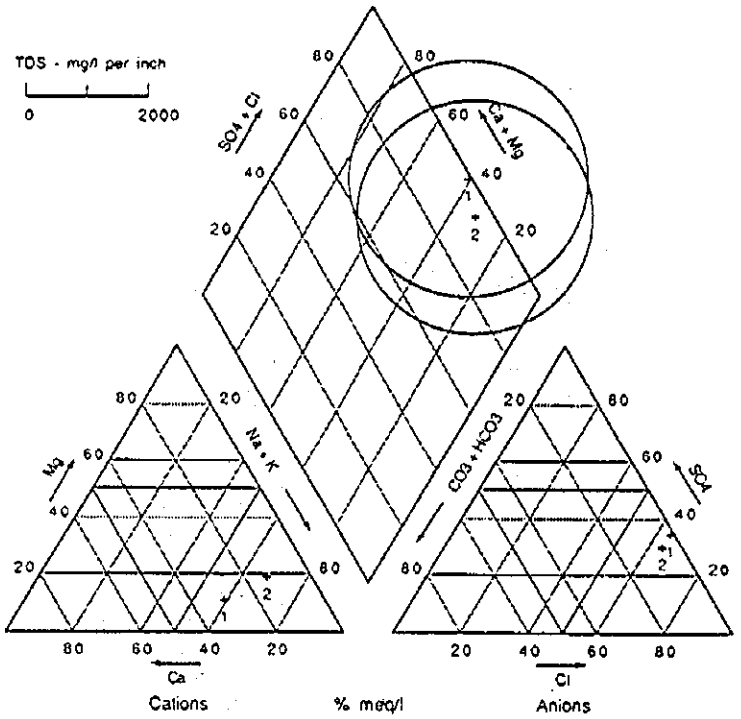

35AB-003

No.	TDS	Sample	No.	TDS	Sample
1	3955	Feb-95			
2	3894	Dec-95			

Fig. 8.2.7-5 Piper Diagram (Spring No. 35AB-003: W. Sudr)

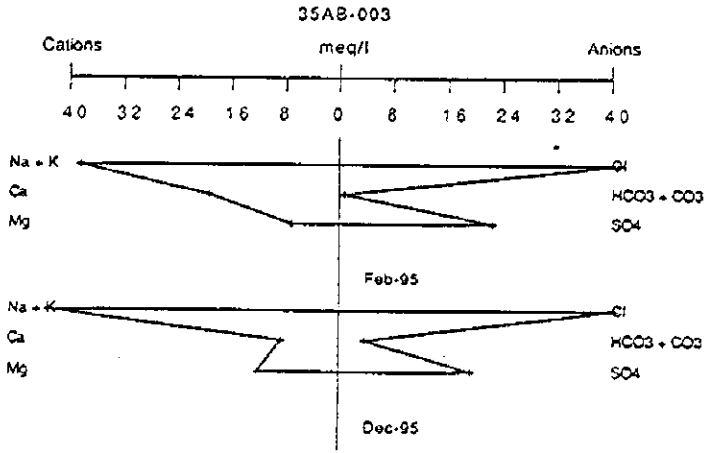

Fig. 8.2.7-6 Stiff Diagram (Spring No. 35AB-003: W. Sudr)

8.2.8 Taba Area

1) General Feature of Basin

Wadi Taba is a small wadi in the easternmost of Sinai, which originates in the border area with Israel and occupies 30 km^2. The area is surrounded by dissected Precambrian Rocks and Upper Cretaceous Formations. A few spring are occurred from the Precambrian Rocks.

2) Well Inventory

There are two (2) springs and three (3) cased wells. As mentioned above, springs are occurred in the Precambrian Rocks. Cased wells were drilled by WRRI in the wadi deposits. Inventory of water sources is summarized in Table 8.1.1-1 (8) and each location is shown in Fig. 8.2.8-1.

Apart from the Wadi Taba, one (1) well was drilled by a private company in the small wadi about 20 km south of Taba.

3) Configuration of Aquifer

There are no suitable aquifer to extract groundwater because of high salinity. The area is so small that recharge to aquifer is insufficient. Therefore, aquifer in the area is affected by saline water from the sea.

4) Groundwater Level

Two (2) data are available. Static water level is 24.5 mBGL at Well No. 1 (Sr. No. 4) in the Wadi Taba and that of another well (out of the wadi) is 32.43 mBGL.

However, all the capped wells are closed by stone at present, therefore, groundwater level cannot be measured during the survey.

5) Groundwater Quality

TDS value is from 2,131 to 3,040 mg/l for springs (See, Fig. 8.2.8-2). Cased wells show more high salinity more than 12,000 mg/l.

6) Hydrogeological Characteristics of Basin

The catchment area is generally underlain by Precambrian Rocks which is overlain by Upper Cretaceous formations. They are dissected to small blocks by faults.

Groundwater springs out from the fissures in the rocks. Spring 2 (Sr. No. 2) was covered by sand and gravel deposits derived by a flood occurred in January 1997.

Although thick Quaternary Deposit was distributed in the wadi, those cannot be aquifers.

7) Groundwater Extraction

Spring water was once used for domestic purpose. However, no groundwater is in use.

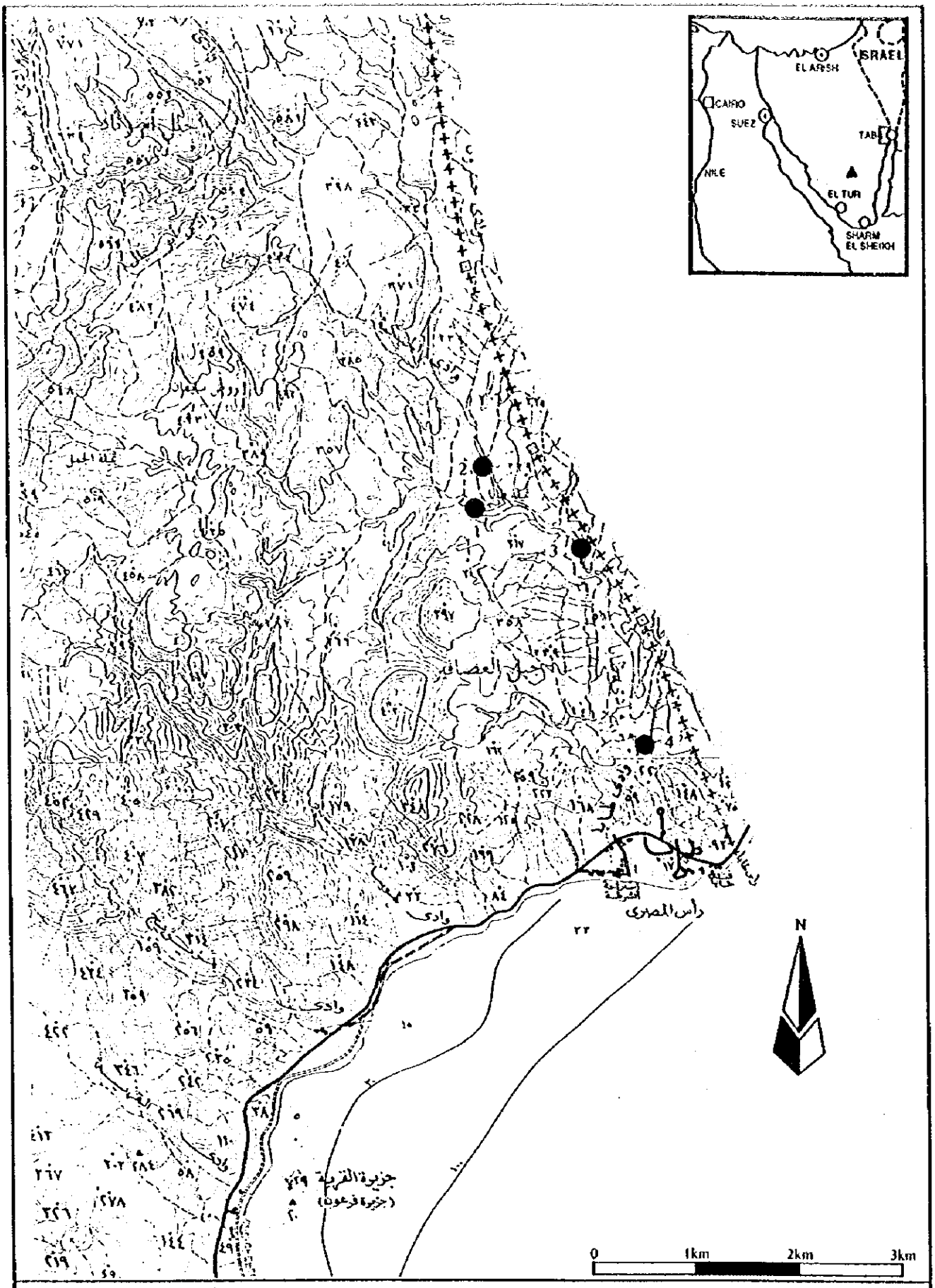

Fig. 8.2.8-1 (1) Well Location (Taba Area)

