



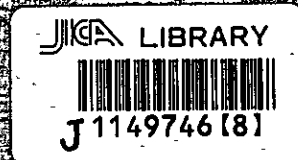
WATER RESOURCES RESEARCH INSTITUTE
NATIONAL WATER RESEARCH CENTER
MINISTRY OF PUBLIC WORKS AND WATER RESOURCES
THE ARAB REPUBLIC OF EGYPT

SOUTH SINAI GROUNDWATER RESOURCES STUDY
IN
THE ARAB REPUBLIC OF EGYPT

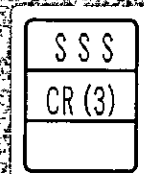
GROUNDWATER RESOURCES MAPS

1. HYDROGEOLOGICAL MAP (SCALE 1/250,000)
2. HYDROGEOLOGICAL MAP (SCALE 1/1,000,000)
3. HYDROGEOLOGICAL MAP (SCALE 1/2,000,000)
4. GROUNDWATER RESOURCES MAP (SCALE 1/500,000)
5. GROUNDWATER RESOURCES MAP (SCALE 1/1,000,000)
6. GROUNDWATER RESOURCES MAP (SCALE 1/2,000,000)

MARCH 1999



JAPAN INTERNATIONAL COOPERATION AGENCY
(JICA)



29°30'

HYDROGEOLOGICAL UNIT

Granular Aquifers

Quaternary

1. Extensive and Highly Productive Aquifers

- Sand Dune Deposits
- Gravel Deposits (El-Qaa Plain)

2. Local and Moderately Productive Aquifers

- Sand Dune Deposits
- Wadi Deposits, Gravel Deposits (El Qaa Plain)

3. Local and Low Productive Aquifers

- Sand Dune Deposits
- Wadi Deposits

Pre-Quaternary

1. Extensive and Moderately to Highly Productive Aquifers

- Lower Cretaceous Maaha Formation

2. Extensive and Low to Moderately Productive Aquifers

- Tertiary Neogene Formations (North Sinai)
- Upper Cretaceous Tarif Sandstone
- Jurassic Upper Jurassic Formation
- Jurassic Safa Formation and Older Formations
- Jurassic Raqabah Formation
- Triassic Qusayb/Arif El Naga Formation
- Triassic Carboniferous Formations
- Triassic Cambrian Formations

Karstified and Fissured Aquifers

1. Extensive and Highly Productive Aquifers

- Upper Cretaceous Wata Formation
- Upper Cretaceous Galalah Formation

2. Local or Discontinuous Productive Aquifers, or Extensive but Only Moderately Productive Aquifers

- Eocene Egma Formation
- Upper Cretaceous Sudr Formation

Insignificant Aquifers

1. Minor Aquifer with Local and Limited Groundwater Resource

- Quaternary Sabkah Deposits
- Quaternary Gravel Deposits
- Tertiary Neogene Formations (South Sinai)
- Tertiary Paleogene Formations
- Upper Cretaceous Duwwi Formation
- Upper Cretaceous Matallah Formation

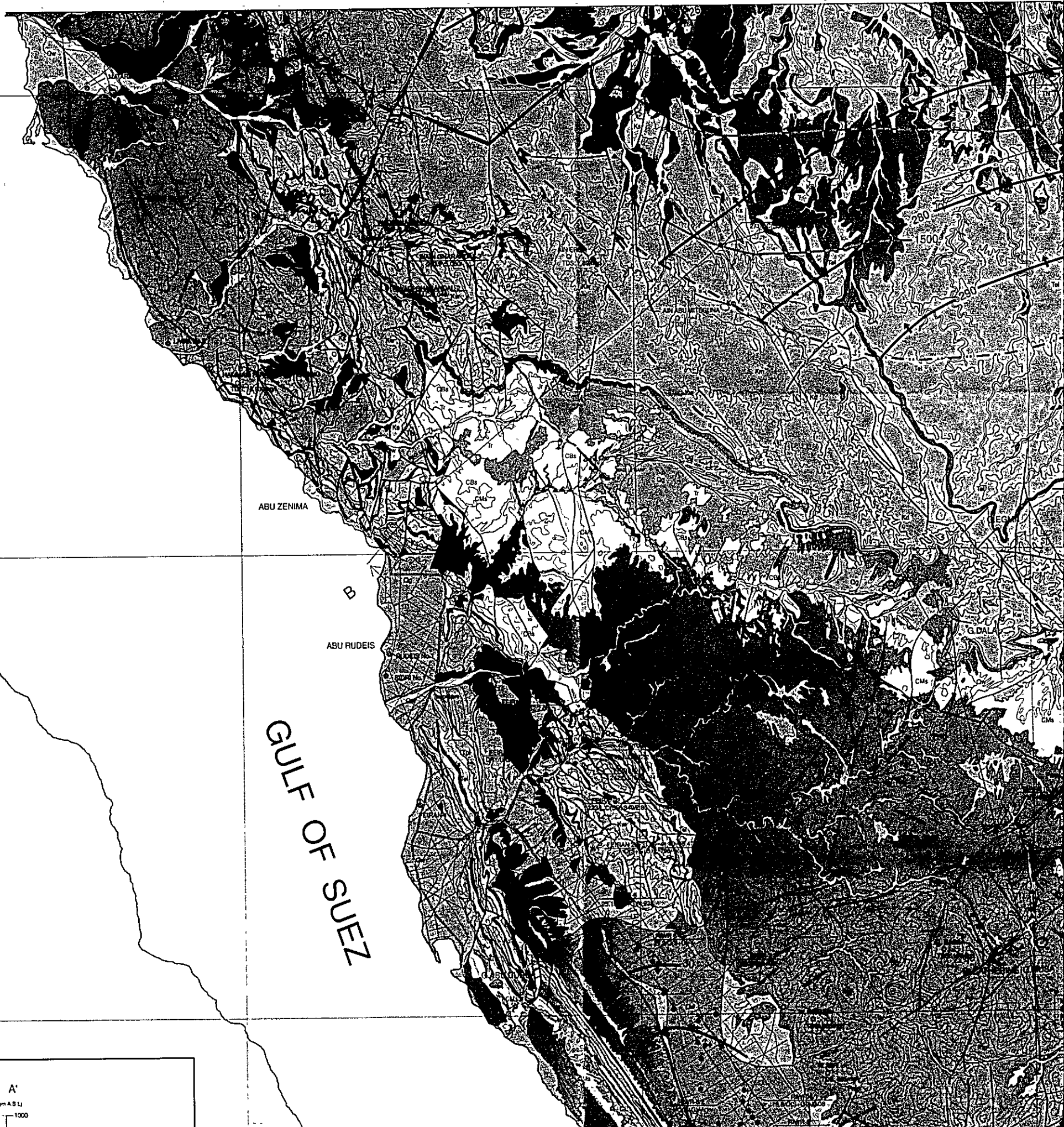
2. Strata with Essentially No Groundwater Resources

- Quaternary Terrace Deposits
- Tertiary Extrusive Basaltic Rocks
- Tertiary Esna Formation
- Upper Cretaceous Basaltic Dyke
- Triassic Dolerite Sills
- Precambrian Felsic or Intermediate Plutonic Rocks
- Precambrian Pyroclastic Rocks
- Precambrian Mafic or Ultramafic Plutonic Rocks
- Precambrian Metamorphosed Igneous Rocks
- Precambrian Gneiss

29°00'

28°30'

32°30'

