.C.	Moisture Content.
L.L.	Liquid Limit.
P.L.	Plastic Limit.
P.I.	Plasticity Index.
L.S.	Linear Shrinkage.
C.I.	Consistency Index.
GS	Specific Gravity.
Uni. Class	Unified Soil Classification System.
γ_{wet}	Natural Unite Weight.
γ_{dry}	Dry Unit Weight.
Qu	Unconfined Compressive Strength.
C	Cohesion in kN/m^2.
ϕ	Angle of Internal Friction.
e_o	Initial Void Ratio.
Cc	Compression Index.
Cr	Swelling Index.
Cv	Coefficient of Consolidation.
Pc	Preconsolidation Pressure.
Po	Overburden Pressure.
Ps	Swelling Pressure.
C.P. %	Collapse Potential.
K	Coefficient of Permeability.
SO_3 %	Sulphate Content
ORG. %	Organic Matter.
T.S.S %	Total Soluble Salts.
CL %	Chloride Content.
PH	Acidity or Alkalinity.
GYP. %	Gypsum Content.

MINISTRY OF HOUSING & CONSTRUCTION

NATIONAL CENTER FOR RESEARCH & CONSTRUCTION LABS

PROJECT:- Diesel Power Plant At Al-Khashaba/Samawa

RECORD OF TEST RESULTS

B.H.No.:-1

Samples		Type	Depth of Sample		M.C	Index Property			Particle size distribution & Hydrometer analysis				GS	SPT "N" val.	Symbol	Description of Soil	Chemical Tests					
Field No.	Lab No.		From m.	To m.	%	L.L %	P.I %	L.sh %	Clay %	Silt %	Sand %	Gravel %					SO_3 %	ORG %	GYP %	$CaCo_3$ %	PH	CL %
									Borehole No. 1													
1	3537	D	0.0	1.5		38	19	10						–	CL	Brown lean clay	0.82	0.69			8.42	1.3
2	3538	U	1.5	2.0	25									–	CL	Top: do(medium)						
									(5	90	5	0)			ML	Bott: brown silt						
3	3539	SS	2.0	2.5										17	ML	Do(very stiff)	0.39					0.48
4	3540	SS	3.5	4.0						(-29-	71	0)		24	SM	Medium grey silty sand						
5	3541	SS	5.0	5.5		44	23							48	CL	Top:hard brown lean clay						
									(3	41	56	0)			SM	Bott: dense grey silty sand						
6	3542	SS	7.0	7.5										53	SM	Do(very dense)						
7	3543	SS	9.0	9.5						(-17-	83	0)		45	SM	Dense grey silty sand	0.2				8.74	1.14
8	3544	SS	11.0	11.5										41	SM	Do						
9	3545	SS	13.0	13.5						(-37-	63	0)		98/10"	SM	Top: do(very dense)						
															CL-ML	Bott: hard silty clay	0.53				8.6	
10	3546	SS	15.5	16.0					(14	83	3	0)		50/4"	CL-ML	Do(hard)						
11	3579	Water sample															0.02				7.98	0.04

Depth of ground water = 1.5 m. below N.G.S

MINISTRY OF HOUSING & CONSTRUCTION

NATIONAL CENTER FOR RESEARCH & CONSTRUCTION LABS

PROJECT:- Diesel Power Plant At Al-Khashaba/Samawa

RECORD OF TEST RESULTS

B.H.No.:-2

Samples		Type	Depth of Sample		M.C	Index Property			Particle size distribution & Hydrometer analysis				GS	SPT "N" val.	Symbol	Description of Soil	Chemical Tests					
Field No.	Lab No.		From m.	To m.	%	L.L %	P.I %	L.sh %	Clay %	Silt %	Sand %	Gravel %					SO_3 %	ORG %	GYP %	$CaCo_3$ %	PH	CL %
									Borehole No. 2													
1	3547	D	0.0	1.5					(10	64	19	7)		–	CL-ML	Brown silty clay with sand	1.53	1.12			8.56	1.87
2	3548	U	1.5	2.0	25									–	CL-ML	Top: do						
									(7	79	14	0)			ML	Bott: brown silt						
3	3549	SS	2.0	2.5										20	ML/SM	Medium grey sandy silt to silty sand	0.31					
4	3550	SS	3.5	4.0					(1	58	41	0)		24	ML/SM	Do						
5	3551	SS	5.5	6.0										49	ML/SM	Do(dense)	0.1				8.68	0.62
6	3552	SS	7.5	8.0					(1	54	45	0)		54	ML/SM	Do(very dense)						
7	3553	SS	9.5	10.0										50	ML/SM	Do(dense)						
8	3554	SS	11.5	12.0					(-22-		78	0)		48	SM	Dense grey silty sand	0.15					0.43
9	3555	SS	13.5	14.0										63	SM	Do(very dense)						
10	3556	SS	15.5	16.0										50/5"	SM	Top: do						
						58	30								CH	Bott: hard green fat clay						