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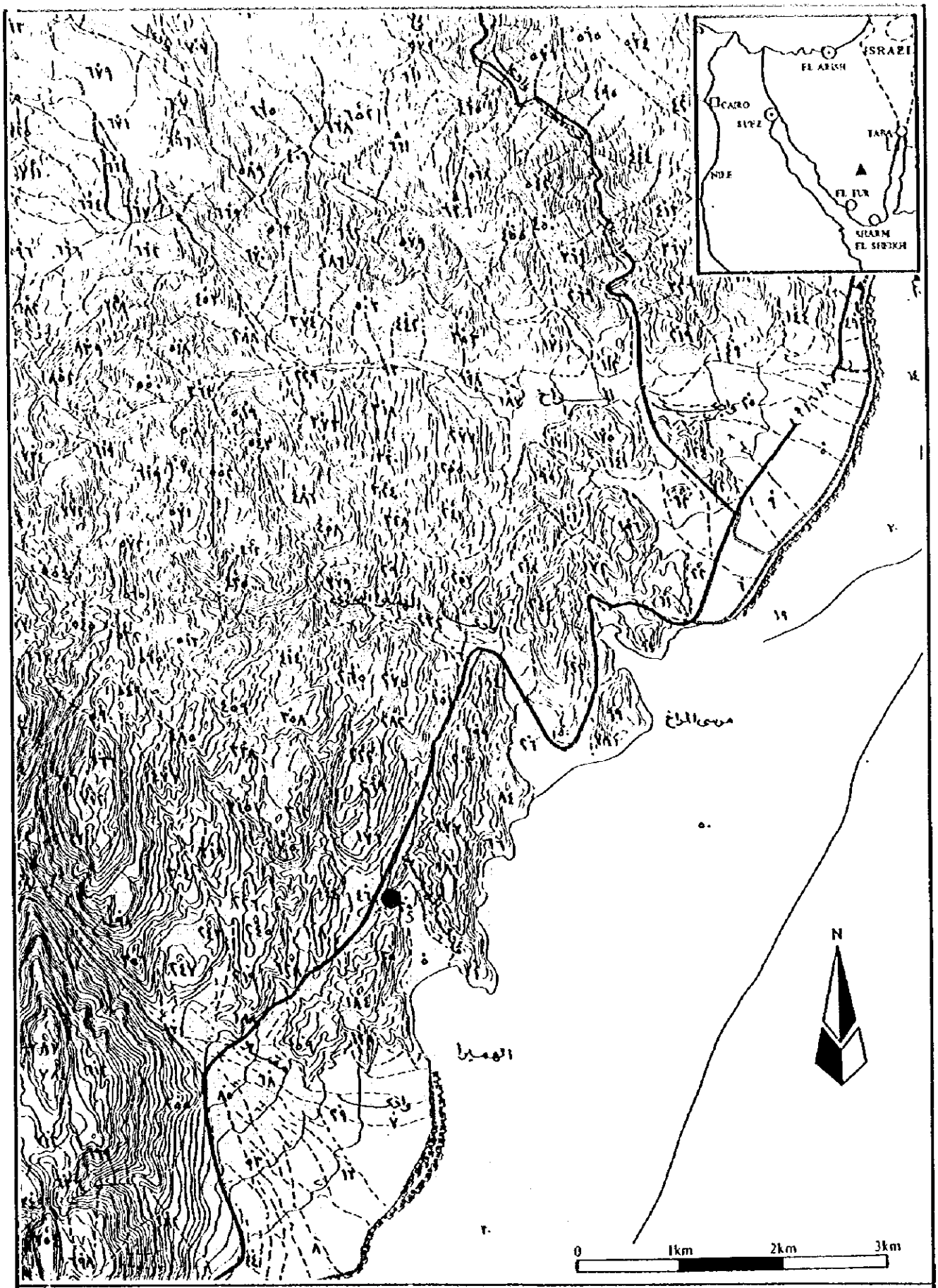

Fig. 8.2.8-1 (2) Well Location (Taba Area)

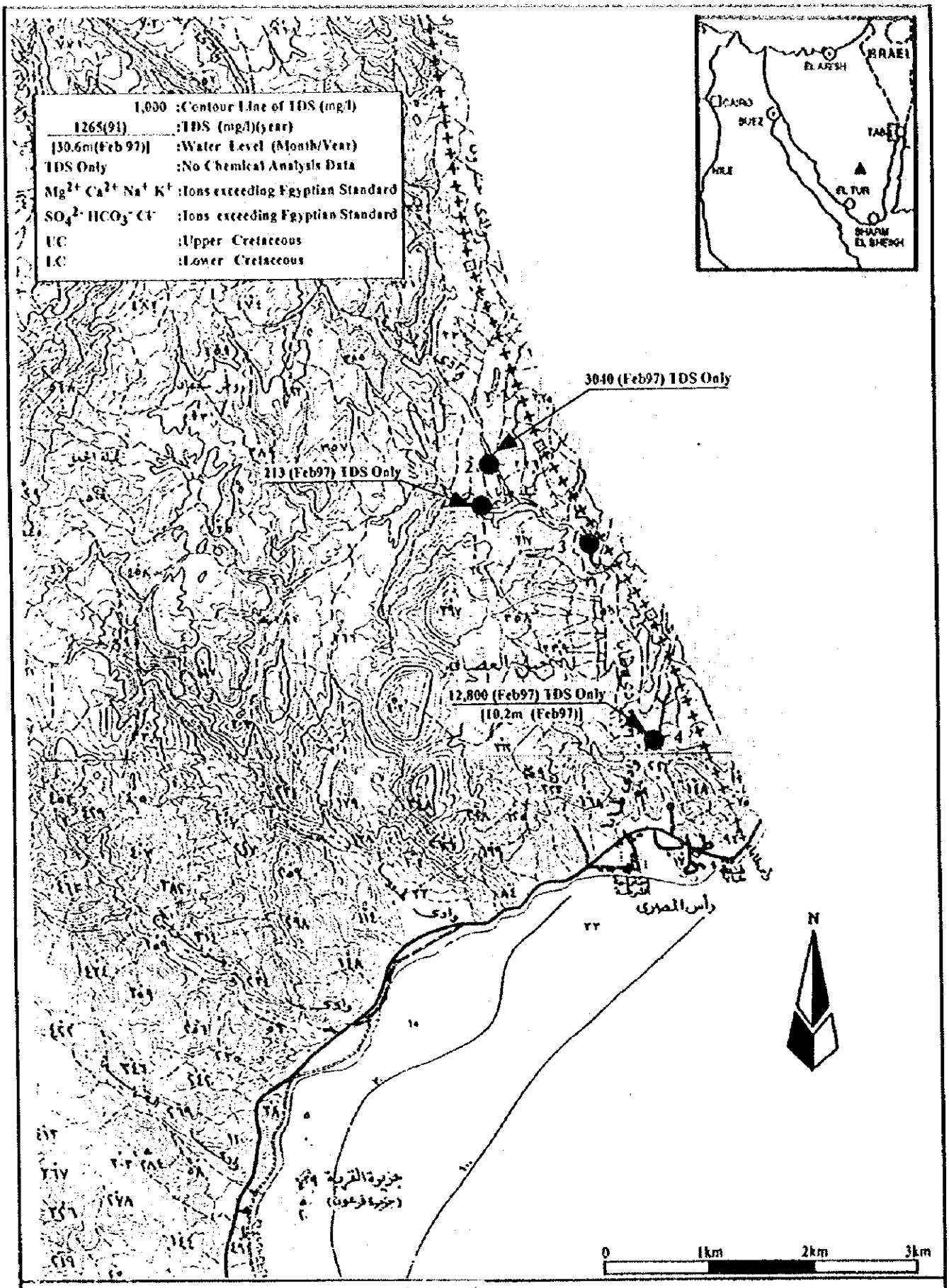

Fig. 8.2.8-2 (1) Groundwater Quality (Taba Area)