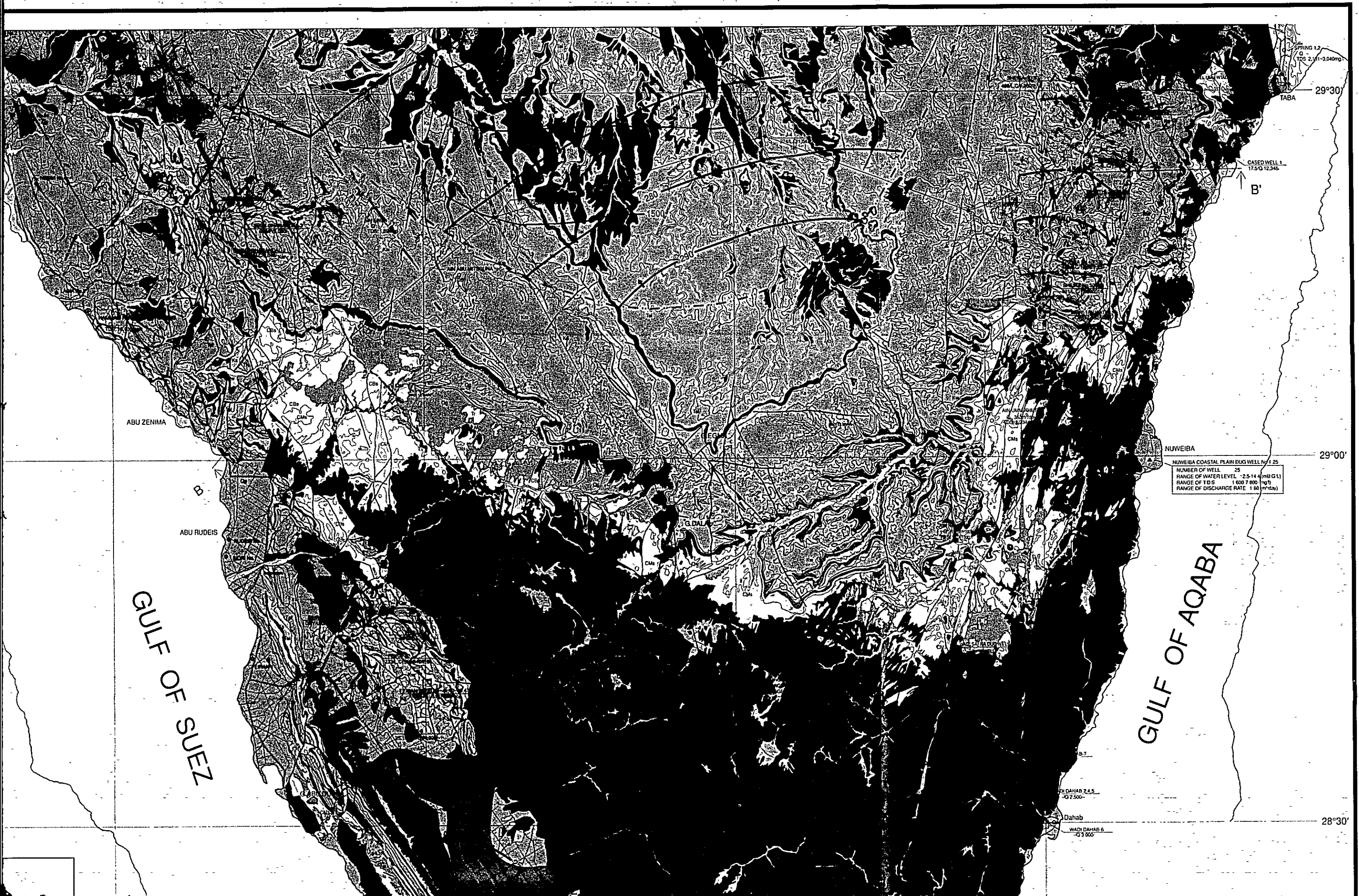


A

1:50,000 Scale

A'

1:50,000 Scale



ABU ZENIMA

ABU RUDEIS

GULF OF SUEZ

GULF OF AQABA

NUWEIBA
NUWEIBA COASTAL PLAIN DUG WELL No. 1 25
NUMBER OF WELLS 25
RANGE OF WATER LEVEL -2.5-14.4 (MB G.L.)
RANGE OF TDS 1 600-7 800 (mg/l)
RANGE OF DISCHARGE RATE 1 80 (m³/day)

CASED WELL 1
17.5 Q 12.346

SPRING 1.2
TDS 2 161-3 040 mg/l

TABA

DAHAB 2 4.5
Q 2 500

Dahab
WADI DAHAB 6
Q 3 000

29°30'

29°00'

28°30'

B'

B

2 Local or Discontinuous Productive Aquifers, or Extensive but Only Moderately Productive Aquifers

- Eocene
- Upper Cretaceous
- Egma Formation
- Sudr Formation

Insignificant Aquifers

1. Minor Aquifer with Local and Limited Groundwater Resource

- Quaternary
- Tertiary
- Upper Cretaceous
- Sabkah Deposits
- Gravel Deposits
- Neogene Formations(South Sinai)
- Paleogene Formations
- Duwn Formation
- Matalah Formation

2. Strata with Essentially No Groundwater Resources

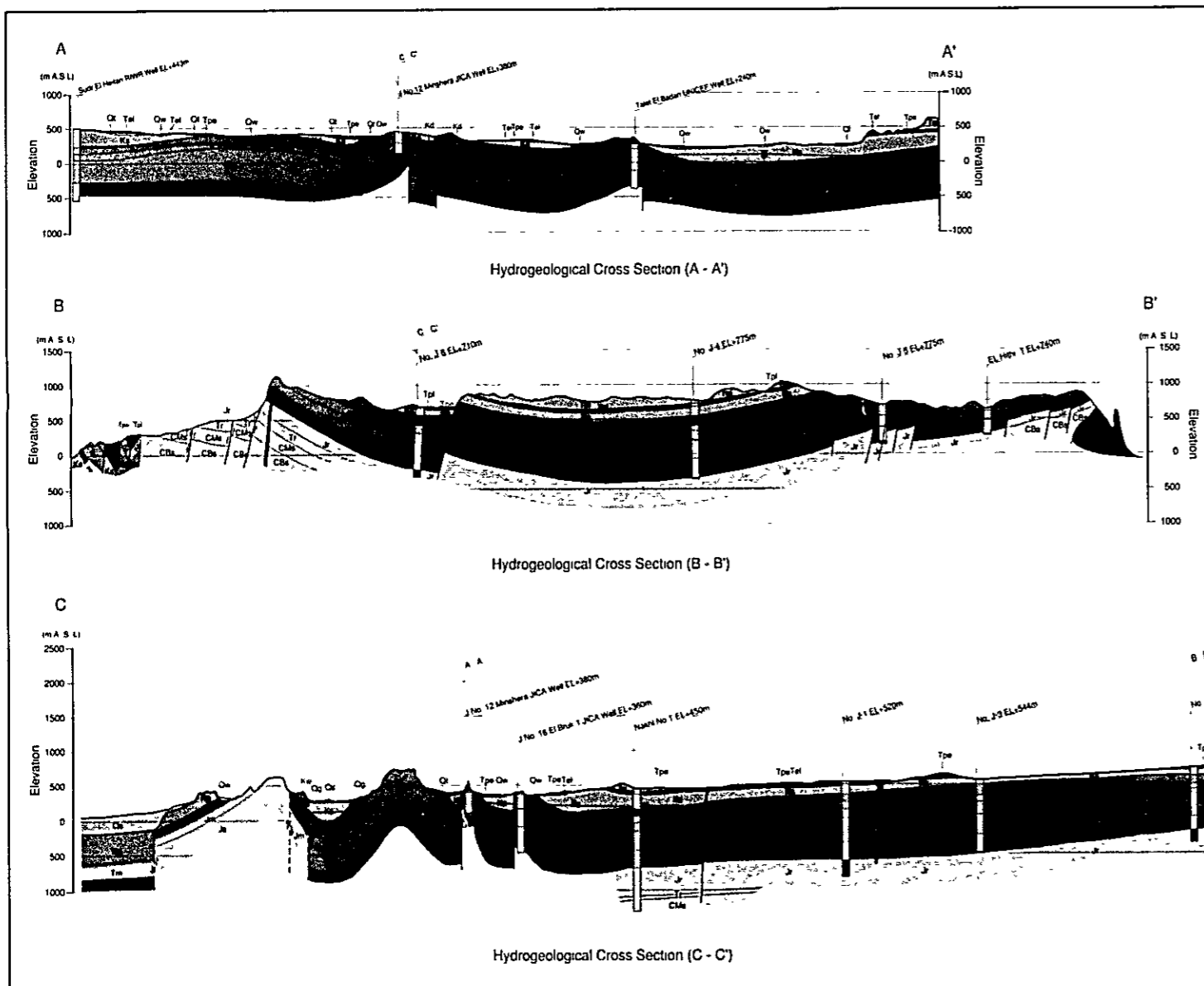
- Quaternary
- Tertiary
- Upper Cretaceous
- Triassic
- Precambrian
- Terrace Deposits
- Extrusive Basaltic Rocks
- Esna Formation
- Basaltic Dyke
- Dolente Sills
- Felsic or Intermediate Plutonic Rocks
- Pyroclastic Rocks
- Mafic or Ultramafic Plutonic Rocks
- Metamorphosed Igneous Rocks
- Gneiss