Depth of ground water = 1.52 m. below N.G.S

MINISTRY OF HOUSING & CONSTRUCTION
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PROJECT:- Diesel Power Plant At Al-Khashaba/Samawa

RECORD OF TEST RESULTS

B.H.No.:-3,4

Samples		Type	Depth of Sample		M.C	Index Property			Particle size distribution & Hydrometer analysis				GS	SPT "N" val.	Symbol	Description of Soil	Chemical Tests					
Field No.	Lab No.		From m.	To m.	%	L.L %	P.I %	L.sh %	Clay %	Silt %	Sand %	Gravel %					SO_3 %	ORG %	GYP %	$CaCo_3$ %	PH	CL %
									Borehole No. 3													
1	3557	D	0.0	1.0					(27	67	6	0)		–	CL	Brown lean clay	0.13	0.65			8.56	2.08
2	3558	U	1.0	1.5	20	51	24	14						–	CH	Very stiff brown fat clay						
3	3559	SS	1.5	2.0					(19	76	5	0)		20	CL	Very stiff brown lean clay	0.1					0.8
4	3560	SS	3.0	3.5										22	ML/SM	Medium brown sandy silt to silty sand						
5	3561	SS	5.0	5.5										58	SM	Very dense grey silty sand	0.18				8.74	0.53
6	3562	SS	7.0	7.5					(-18-		82	0)		54	SM	Do						
7	3563	SS	9.5	10.0										50	SM	Do(dense)						
									Depth of ground water = 1.55 m. below N.G.S													
									Borehole No. 4													
1	3564	D	0.0	1.0					(32	59	9	0)		–	CL	Brown lean clay	0.93	1.12			8.46	1.69
2	3565	U	1.0	1.5	19	43	22	11						–	CL	Do(very stiff)						
3	3566	SS	1.5	2.0					(28	69	3	0)		15	CL	Do(stiff)						
4	3567	U	3.0	3.5					(-17-		83	0)		–	SM	Brown silty sand	0.45				8.74	0.66
5	3568	SS	3.5	4.0					(33	62	5	0)		23	CL	Top: very stiff brown lean clay						
															SP	Bott: medium grey silty sand						
6	3569	SS	5.5	6.0					(-3-		97	0)		48	SP	Do(dense)						
7	3570	SS	7.5	8.0										56	SM	Very dense grey silty sand						
8	3571	SS	9.5	10.0					(--23-		77	0)		50	SM	Do(dense)	0.1					0.51
									Depth of ground water = 1.48 m. below N.G.S													

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PROJECT:- Diesel Power Plant At Al-Khashaba/Samawa

RECORD OF TEST RESULTS B.H.No.:-5

Samples		Type	Depth of Sample		M.C	Index Property			Particle size distribution & Hydrometer analysis				GS	SPT "N" val.	Symbol	Description of Soil	Chemical Tests					
Field No.	Lab No.		From m.	To m.	%	L.L %	P.I %	L.sh %	Clay %	Silt %	Sand %	Gravel %					SO_3 %	ORG %	GYP %	$CaCo_3$ %	PH	CL %
									Borehole No. 5													
1	3572	D	0.0	1.0		46	24	12						--	CL	Brown lean clay	0.99	1.12			8.41	1.69
2	3573	U	1.0	1.5	32									--	CL	Do						
3	3574	SS	1.5	2.0		50	27							24	CH	Very stiff brown fat clay						
4	3575	SS	3.5	4.0					(5	64	31	0)		58	ML/SM	Very dense grey sandy silt to silty sand	0.35				8.5	1.35
5	3576	SS	5.5	6.0										45	SM	Dense grey silty sand						
6	3577	SS	7.5	8.0					(0	46	54	0)		55	SM	Do(very dense)	0.1					0.98
7	3578	SS	9.5	10.0					(-28-		72	0)		65	SM	Do						
8	3580	Water sample															0.01				7.99	0.08