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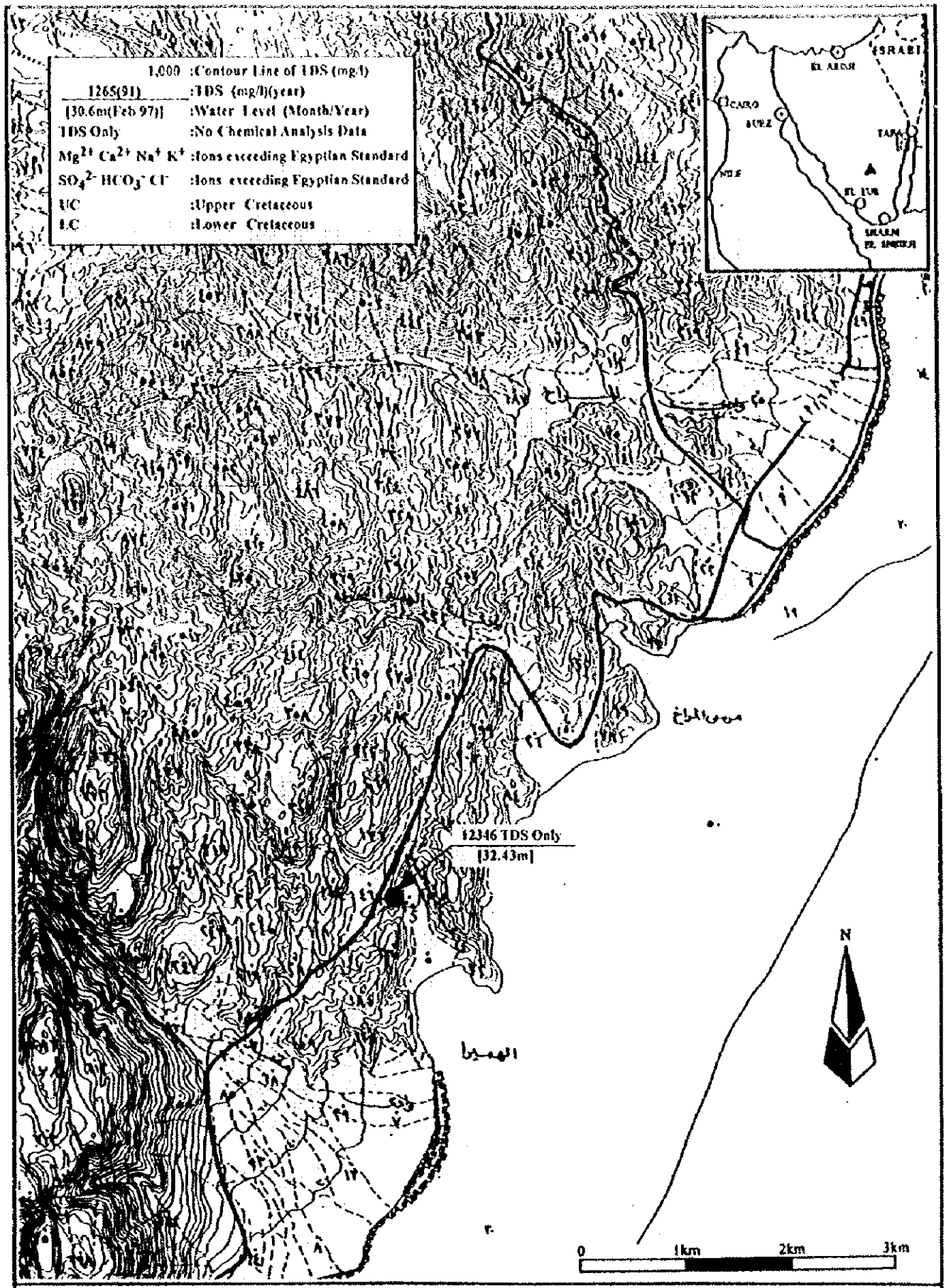

Fig. 8.2.8-2 (2) Groundwater Quality (Taba Area)

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8.2.9 Wadi Watir

1) General Features of Basin

The Wadi Watir is located in the northeastern part of South Sinai. It originates from the area near the south of Naqb and flow into Aqaba Bay collecting major wadis such as W. Sheira, Wadi El Hathy, W. Khareiza and Wadi Zalaga. Ain Furtaga spring occurs in the downstream of the wadi.

2) Well Inventory

There are 18 dug wells and 9 cased wells tapping groundwater from the Quaternary aquifers in the wadi, especially concentrating in the Sheikh Attia area. They are listed as well inventory (See, Table 8.1.1-1(9)). Their locations are shown in Fig. 8.2.9-1 and 2.

3) Supplementary Geological Survey

Geological and geophysical surveys were carried out by Cairo University under the cooperation with WRRI covering the wide area; Themed, Sheikh Attia, Taba and Nuweiba Coastal Plain, etc.

Along the W. Watir, including the branch of W. Watir named as W. Zalaga, TEM survey was conducted by JICA Study Team, during 1st stage of the 2nd field study. The location of the survey area is shown in Fig. 6.2.3-13. A total of five (5) geoelectrical profiles are provided. The profiles are compiled with an interval of approximately 1 km measuring station and analyzed depth of 400 to 450m depth.

In the W. Watir, a total of three (3) profiles were established as shown in Fig. 8.2.9-3. Lines O and P are in the upstream from Sheikh Attia and Sheikh Attia area respectively. Line N is in the downstream of the Wadi Khareiza. These figures show analyzed layered model in the resistivity block profile and resistivity inversion showing isoresistivity.

The existing well, Sheira-4 is located at measurement station of P001 in Line P. Based on this lithological data and apparent resistivity, three (3) layers were identified in these profiles. The 2nd layer (II) develops locally. Considering low resistivity range of less than 5 ohm-m and lithological log of existing well, the layer is estimated as shale intercalation.

The interpretation of the each geoelectrical profiles are as follows;

Layer	Resistivity Rang (ohm-m)	Estimated Lithology	Hydrogeological Interpretation
(I)	20 - 100	wadi deposit in surface, mainly chart	Sudr formation of upper cretaceous
(II)	< 5	shale intercalation	upper cretaceous formation
(III)	10 - 40	limestone, partly chart intercalation	upper cretaceous formation

4) Groundwater Level

In the W. Watir area, the groundwater level are recorded for 17 dug wells and five (5) cased wells. Groundwater level is shown in Fig. 8.2.9-4 and 5. As for the dug wells, a range of groundwater level is from 4.23 to 11.8 mBGL and a average level is 9.70mBGL. On the other hand, as for cased wells, a range of groundwater level is from 14.3 to 43.89 mBGL, averaging 21.53 mBGL.

5) Groundwater Quality

(1) Obtained Data

In the Wadi Watir area, a total of 32 water points, consisting 9 cased wells, 4 springs and 18 dug wells, is listed in well inventory. Among these water points, chemical analysis data for 11 wells are obtained mainly from CRONO database (See, Table below).

Availability of Water Quality Data (Wadi Watir)

Sr. No.	Well Identification		Availability of water Quality Data		
	WRRI Code No.	Well Name	Periodical Measurement Since/To	Interval	Number of Data
2	66BA-002	Mosalam Hemdan	5/94-3/95	3M, 7M	3
3	66BA-003	Abu-Hemad	8/94	one data	1
4	66BA-004	Anaze	5/94, 3/95	10M	2
6	66BA-006	M Attawy	5/94, 8/94	3M	2
8	66BA-008	Soliman Abu Allaw	8/94, 3/96	7M	2
9	66BA-009	Saleem Attawy	5/94, 3/95	3M, 7M	3
10	66BA-010	Nassar Aed Mefargy	8/94	one data	1
11	66BA-011	Zedan Eed	5/94, 3/95	3M, 6M , 13M	4
12	66BA-012	Zedan Rashed	3/95	one data	1
13	66BA-013	Hessen Saleem	8/94	one data	1
14	66BA-014	Saleem Abu Makawi	5/94, 3/95	3M, 7M	3

The available data is limited for dug wells, no chemical analysis data for springs and cased wells are available. The year of data is mostly 1994 and/or 1995. No periodical measurement was conducted in this area. Chemical analysis for the

samples taken from 2 water points of a spring of Furtaga-1 Spring and a dug well of Salch Suleem have been carried out by JICA Study Team (1997).

(2) Groundwater Quality of Springs in Wadi Watir

Using the data of only TDS value, a groundwater quality map of springs of the area is provided as shown as Fig. 8.2.9-4. The TDS value of each spring shows a similar value of approximately 1000 to 1300mg/l.

(3) Groundwater Quality of Shallow Aquifer in Wadi Watir

A groundwater quality map of dug wells is provided as shown as Fig. 8.2.9-5 for dug wells at Sheikh Attia area. The location of most of dug wells is concentrated in small area of 1 km2. The distribution of TDS value, however, is not evenly distributed. The range of TDS value is from 600 mg/l to over 6,000 mg/l, within the very narrow area.

The lowest value is 646 mg/l in well No. 6 (66BA-006), and highest value is 6364 mg/l in well No. 13 (66BA-013). Generally, the wells showing its TDS value more than 1,000 mg/l, several ions exceeds a value of Egyptian drinking water standard. Moreover, SO_4^{2-} ion is exceeding at all of these well.

As a represented well in the area, Piper and Stiff diagram of well No. 11 (66BA-011) shows in Fig. 8.2.9-7 and Fig.8.2.9-8 respectively.

6) Hydrogeological Characteristics of Basin

The upstream from Sheikh Attia is underlain by mainly Upper Cretaceous Limestone. No Precambrian Basement Rocks appear in this area. Wadi El Hathy and Wadi Khadeira originate from the limestone area and merge to Wadi Watir near Sheikh Attia. These wadis are active and floods are sometimes occurred in rainy season. Main Quaternary aquifer occurs at Sheikh Attia area. Therefore, the aquifer is recharged by flood water. Water Quality of this area is generally good.

Judging from the depth of wells (cased wells and dug wells) and groundwater level of those, there are two(2) aquifers in the wadi, deep aquifer and shallow aquifer.

7) Groundwater Extraction

In Sheikh Attia area, 16 dug wells are used for irrigation and domestic purpose. Total extraction rate reaches 680 m^3/day.