28°30'

32°30'

GULF OF SUEZ

ABU RUDEIS



EL QAA PLAN DUG WELL No 29 11 22
 NUMBER OF WELL 20
 RANGE OF WATER LEVEL 1.9-18.4 (mB G L)
 RANGE OF TDS 1.250 (mg/l)
 RANGE OF DISCHARGE RATE (m³/day)

EL QAA PLAN DUG WELL No 23 31
 NUMBER OF WELL 9
 RANGE OF WATER LEVEL 1.8-12.5 (mB G L)
 RANGE OF TDS 3.250 (mg/l)
 RANGE OF DISCHARGE RATE (m³/day)

S=1 : 250,000
 0 10 20 30(Km)

RANGE OF WATER LEVEL: 2.5-14.4 (mB.G.L.)
 RANGE OF T.D.S: 1 600-7 800 (mg/l)
 RANGE OF DISCHARGE RATE: 1-60 (m³/day)

GULF OF SUEZ

GULF OF AQABA

ABU RUDEIS

28°30'

EL QAA PLAIN DUG WELL No 2 9 11 22
 NUMBER OF WELL 20
 RANGE OF WATER LEVEL 1.9-18.4 (mB.G.L.)
 RANGE OF T.D.S 1,250 (mg/l)
 RANGE OF DISCHARGE RATE (m³/day)

RWR 2
 7 & Q(S+G)-

HAMAM MUSA
 TDS 9,378mg/l

RWR 1
 0 & Q(S+G)-

EL TUR

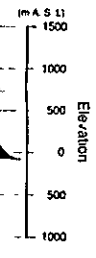
EL QAA PLAIN DUG WELL No 23-31
 NUMBER OF WELL 9
 RANGE OF WATER LEVEL 1.8-12.5 (mB.G.L.)
 RANGE OF T.D.S 3,280 (mg/l)
 RANGE OF DISCHARGE RATE (m³/day)

BI DAHAB 2 4 5
 -Q 2,500-

Dahab

WADI DAHAB-6
 -Q 3,000-

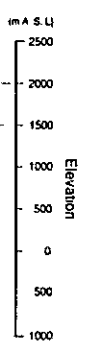
B'



33°00'

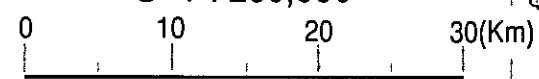
33°30'

C'



28°00'

S=1 : 250,000

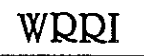


SHARM EL SHEIKH

RAS MOHAMED

34°00'

34°30'

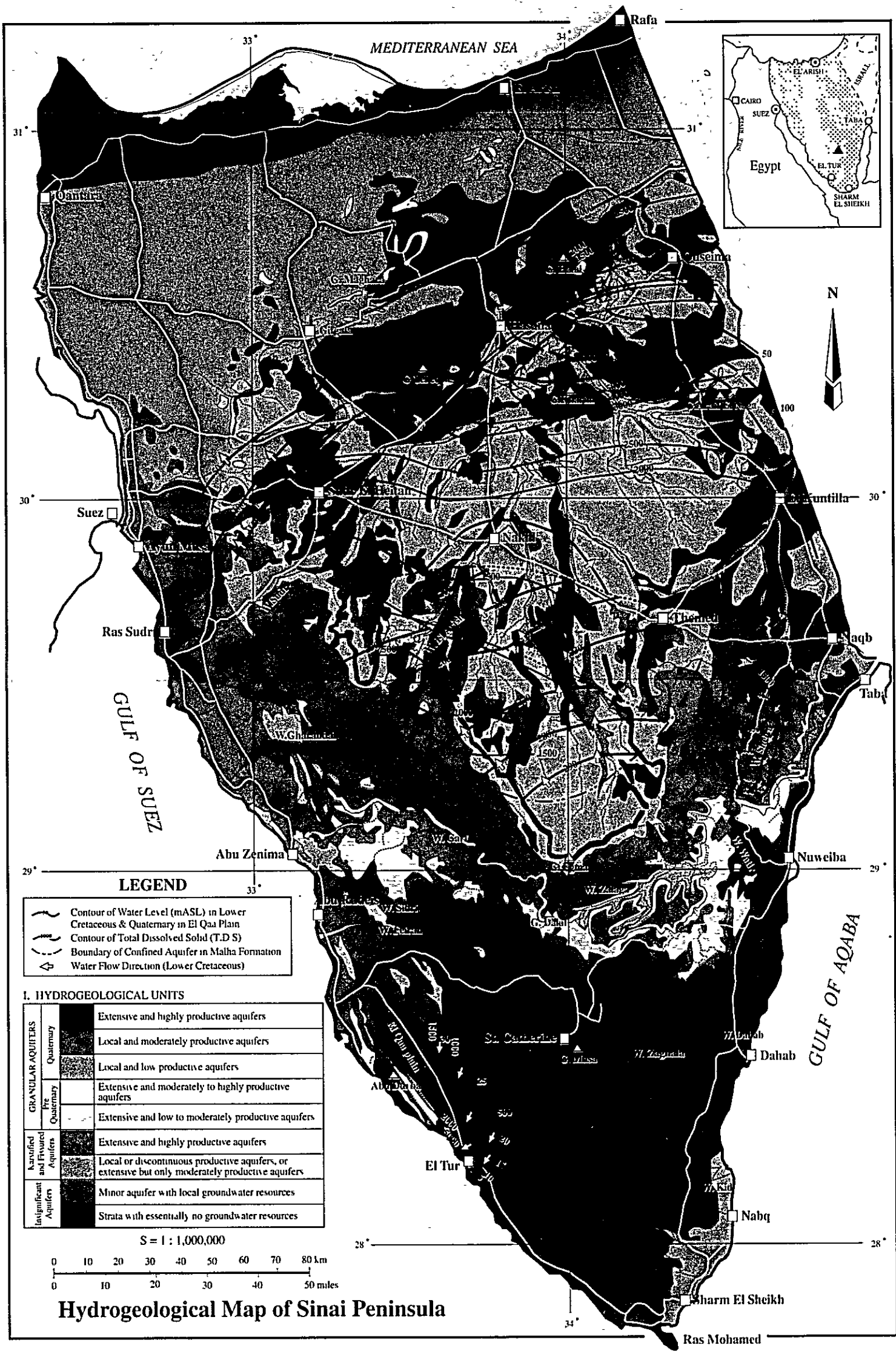


WATER RESOURCES RESEARCH INSTITUTE (WRI)
 NATIONAL WATER RESEARCH CENTER (NWRC)
 MINISTRY OF PUBLIC WORKS AND WATER RESOURCES (MPWWR)
 SOUTH SINAI GROUNDWATER RESOURCES STUDY

IN
 THE ARAB REPUBLIC OF EGYPT
 HYDROGEOLOGICAL MAP
 1/250,000

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

DATE MARCH, 1999



LEGEND

- Contour of Water Level (mASL) in Lower Cretaceous & Quaternary in El Qaa Plain
- Contour of Total Dissolved Solid (T.D.S)
- Boundary of Confined Aquifer in Malha Formation
- Water Flow Direction (Lower Cretaceous)