Depth of ground water = 1.5 m. below N.G.S

Borelogs

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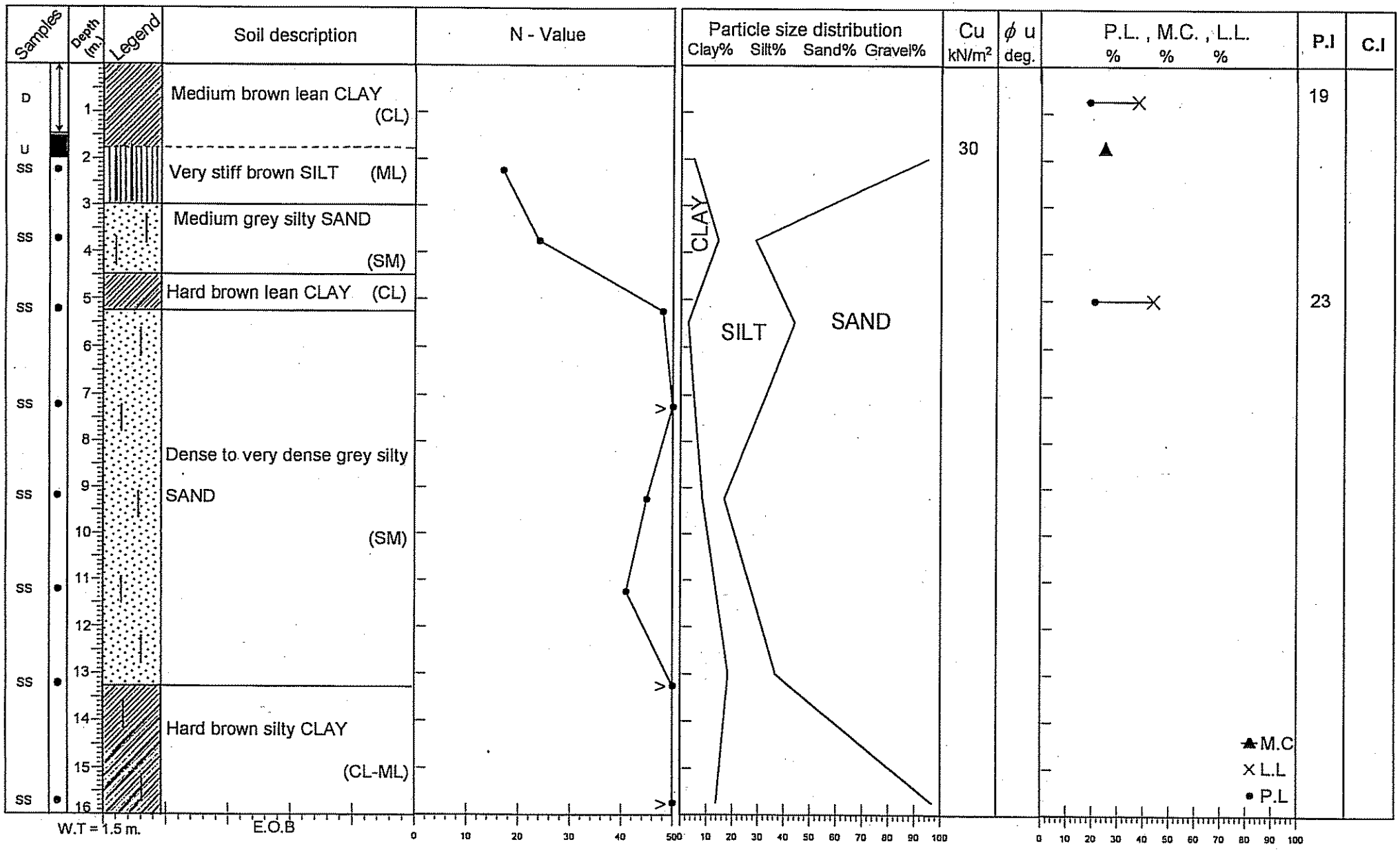
BOREHOLE LOG