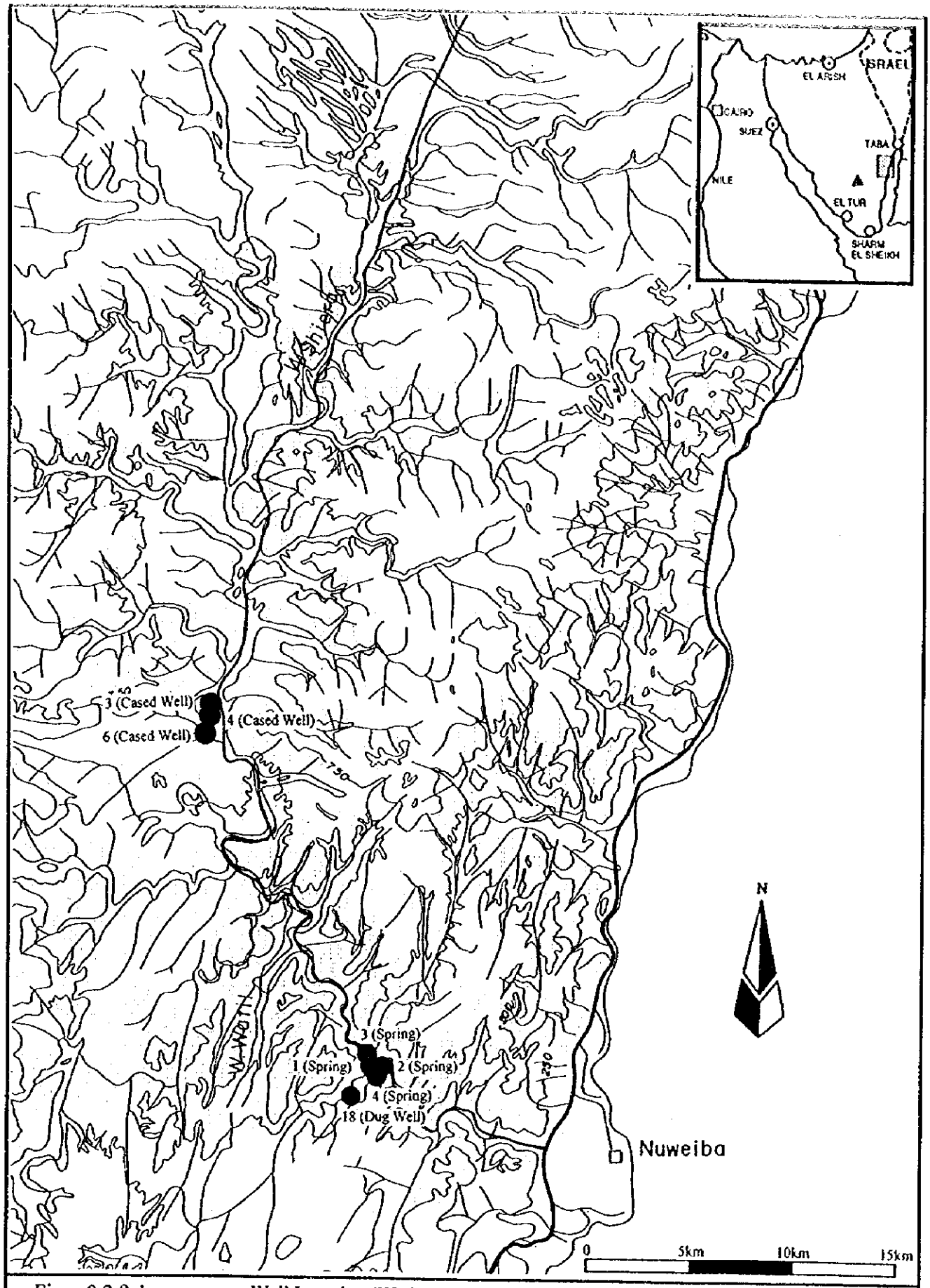

Fig. 8.2.9-1 Well Location (Wadi Watir)

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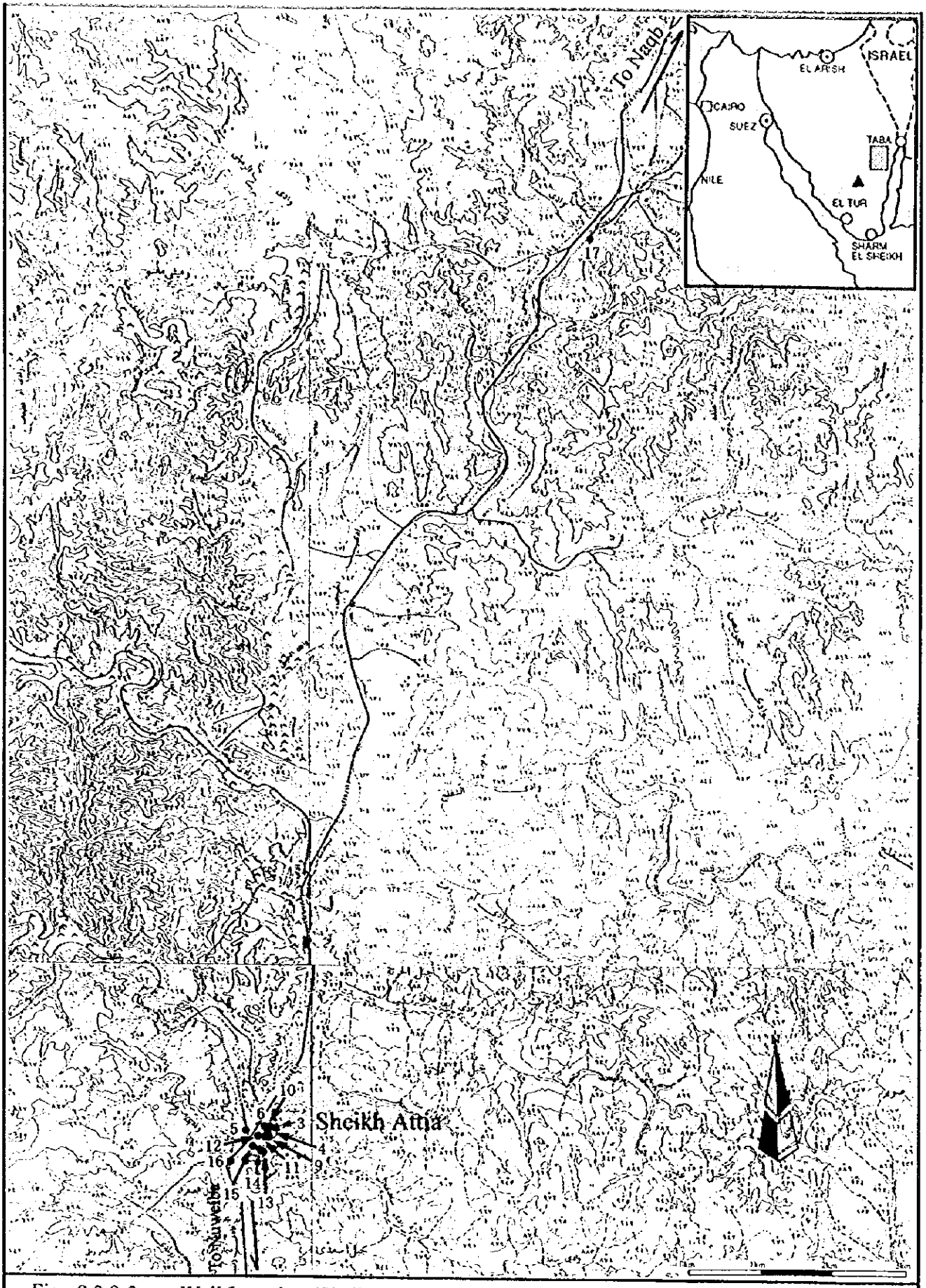

Fig. 8.2.9-2 Well Location (Sheikh Attia and W. Watir)

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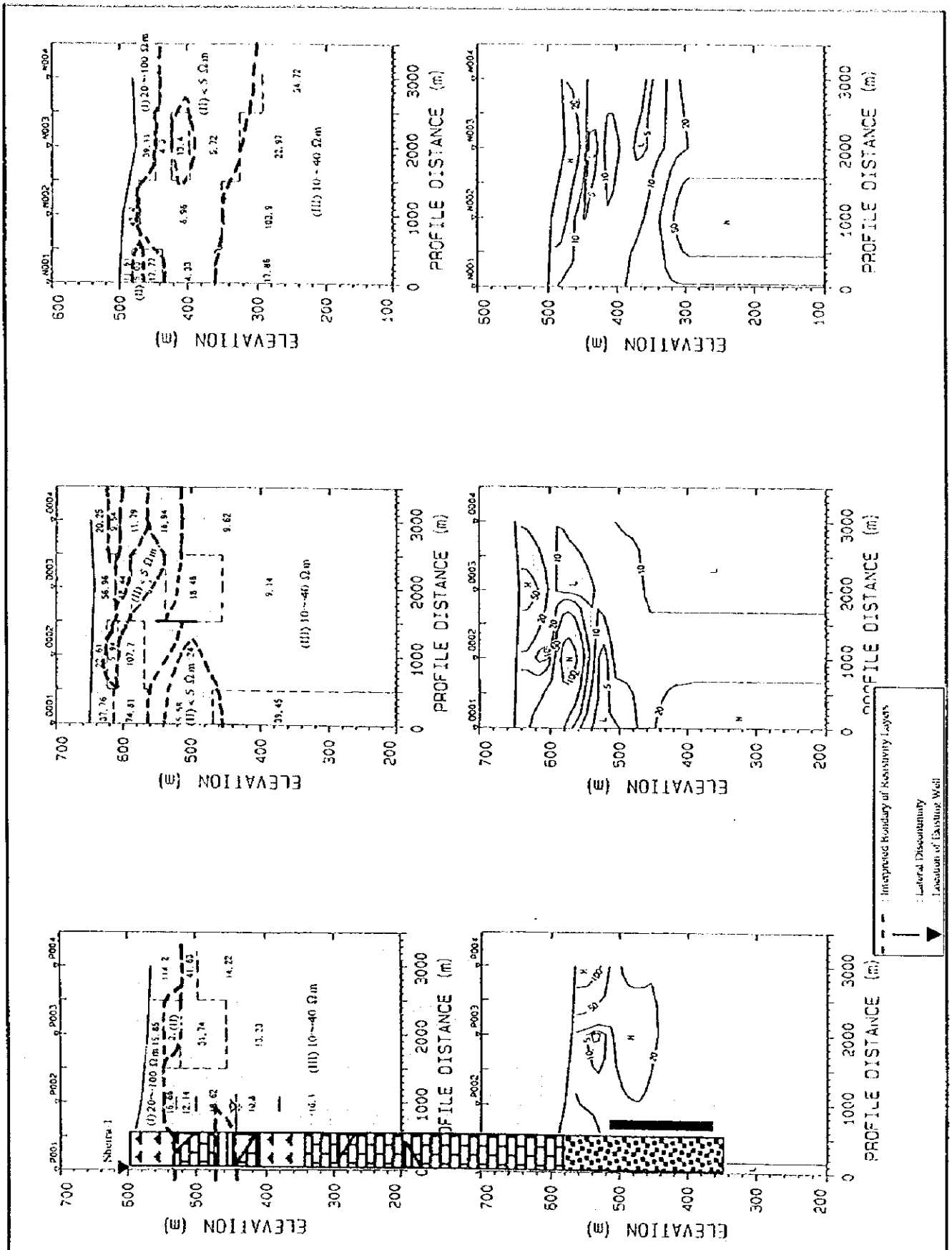