I. HYDROGEOLOGICAL UNITS

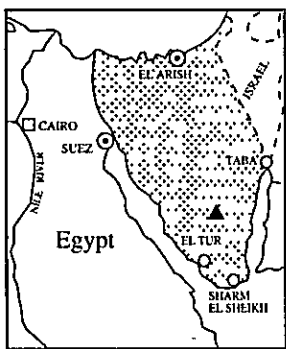
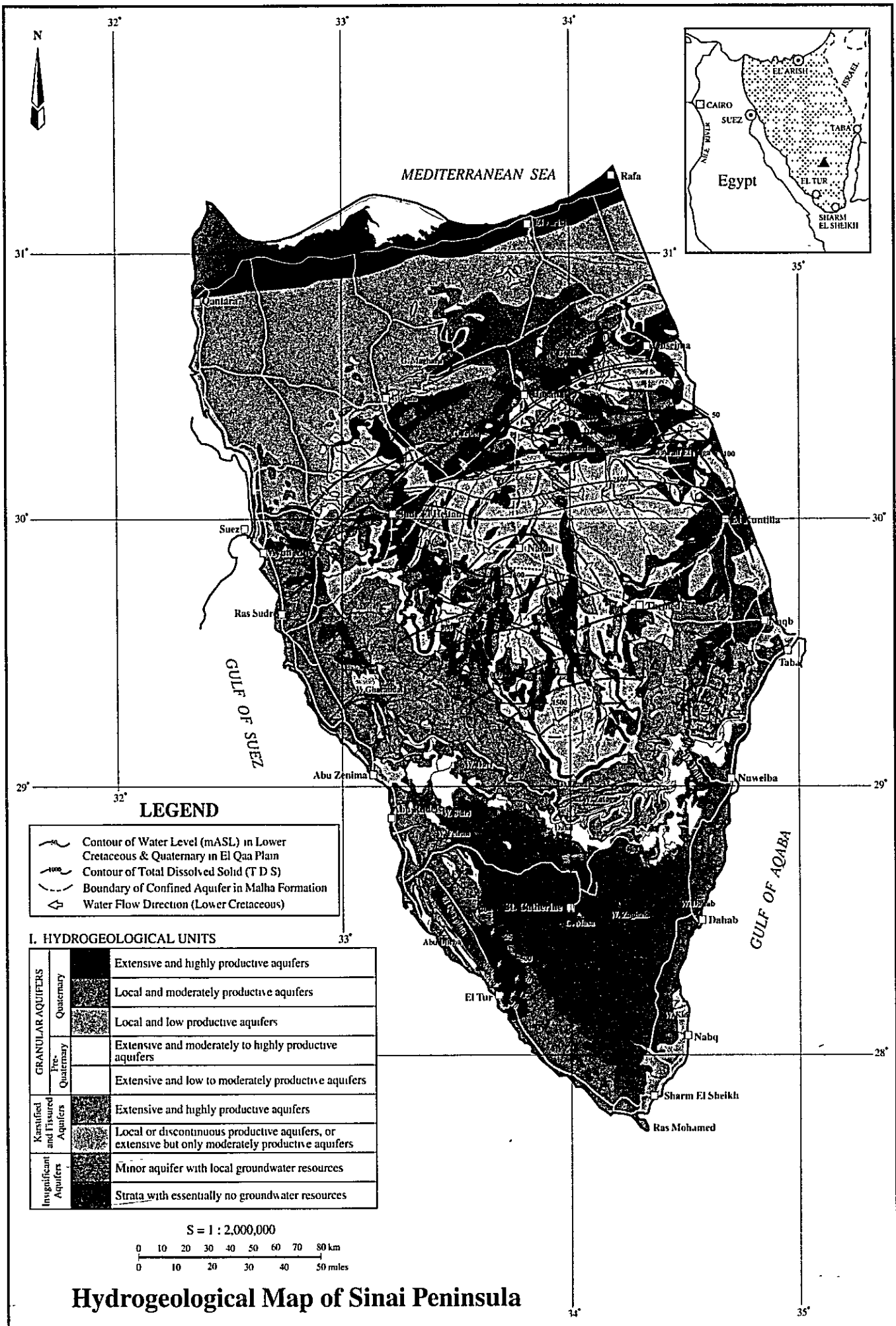
GRANULAR AQUIFERS	Quaternary		Extensive and highly productive aquifers
			Local and moderately productive aquifers
	Pre-Quaternary		Local and low productive aquifers
			Extensive and moderately to highly productive aquifers
Karstified and Fractured Aquifers		Extensive and low to moderately productive aquifers	
		Extensive and highly productive aquifers	
Insignificant Aquifers		Local or discontinuous productive aquifers, or extensive but only moderately productive aquifers	
		Minor aquifer with local groundwater resources	
			Strata with essentially no groundwater resources

S = 1 : 1,000,000

0 10 20 30 40 50 60 70 80 km

0 10 20 30 40 50 miles

Hydrogeological Map of Sinai Peninsula



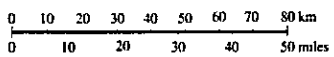
LEGEND

- Contour of Water Level (mASL) in Lower Cretaceous & Quaternary in El Qaa Plan
- Contour of Total Dissolved Solid (T D S)
- Boundary of Confined Aquifer in Malha Formation
- Water Flow Direction (Lower Cretaceous)

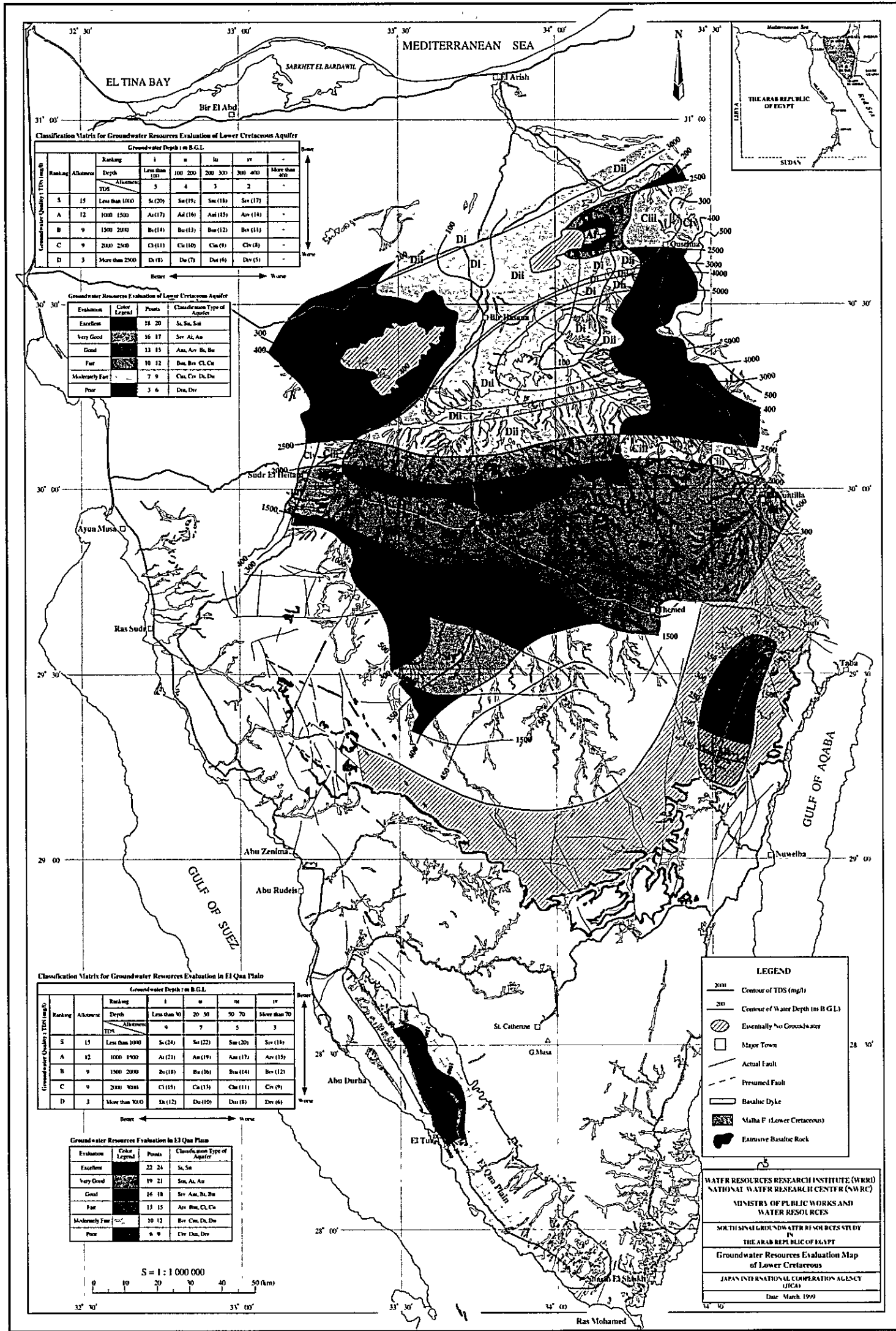
I. HYDROGEOLOGICAL UNITS

GRANULAR AQUIFERS	Quaternary		Extensive and highly productive aquifers
	Pre-Quaternary		Local and moderately productive aquifers
Kansified and fissured Aquifers	Quaternary		Local and low productive aquifers
	Pre-Quaternary		Extensive and moderately to highly productive aquifers
Insignificant Aquifers	Quaternary		Extensive and low to moderately productive aquifers
	Pre-Quaternary		Extensive and highly productive aquifers
Insignificant Aquifers	Quaternary		Local or discontinuous productive aquifers, or extensive but only moderately productive aquifers
	Pre-Quaternary		Minor aquifer with local groundwater resources
Insignificant Aquifers	Quaternary		Strata with essentially no groundwater resources
	Pre-Quaternary		Strata with essentially no groundwater resources