Project : Diesel Power Plant At Al-Khashaba / Samawa

B.H. No. : 1



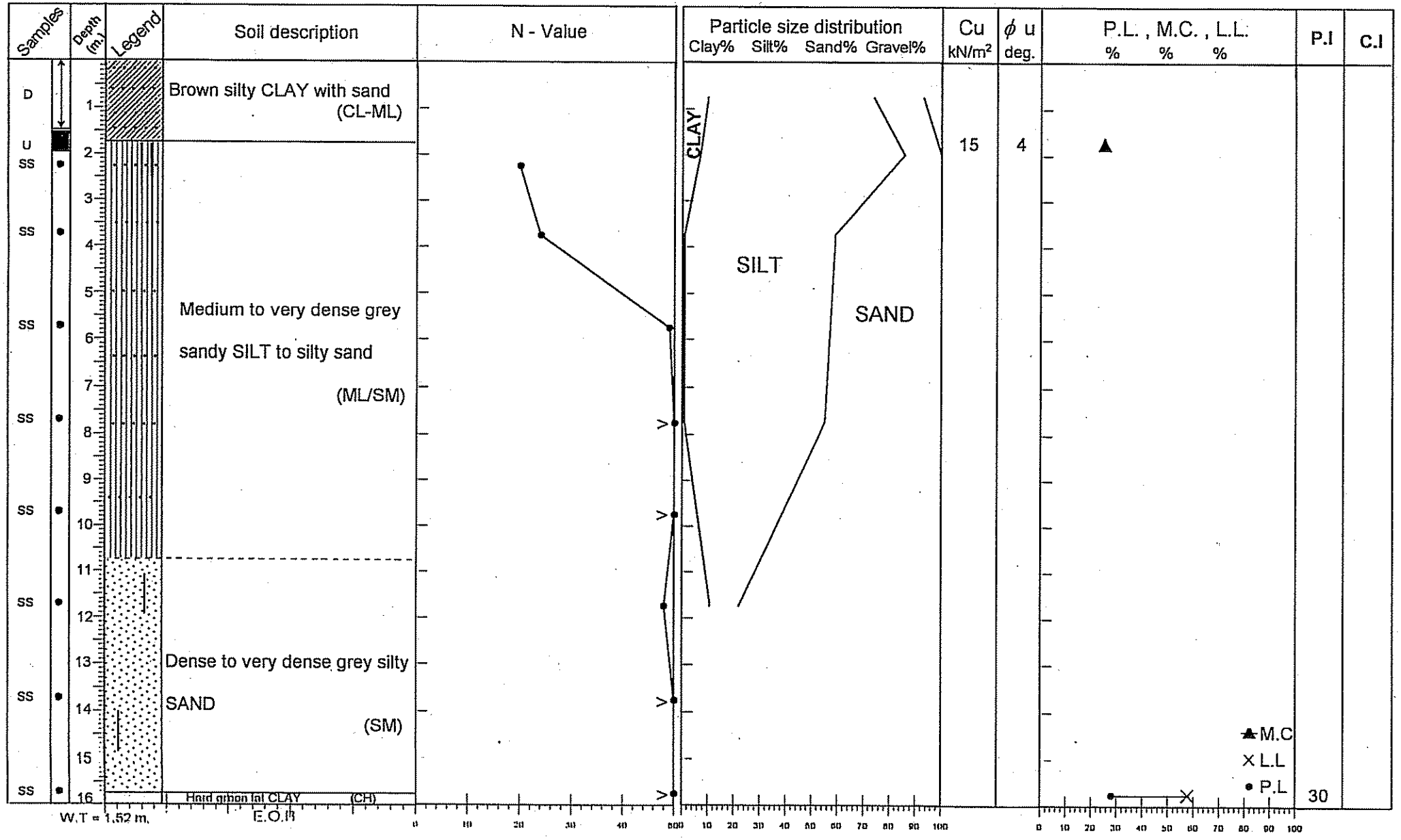
NATIONAL CENTER FOR CONSTRUCTION LABS. & RESEARCH

DIRECTORATE OF SOIL INVESTIGATION

BOREHOLE LOG

Project : Diesel Power Plant At Al-Khashaba / Samawa

B.H. No. : 2



NATIONAL CENTER FOR CONSTRUCTION LABS. & RESEARCH

DIRECTORATE OF SOIL INVESTIGATION

BOREHOLE LOG

Project : Diesel Power Plant At Al-Khashaba / Samawa

B.H. No. : 3

Samples	Depth (m.)	Legend	Soil description	N - Value	Particle size distribution Clay% Silt% Sand% Gravel%	Cu kN/m²	ϕ u deg.	P.L. , M.C. , L.L. % % %	P.I	C.I
D, U, SS	1–2		Very stiff brown lean or fat CLAY (CL,CH)		CLAY	12.0			24	
SS	3–4		Medium brown sandy SILT to silty SAND (ML/SM)		SILT					
SS, SS, SS	5–10		Dense to very dense grey silty SAND (SM)		SAND			M.C, L.L, P.L		
	11–16		E.O.B W.T = 1.55 m.							