Fig. 8.2.9-3 Geoelectric Profile (Line N, O and P: W. Watir)

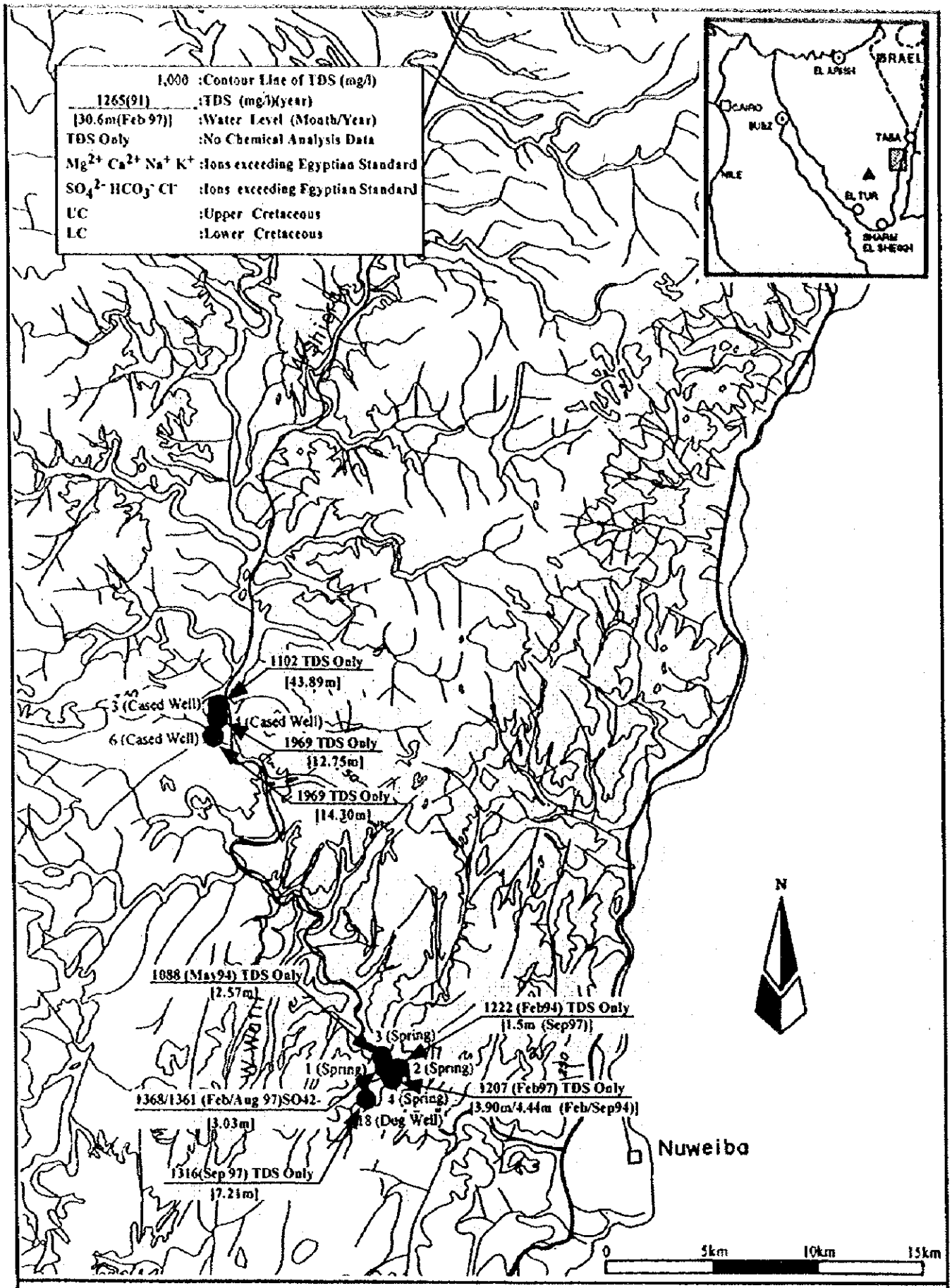

Fig. 8.2.9-4 Groundwater Level/Quality: W. Watir (unit: mBGL)

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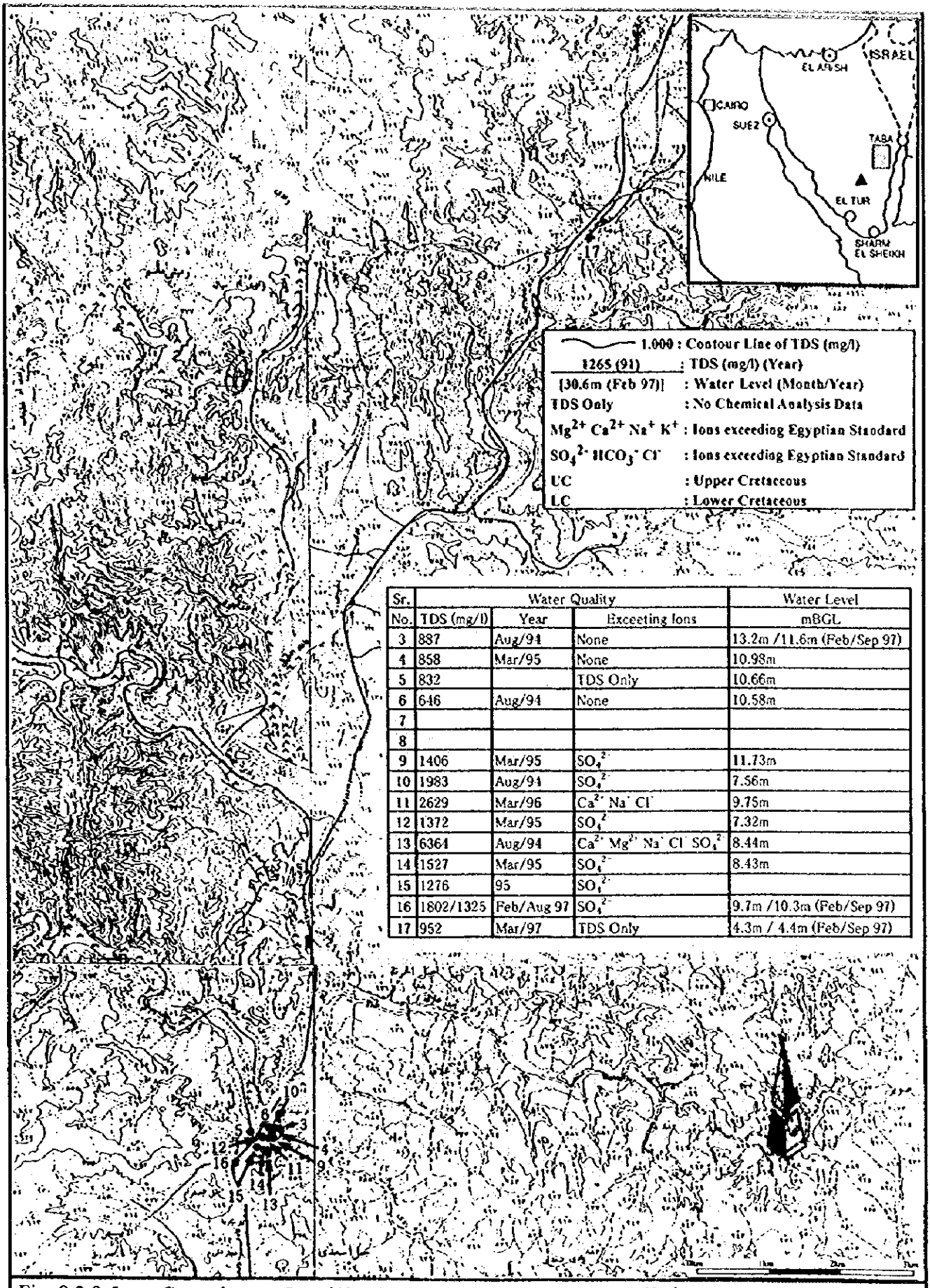
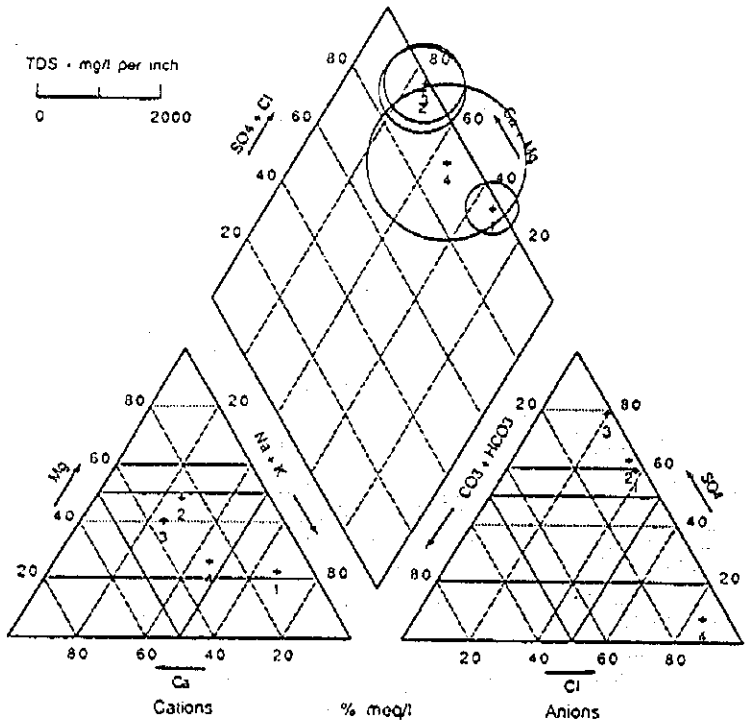