S = 1 : 2,000,000



Hydrogeological Map of Sinai Peninsula



Classification Matrix for Groundwater Resources Evaluation of Lower Cretaceous Aquifer

Ranking	Alternative	Groundwater Depth (m B.G.L.)				
		Less than 100	100-200	200-300	300-400	More than 400
S	15	1	2	3	4	5
A	12	6	7	8	9	10
B	9	11	12	13	14	15
C	6	16	17	18	19	20
D	3	21	22	23	24	25

Groundwater Resources Evaluation of Lower Cretaceous Aquifer

Evaluation	Color Legend	Points	Classification Type of Aquifer
Excellent	(Dark Green)	15-20	Sa, Sb, Sc
Very Good	(Medium Green)	16-17	Se, Aa, Ab
Good	(Light Green)	13-15	Ac, Ad, Ae, Bb, Bc
Fair	(Yellow-Green)	10-12	Bd, Be, Cc, Cd
Moderately Fair	(Yellow)	7-9	Ca, Cb, Cc, Dd
Poor	(Orange)	3-6	Da, Db

Classification Matrix for Groundwater Resources Evaluation in El Qaa Plain

Ranking	Alternative	Groundwater Depth (m B.G.L.)			
		Less than 10	10-20	20-30	More than 30
S	15	1	2	3	4
A	12	5	6	7	8
B	9	11	12	13	14
C	6	16	17	18	19
D	3	21	22	23	24

Groundwater Resources Evaluation in El Qaa Plain

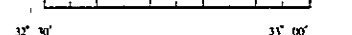
Evaluation	Color Legend	Points	Classification Type of Aquifer
Excellent	(Dark Green)	22-24	Sa, Sb
Very Good	(Medium Green)	19-21	Sc, Aa, Ab
Good	(Light Green)	16-18	Ac, Ad, Ae, Bb, Bc
Fair	(Yellow-Green)	13-15	Bd, Be, Cc, Cd
Moderately Fair	(Yellow)	10-12	Ca, Cb, Cc, Dd
Poor	(Orange)	6-9	Da, Db, Dc

LEGEND

- 200 Contour of TDS (mg/l)
- 200 Contour of Water Depth (m B.G.L.)
- Essentially No Groundwater
- Major Town
- Actual Fault
- Presumed Fault
- Basaltic Dyke
- Maha F (Lower Cretaceous)
- Emissive Basaltic Rock

WATER RESOURCES RESEARCH INSTITUTE (WRRI)
 NATIONAL WATER RESEARCH CENTER (NWRC)
 MINISTRY OF PUBLIC WORKS AND WATER RESOURCES
 SOUTH-SINAI GROUNDWATER RESOURCES STUDY IN THE ARAB REPUBLIC OF EGYPT
 Groundwater Resources Evaluation Map of Lower Cretaceous
 JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
 Date: March 1999

S = 1 : 1 000 000



32°30'

33°00'

33°30'

34°00'