N - Value: 0 10 20 30 40 50

Particle size distribution: 0 10 20 30 40 50 60 70 80 90 100

P.L. , M.C. , L.L.: 0 10 20 30 40 50 60 70 80 90 100

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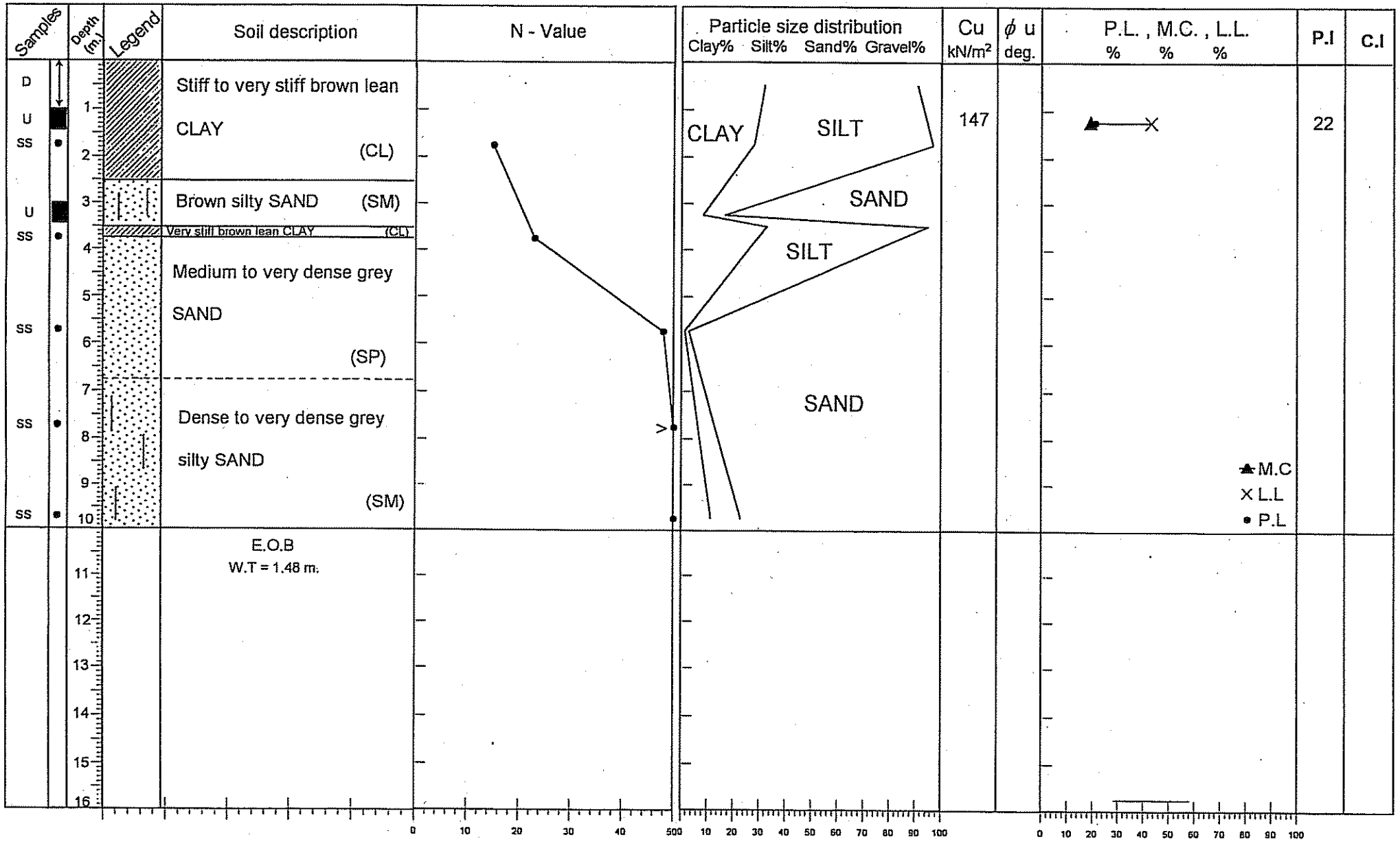
BOREHOLE LOG

Project : Diesel Power Plant At Al-Khashaba / Samawa

B.H. No. : 4



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BOREHOLE LOG

Project : Diesel Power Plant At Al-Khashaba / Samawa

B.H. No. : 5