Sr. No.	Water Quality			Water Level
	TDS (mg/l)	Year	Exceeting Ions	mBGL
3	887	Aug/94	None	13.2m /11.6m (Feb/Sep 97)
4	858	Mar/95	None	10.98m
5	832		TDS Only	10.66m
6	646	Aug/94	None	10.58m
7				
8				
9	1406	Mar/95	SO_4^{2-}	11.73m
10	1983	Aug/94	SO_4^{2-}	7.56m
11	2629	Mar/96	Ca^{2+} Na^{+} Cl^{-}	9.75m
12	1372	Mar/95	SO_4^{2-}	7.32m
13	6364	Aug/94	Ca^{2+} Mg^{2+} Na^{+} Cl^{-} SO_4^{2-}	8.44m
14	1527	Mar/95	SO_4^{2-}	8.43m
15	1276	95	SO_4^{2-}	
16	1802/1325	Feb/Aug 97	SO_4^{2-}	9.7m /10.3m (Feb/Sep 97)
17	952	Mar/97	TDS Only	4.3m / 4.4m (Feb/Sep 97)

Fig. 8.2.9-5 Groundwater Level/Quality: Sheikh Attia and W. Watir (unit: mBGL)

SOUTH SINAI GROUNDWATER RESOURCES STUDY IN THE ARAB REPUBLIC OF EGYPT | JICA



66BA-011

No.	TDS	Sample	No.	TDS	Sample
1	863	May-94			
2	1419	Aug-94			
3	1347	Mar-95			
4	2629	Mar-96			

Fig. 8.2.9-6 Piper Diagram (Well No. 66BA-110 : W. Watir)

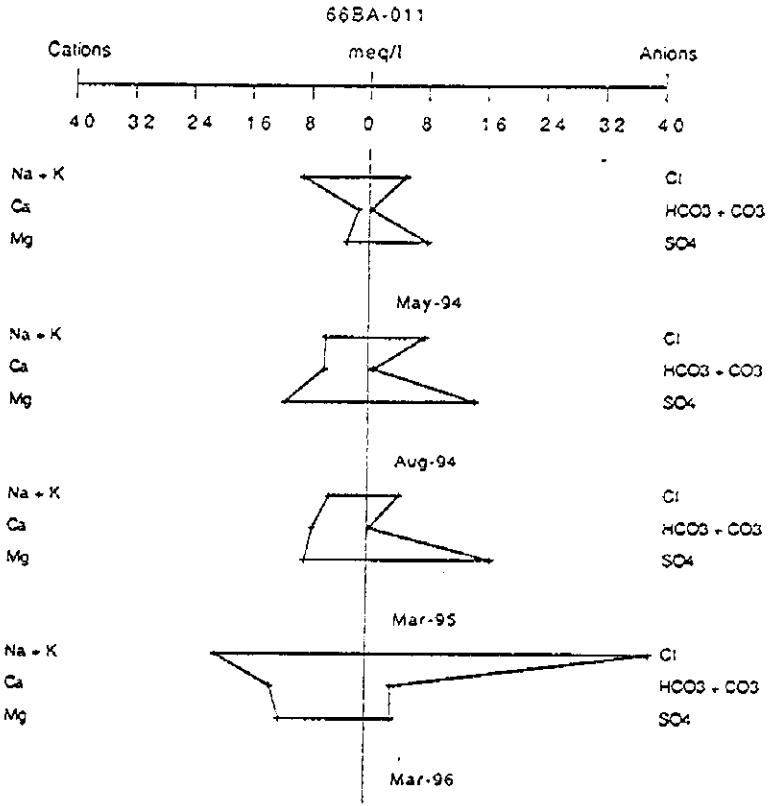


Fig. 8.2.9-7 Stiff Diagram (Well No. 66BA-110 : W. Watir)

8.2.10 Nuweiba Coastal Plain

1) General Feature of Basin

The Nuweiba Coastal Plain is located in the outlet of the Wadi Watir, facing to the Aqaba Bay. The size of the plain is approximately 32 km^2 (EW=4.3 km, NS=7.5 km). The highest point is approximately 40 m ASL (Fig. 8.2.10-1).

It is composed of fun deposits derived from the wadi. The Precambrian Rocks are distributed back of the plain.

Four (4) unit of fan are recognized in the plain: They are I, II and, IIIa and IIIb as shown in Fig. 8.2.10-2. Fan I is the most largest one. It formed main body of coastal plain accumulating the sediments derived from the Wadi Watir.

Fan II is the most small one formed on the Fan I.

Fans IIIa and IIIb are located in the south, of which sediments are supplied by the Wadi Sadda El Samra (Wadi Black Samra) and Wadi Samra El Beda (Wadi White Samra) respectively.

These fans are easily distinguished by their color on the LANDSAT Image and aerial photos. Their colors reflect the origin of sediments supplied. Main sediments of Fan I were supplied from the upstream of the Wadi Watir where Upper Cretaceous Limestone is widely distributed. Therefore, color of Fan I shows white. On the one hand, other Fans show blackish color because origin of sediments of other fans are mainly supplied from Precambrian Basement Rocks. Among Fan II, IIIa and IIIb, sediments of Fan IIIa are the most dark colored. This is due to the distribution of the Cambrian Naqus Formation in the catchment area.

2) Available Data

There are 30 wells in the plain consisting of 25 dug wells and five (5) cased wells (Fig. 8.2.10-1). The inventory is shown in Table 8.1.1-1 (10).

3) Groundwater Level

In the Nuweiba Coastal Plain, the groundwater level are recorded on five (5) cased wells located at the fanhead of Fan I (Group A), 13 dug wells at the foot of the northern half of Fan I (Group B), five (5) dug wells at the southern half of Fan I (Group C)and six (6) dug wells on Fan IIIa and IIIb (Group D). No well is located on Fan II. They are shown in Fig.

8.2.10-3.

Static water level of each well group is as shown in the table below.

Well Group	Static Water Level (mBGL)	Average (mBGL)
A	28.50 - 40.15	34.5
B	6.68 – 12.85	9.9
C	7.4 – 11.95	10.6
D	2.5 – 10.24	5.3

Depth of all the dug wells is in a range from 4 to 13 m (average 9.5 m) and that of cased wells is between 52 and 61 m (average 57.2 m). Static water level of dug wells is between 2.5 and 12.5 mBGL, and -4.2 and 7.1 mASL. Seven (7) dug wells are exploiting groundwater below the sea level.

In contrary to this, depth of cased well is in a range from 52 to 61 m. Static water level of those is between 28.5 and 40.2 m, and -8.2 and 1.5 m ASL. Most cased wells are pumping groundwater under the sea level.

Considering the well depth and static water level, dug wells and cased wells are exploiting groundwater from the same aquifers.

4) Groundwater Quality

(1) Obtained Data

In the Nuweiba coastal plain, a total of 30 wells, consisting 25 dug wells and 5 cased wells, is identified by the well Inventory. On most wells, both of cased well and dug well, chemical analysis data were available. The available chemical analysis data is listed below.