MEDITERRANEAN SEA

J NO 6 EL SHEIKH ZUWAYED
4 9 0 4 8 3 0 1 9 4

J NO 3 EL TAWH
3 0 0 5 5 6 2 5 1 5

EL TINA BAY

SABKHET EL BARDAWIL

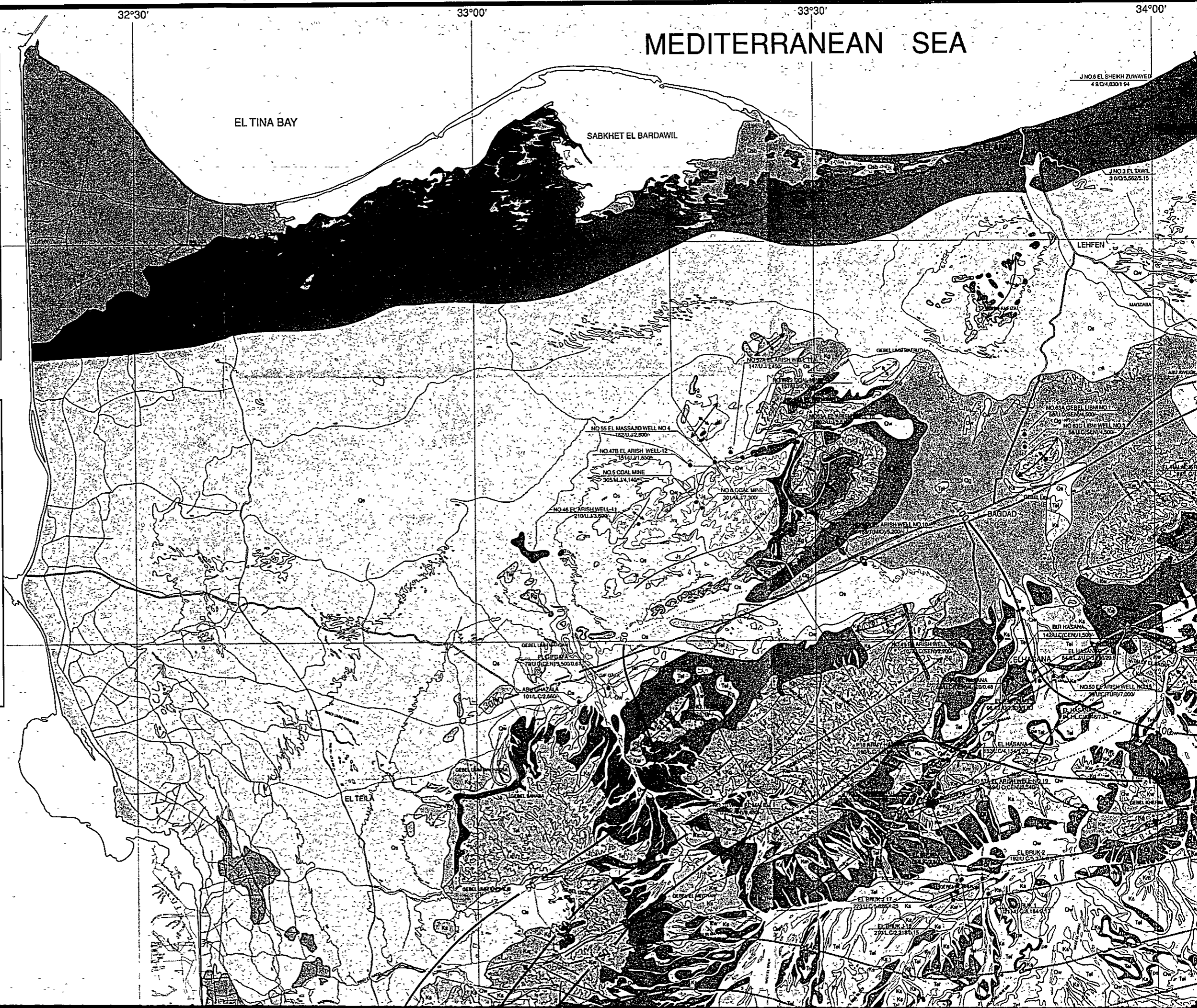
LEHFEN

MAGDABA

BAGDAD

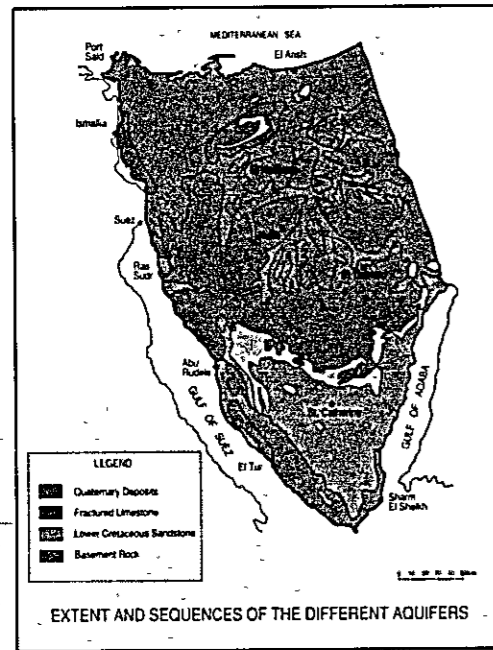
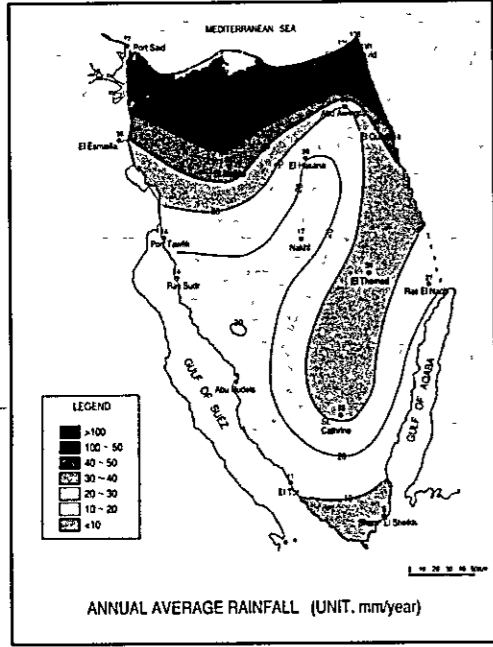
EL TERA

EL BIRUK 2



31°00'

30°30'



LEGEND

33°00'

33°30'

34°00'

34°30'

MEDITERRANEAN SEA

SABKHET EL BARDAWIL

J NO 6 EL SHEKH ZUNAYED
4 93 4.8301 94

J NO 9 EL MASSORA
0 77 (M) 93 4 71 0 68

J NO 3 EL TAVIL
3 0 0 5 560 5 15

NO 1 MISRA
7 0 7 (M) 0 10 4 50

NO 10 BATHI
1 0 4 0 2 2 3 3 4

EL AUGA
N U C 13 6 4 4 0 0 6

NO 16 EL AMRO
1 7 5 1 0 0 0 0 0 0 0 0

NO 76A WADI EL AMRO NO 2
1 6 9 7 (E) 0 0 5 0 0 0 0

NO 55 EL MASSARA WEL NO 4
1 6 2 1 0 0 0 0 0 0

NO 47B EL ARISH WEL NO 12
3 0 1 4 1 1 5 0 0 0

NO 5 COAL MINE
3 0 5 1 4 1 1 4 0 0

NO 46 EL ARISH WEL NO 11
2 1 6 0 1 5 3 0 0 0

NO 3 COAL MINE
3 0 1 4 1 1 5 0 0 0

NO 10A GEBEL LIME NO.
1 6 2 1 0 0 0 0 0 0

NO 10B GEBEL LIME NO.
1 6 2 1 0 0 0 0 0 0

NO 10C GEBEL LIME NO.
1 6 2 1 0 0 0 0 0 0

NO 10D GEBEL LIME NO.
1 6 2 1 0 0 0 0 0 0

NO 10E GEBEL LIME NO.
1 6 2 1 0 0 0 0 0 0

NO 10F GEBEL LIME NO.
1 6 2 1 0 0 0 0 0 0

NO 10G GEBEL LIME NO.
1 6 2 1 0 0 0 0 0 0

NO 10H GEBEL LIME NO.
1 6 2 1 0 0 0 0 0 0

NO 10I GEBEL LIME NO.
1 6 2 1 0 0 0 0 0 0

NO 10J GEBEL LIME NO.
1 6 2 1 0 0 0 0 0 0

NO 10K GEBEL LIME NO.
1 6 2 1 0 0 0 0 0 0

NO 10L GEBEL LIME NO.
1 6 2 1 0 0 0 0 0 0

NO 10M GEBEL LIME NO.
1 6 2 1 0 0 0 0 0 0

NO 10N GEBEL LIME NO.
1 6 2 1 0 0 0 0 0 0

NO 10O GEBEL LIME NO.
1 6 2 1 0 0 0 0 0 0

NO 10P GEBEL LIME NO.
1 6 2 1 0 0 0 0 0 0

NO 10Q GEBEL LIME NO.
1 6 2 1 0 0 0 0 0 0

NO 10R GEBEL LIME NO.
1 6 2 1 0 0 0 0 0 0

NO 10S GEBEL LIME NO.
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NO 10U GEBEL LIME NO.
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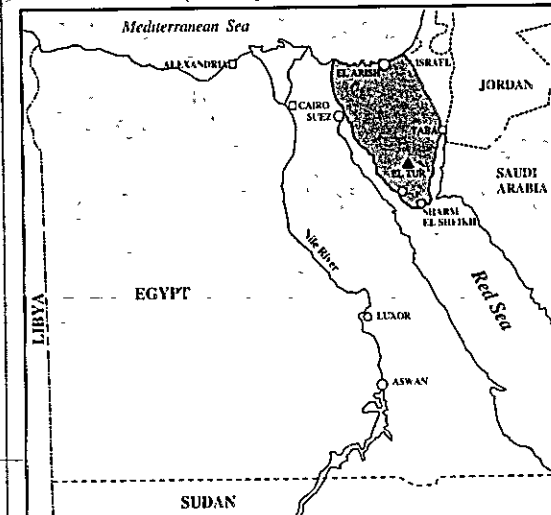
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1 6 2 1 0 0 0 0 0 0

NO 10W GEBEL LIME NO.
1 6 2 1 0 0 0 0 0 0

NO 10X GEBEL LIME NO.
1 6 2 1 0 0 0 0 0 0

NO 10Y GEBEL LIME NO.
1 6 2 1 0 0 0 0 0 0

NO 10Z GEBEL LIME NO.
1 6 2 1 0 0 0 0 0 0



31°00'

30°30'