Availability of Water Quality Data (Nuweiba Costal Plain)

Sr. No.	Well Identification: WRRI Code No.	Well Identification: Well Name	Availability of water Quality Data: Periodical Measurement: Since/To	Periodical Measurement: Interval	Number of Data
1	66DB-001	M.El Sakhen	5/94 - 3/95	3M, 7M	3
2	66DE-002	El Mezena (6)	5/94 - 3/96	7M, 12M	3
3	66DB-003	Eed Awda	5/94 - 3/96	3M, 7M, 12M	4
4	66DB-004	M.Hemyed	5/94 - 3/96	3M, 7M, 12M	4
5	66DB-005	Ebrahem Hemyed	5/94 - 3/96	3M, 7M	3
6	66DB-006	El Mezena(1)	5/94 - 3/96	3M, 7M, 12M	4
7	66DB-007	Frage Subah	5/94 - 3/96	3M, 7M, 12M	4
8	66DB-008	Hassan Awda	5/94 - 3/96	3M, 19M	3
9	66DB-009	El Mezena(2)	5/94 - 3/96	3M, 7M, 12M	4
10	66DB-010	El Mezena(3)	5/94 - 3/96	3M, 7M, 12M	4
11	66DB-011	Faragallah Hemdan	5/94 - 3/96	3M, 7M, 12M	4
12	66DB-012	Soliman Khodear	5/94 - 3/96	3M, 19M	3
13	66DB-013	Salem Gomah	5/94 - 3/96	3M, 7M, 12M	4
14	66DB-014	Sallam Soliman	5/94 - 3/96	3M, 19M	3
15	66EB-001	El Mezena(5)	5/94 - 3/96	10M, 12M	3
16	66EB-002	Saf Elbahrawy	5/94	one data	1
17	66EB-003	El Mezena(4)	5/94 - 3/95	10M	2
18	66EB-010	Hemdan Hassan	5/94 - 3/96	3M, 7M, 12M	4
20	66EB-007	El Gamea	5/94 - 3/95	3M, 7M	3
21	66EB-008	Abd Allah Hemad	5/94 - 3/96	3M, 7M, 12M	4
22	66EB-012	Atawy Soliman	5/94 - 3/96	3M, 7M, 12M	4
23	57CC-001	Salama	5/94	one data	1
24	66EB-004	Gomaa Awied	5/94	one data	1
26	66DB-015	REGWA 1	5/94, 8/94	3M	2
27	66DB-016	REGWA 2	5/94, 8/94	3M	2
28	66DB-017	REGWA 5	5/94, 8/94	3M	2
29	66EB-005	REGWA 6	5/94 , 8/95	3M	2
30	66DB-018	REGWA 8	5/94, 8/94	3M	2

These measurements were conducted on mainly period between 1994 to 1996 with 3 to 12 months intervals. Apart from these measurements chemical analysis for the samples taken from 2 dug wells of Ebrahem Hemyed and Abd Allah Hemad have been carried out by the JICA Study Team in 1997.

(2) Relation between alluvial fans and well groups

Based on the analyzed TDS value of 25 dug wells, a groundwater quality map is provided as shown as Fig. 8.2.10-4. A groundwater quality map of cased wells is provided as shown as Fig. 8.2.10-5. The range of depth of these dug wells is approximately 4m to 12m, and cased well is 50m to 60m.. As mentioned in foregone section, there are 4 units of alluvial fans in the plain. Considering the distribution of well groups in the plain, the relation between alluvial fans and well groups are summarized as follows

i) Well Group-1 (Well Map No.26 to 30, Cased Wells): The group is located on the top of Fan-I.

ii) Well Group-2 (Well Map No. 1 to 14, Dug Wells): The group is located on the north-east edge of the Fan-I.

iii) Well Group-3 (Well Map No. 15 to 19, Dug Wells): The Group is located on south-east edge of the Fan-I.

iii) Well Group-4 (Well Map No. 20 to 25, Dug Wells): The Group is located on the Fan-IIIa.

(3) Groundwater Quality of Fan-I (Wadi Watir Deposit)

The generation source of the fan sediments is Wadi Watir. The depth to the aquifer is directly proportional to the thickness of fan deposit. On the top of fan where Well Group-1 is located, the depth to aquifer is deeper (50m to 60m). On the other hand, the depth of aquifer is shallow in the edge of the fan where Well Group-2 and Well Group-3 are located. Consequently groundwater salinity is rather low in Well Group-1 and Well Group-2, considerably high in Well Group-3. This phenomenon is attributed to the influence of the groundwater flow from Wadi Watir. Since the Well Group-1 and Well Group-2 are located on the groundwater flow line, the salinity is rather low compared with Well Group-3.

A groundwater quality map of cased wells is provided as shown as Fig. 8.2.10-5. The contour lines were drawn clearly along the topographical contour line. The TDS value shows gradual increase in the east direction. Considering the its location of top of fan, high TDS value is rather high at some of wells. The highest peak of TDS value is 9470 mg/l of the well No. 29 (66EB-005).

(4) Groundwater Quality of Fan-IIIa (Wadi El Sadha El Samra Deposit)

Extremely high TDS value of more than 10,000 mg/l is distributed along the coastal line. Such high salinity considered to be because of sea water intrusion. At most of wells, major ions, i.e., Ca^{2+}, Cl^{-} and SO_4^{2-} are exceeding the Egyptian drinking water standard. The generation source of the fan sediments is Wadi El Sadha El Samra. Considering the scale of the wadi, recharge rate of groundwater may be smaller than the rate of Wadi Watir. The rather high salinity than the Wadi Watir can be explained by this consideration.

(5) Variation of Groundwater Quality

The variation of TDS value in the area is shown in Fig. 8.2.10-6. In the Nuweiba City Area, the graph shows that the TDS value increase slightly during period of May 1994 to March 1995. Generally, the variation is stable in the area.

On the other hand, in the Migena Bay area, TDS value increase largely (from 8,000 to over 11,000 mg/l) during period of May 1994 to March 1995.

5) Hydrogeological Characteristics of Basin

The aquifer is occurred in the four (4) zones of the Fan Deposits.

The first zone is at the area of fanhead of Fan I. Cased wells were constructed only in this zone. Screen length is between 13 and 15 m. Elevation of bottom of screen is in a range from -- 17 to -- 22 mASL. After flowing into the coastal plain, groundwater immediately infiltrate to deep part of the Fan Deposits. Therefore, water level is rather deep in this zone.

The second zone is along the foot of Fan I of which elevation is between 12 to 17 m. This zone distributes from the Nuweiba City toward the Nuweiba Port. Fan Deposits decreases its thickness in the area, therefore, groundwater is exploitable by dug wells.

The last zone is distributed at the center and foot of Fan IIIa in Saiyadin Village where elevation is less than 10 m. Water level in this zone is less than 1 mASL and water quality is saline, from 3300 to 7700 mg/l. This is due to scarce recharge from the Wadi El Sadha El Samra.

6) Groundwater Extraction

Groundwater extraction by well group is summarized as the table shown below.

Well Group	Extraction Rate (m^3/day)	Total (m^3/day)
A	N.A	N.A
B	20 - 80	450
C	10 - 80	190
D	1 -20	26

Cased wells (Group A) has no available data. Total extraction rate reaches 666 m^3/day except well group A. According to the interview, total groundwater extraction in Nuweiba is approximately 5,000 m^3/day including that of Ain Furtaga. The spring flow

from Ain Furtaga is estimated at 1,800 m^3/day by WRRI (SSWRDP). Therefore, production of well Group A is estimated to be approximately 2,500 m^3/day.