5000

4000

3000

2500

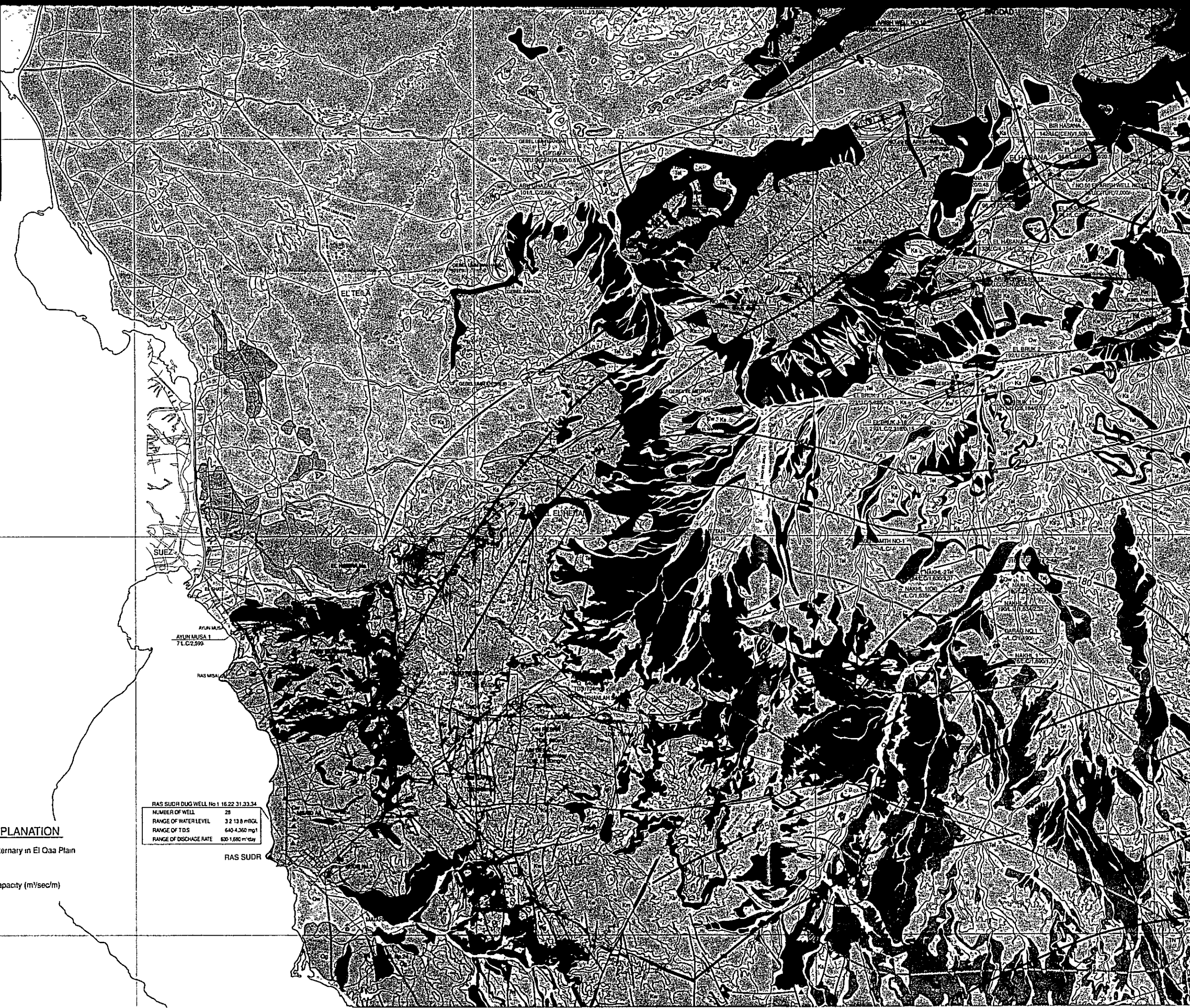
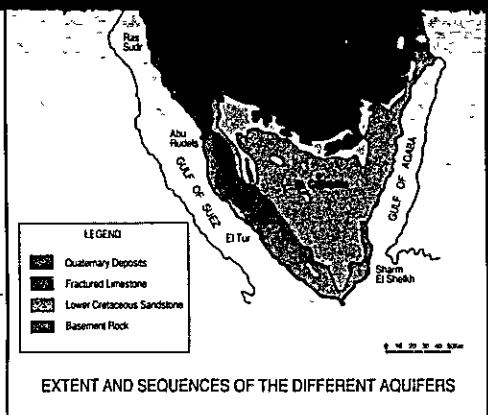
2000

1500

1000

500

0



LEGEND

WATER POINT SYMBOLS

- Cased Well
- Group of Cased Wells
- Oil Exploratory Well or Other Cased Well
- + Piezometer
- ▲ Dug Well
- ▲ Group of Dug Wells
- Spring
- ⊙ Thermal Spring

GEOLOGICAL SYMBOLS

- Geological Boundary
- Normal Fault with Visible Dip
- Actual Fault
- Inferred Fault
- Concealed Fault
- Strike and Dip of Sedimentary Beds
- Anticlinal Axis, Showing Direction of Plunge
- Synclinal Axis
- Geological Cross-Section

HYDRO GEOLOGICAL SYMBOLS AND EXPLANATION

- 200 Contour of Water Level (m ASL) in Lower Cretaceous & Quaternary in El Qaa Plain
- Water Flow Direction
- Well Name
- Water Level (m ASL) / Age of Aquifer / TDS (mg/l) / Specific Capacity (m³/sec/m)
- 1500 Contour of Total Dissolved Solid (TDS)
- Boundary of Confined Aquifer in Malha Formation

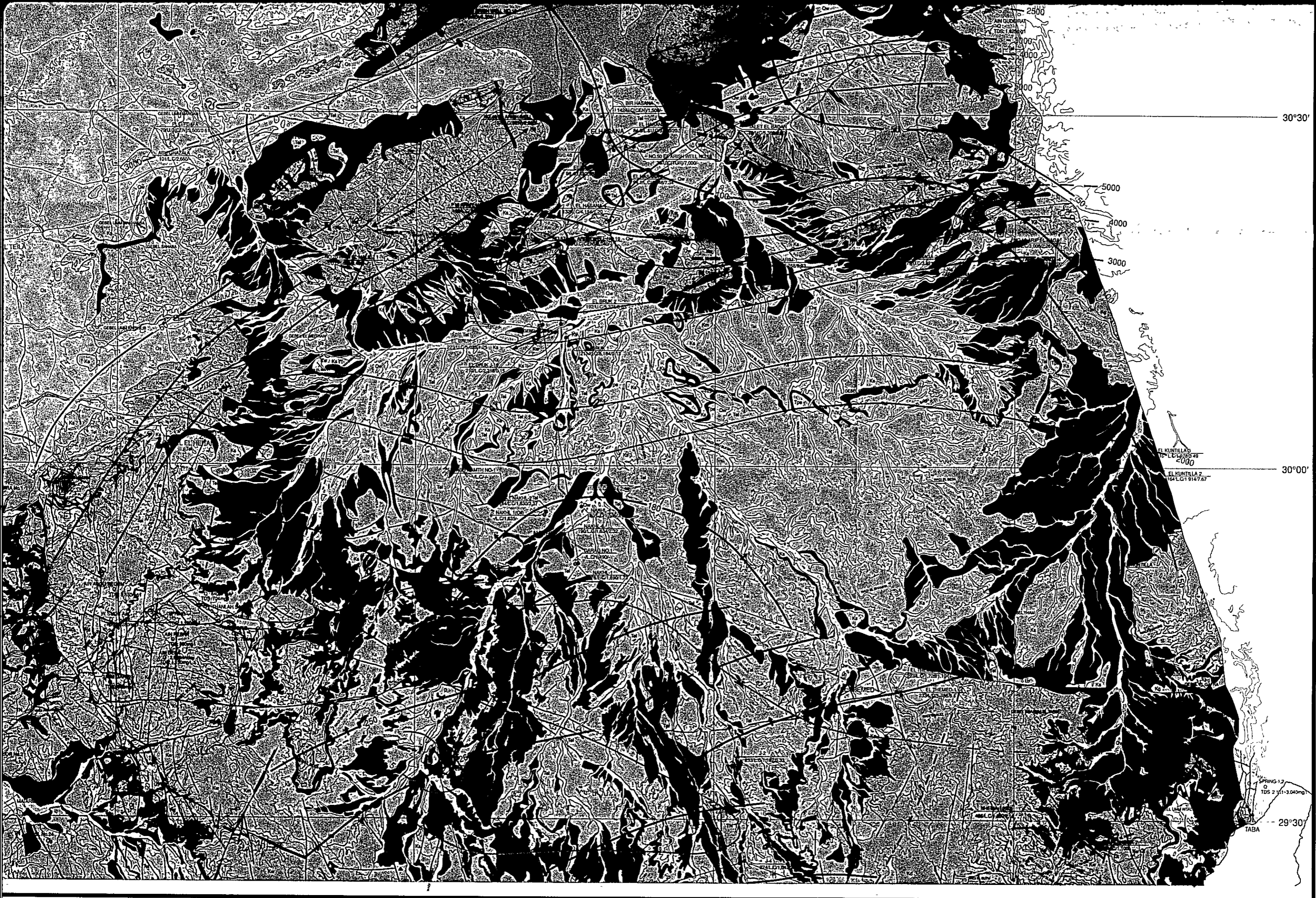
RAS SUDDR DUG WELL No 1 16.22 31.33.34
NUMBER OF WELL 29
RANGE OF WATER LEVEL 32 13.8 mBGL
RANGE OF TDS 640 4.360 mg/l
RANGE OF DISCHARGE RATE 600 1.680 m ³ /day

RAS SUDDR

30°30'

30°00'

29°30'



30°30'

30°00'

29°30'

2500

2000

1500

5000

4000

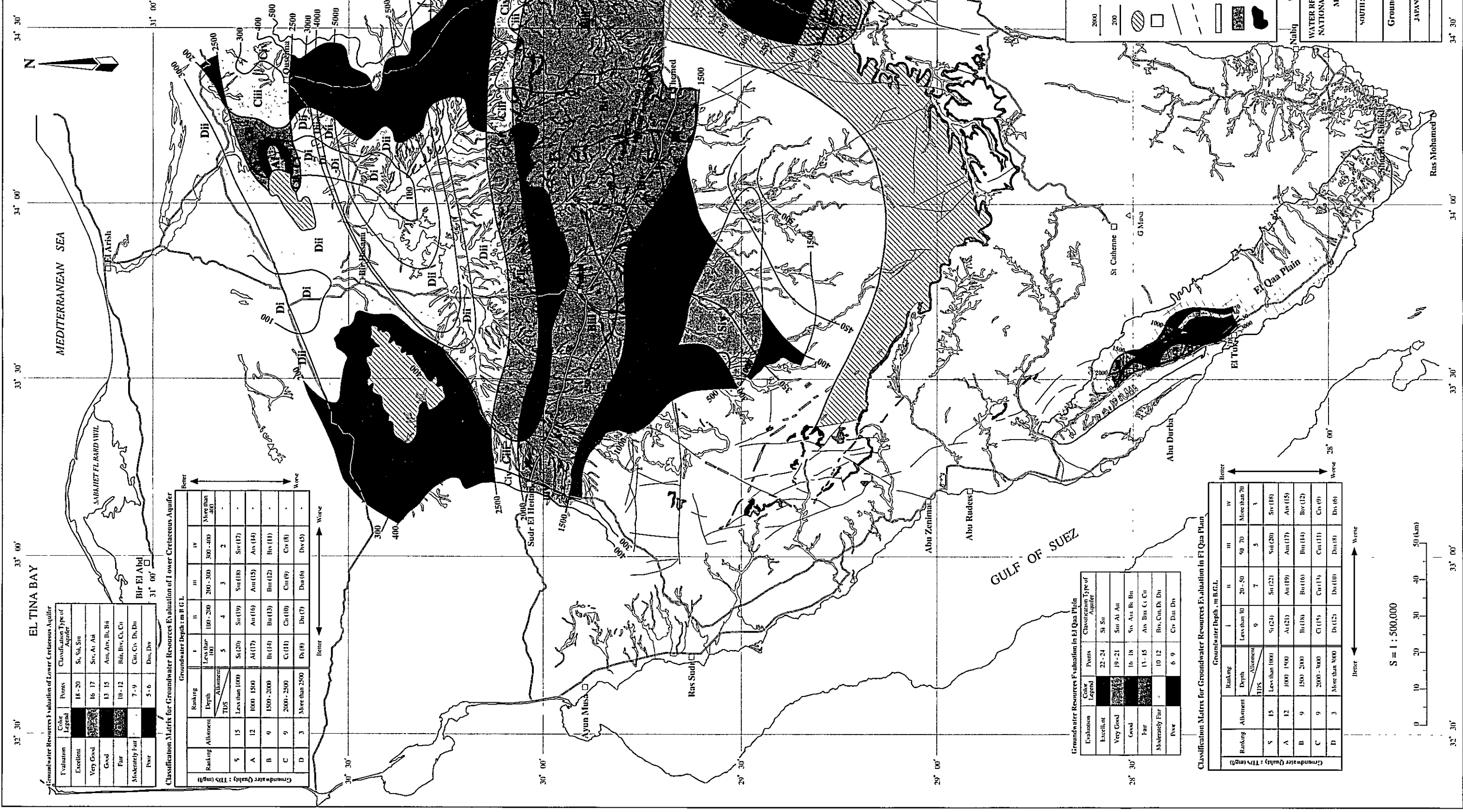
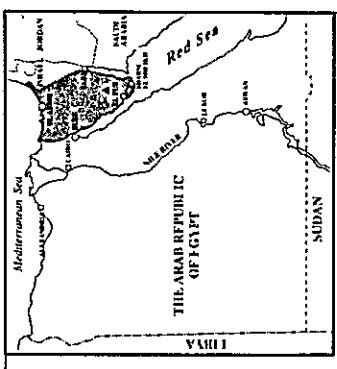
3000

EL KUNTILLAS
TDS 1,675.49
2000

EL KUNTILLA 2
TDS 1,914.75

SPRING-12
TDS 2,111-3,040 mg

TABA



EL TINA BAY

Groundwater Resources Evaluation of Lower Cretaceous Aquifer

Evaluation	Color Legend	Points	Classification Type of Aquifer
Excellent	(Dark Green)	18-20	S ₁ , S ₂ , S ₃
Very Good	(Light Green)	16-17	S _{1v} , A ₁ , A ₂
Good	(Yellow-Green)	13-15	A _{1v} , A _{2v} , B ₁ , B ₂
Fair	(Yellow)	10-12	B _{1v} , B _{2v} , C ₁ , C ₂
Moderately Fair	(Orange)	7-9	C _{1v} , C _{2v} , D ₁ , D ₂
Poor	(Red)	5-6	D _{1v} , D _{2v}

Classification Matrix for Groundwater Resources Evaluation of Lower Cretaceous Aquifer

Ranking Allotment	Ranking	Groundwater Depth, m B.G.L.			
		i	ii	iii	iv
S	15	Less than 100	101-200	201-300	301-400
		5	4	3	2
A	12	Less than 1000	S ₁ (20)	S _{1v} (18)	S _{1v} (17)
		1000-1500	A ₁ (17)	A _{1v} (15)	A _{1v} (14)
B	9	1500-2000	B ₁ (14)	B _{1v} (12)	B _{1v} (11)
		2000-2500	C ₁ (11)	C _{1v} (9)	C _{1v} (8)
D	3	More than 2500	D ₁ (9)	D _{1v} (7)	D _{1v} (6)

Groundwater Resources Evaluation in El Qaa Plain

Evaluation	Color Legend	Points	Classification Type of Aquifer
Excellent	(Dark Green)	22-24	S ₁ , S ₂
Very Good	(Light Green)	19-21	S _{1v} , A ₁ , A ₂
Good	(Yellow-Green)	16-18	S _{1v} , A _{1v} , B ₁ , B ₂
Fair	(Yellow)	13-15	A _{1v} , B _{1v} , C ₁ , C ₂
Moderately Fair	(Orange)	10-12	B _{1v} , C _{1v} , D ₁ , D ₂
Poor	(Red)	6-9	C _{1v} , D _{1v} , D ₂

Classification Matrix for Groundwater Resources Evaluation in El Qaa Plain

Ranking Allotment	Ranking	Groundwater Depth, m B.G.L.			
		i	ii	iii	iv
S	15	Less than 10	20-50	50-70	More than 70
		9	7	5	3
A	12	Less than 1000	S ₁ (24)	S _{1v} (20)	S _{1v} (18)
		1000-1500	A ₁ (21)	A _{1v} (19)	A _{1v} (15)
B	9	1500-2000	B ₁ (18)	B _{1v} (14)	B _{1v} (12)
		2000-2500	C ₁ (15)	C _{1v} (13)	C _{1v} (9)
D	3	More than 2500	D ₁ (12)	D _{1v} (8)	D _{1v} (6)

LEGEND

- 2000 Contour of TDS (mg/l)
- 200 Contour of Water Depth (m B.G.L)
- Essentially No Groundwater
- Major Town
- Actual Fault
- Presumed Fault
- Basaltic Dyke
- Albina F. (Lower Cretaceous)
- Extrusive Basaltic Rock

WATER RESOURCES RESEARCH INSTITUTE (WRRI)
 NATIONAL WATER RESEARCH CENTER (NWRC)
 MINISTRY OF PUBLIC WORKS AND WATER RESOURCES
 SOUTHERN GROUNDWATER RESOURCES STUDY IN THE ARAB REPUBLIC OF EGYPT
 Groundwater Resources Evaluation Map of Lower Cretaceous
 JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
 Date: March 1999

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