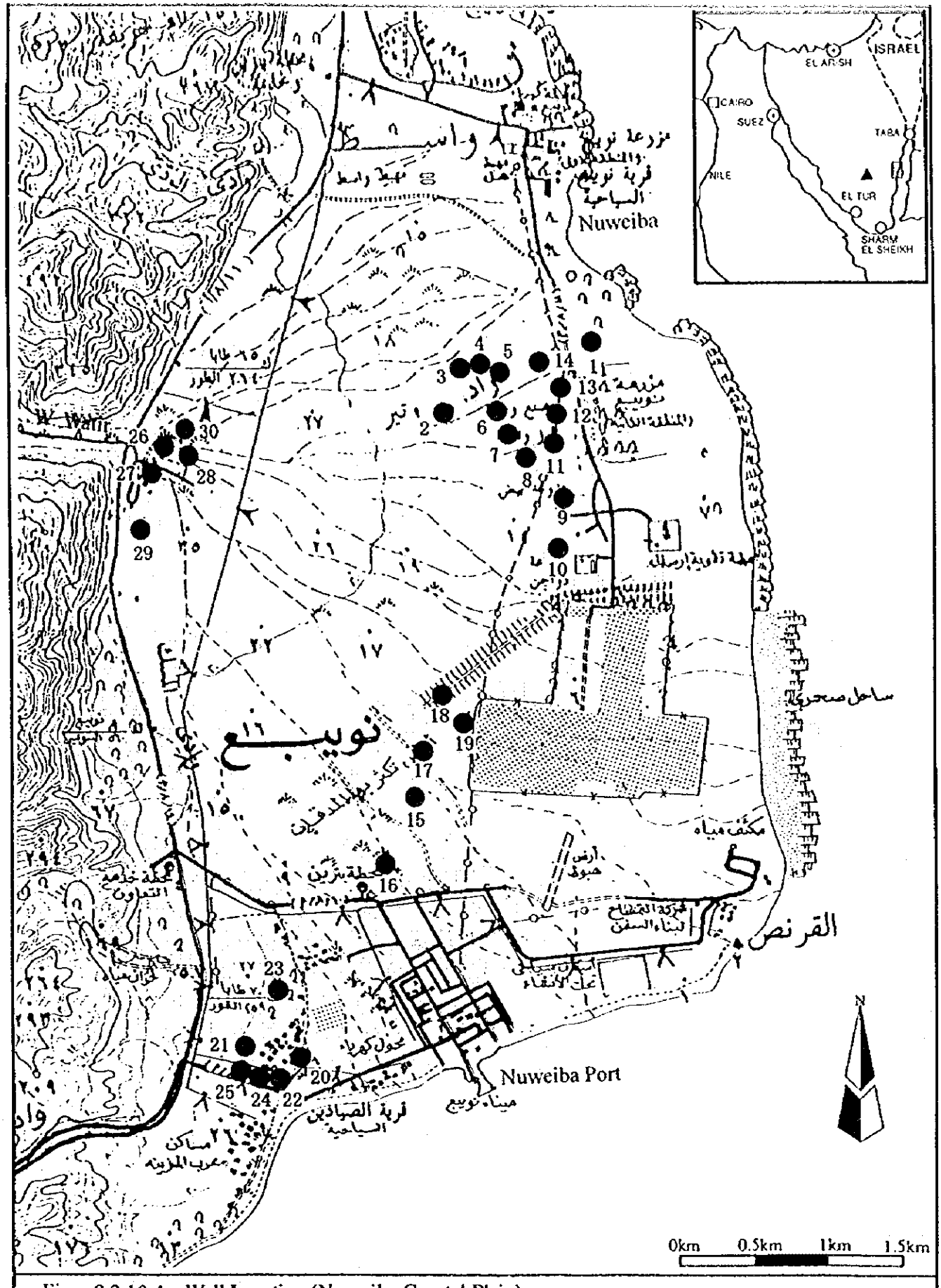


Fig. 8.2.10-1 Well Location (Nuweiba Coastal Plain)

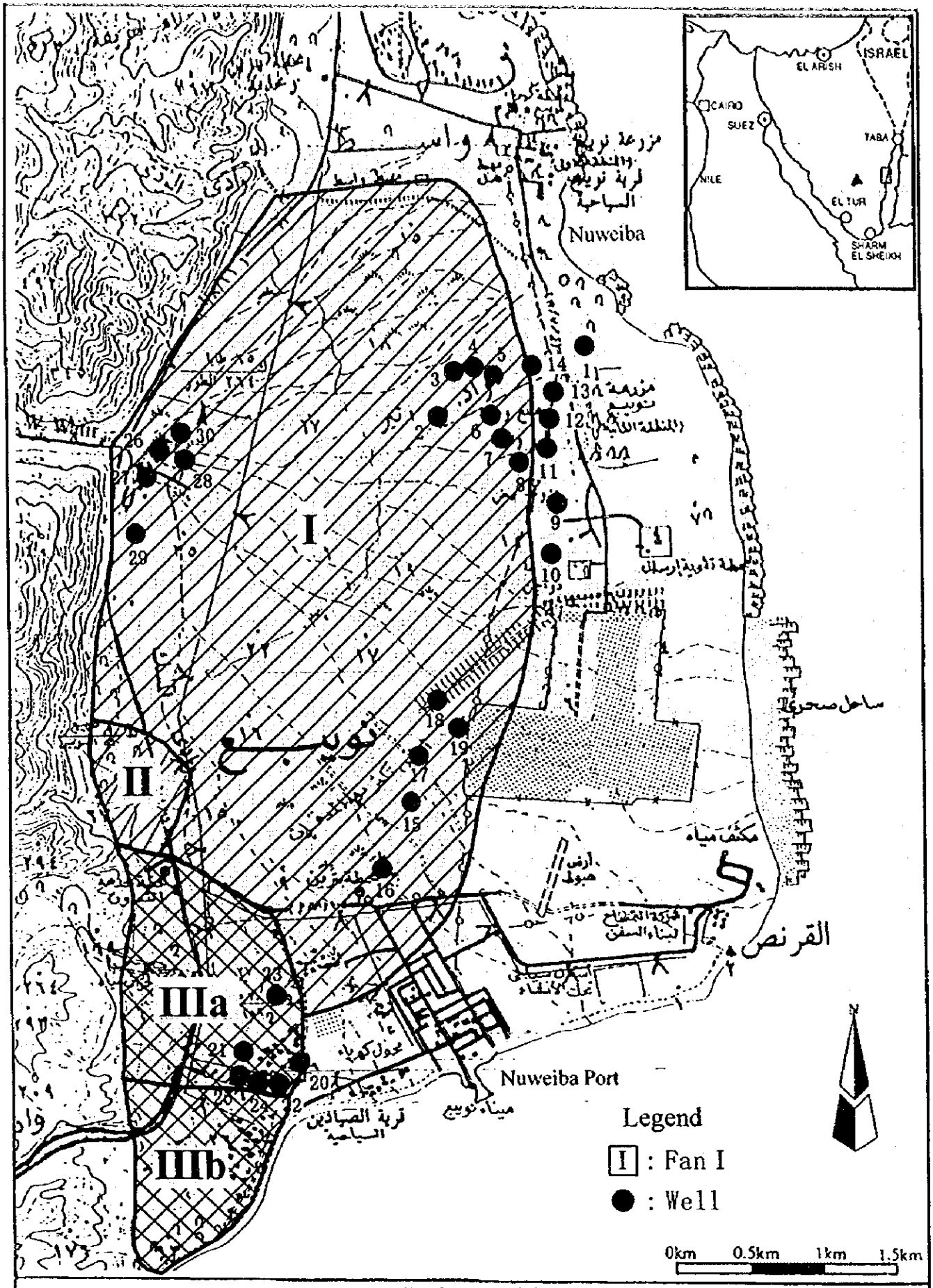


Fig. 8.2.10-2 Micro-Topography (Nuweiba Coastal Plain)

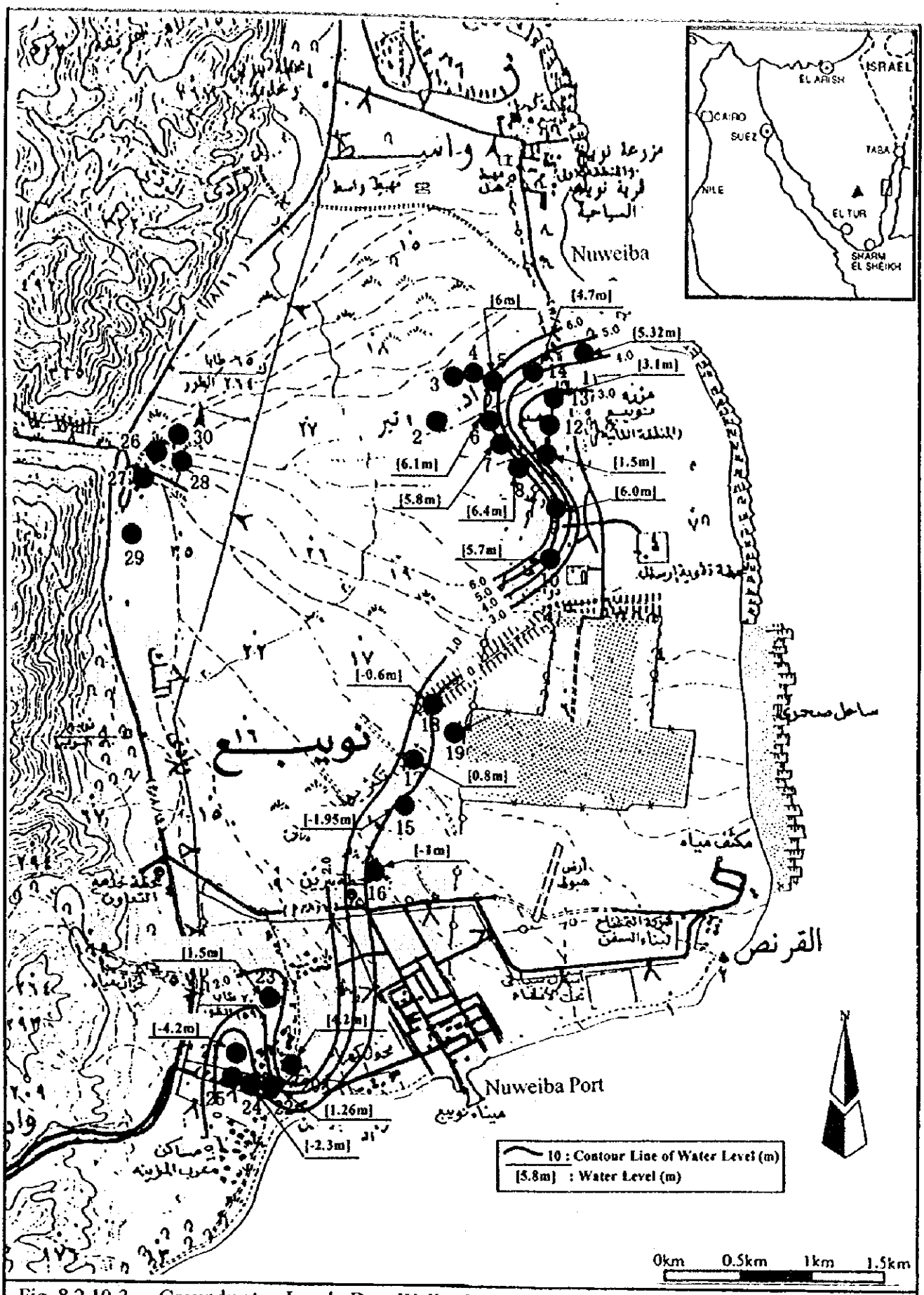


Fig. 8.2.10-3 Groundwater Level: Dug Well of Nuweiba Coastal Plain (unit: mASL)

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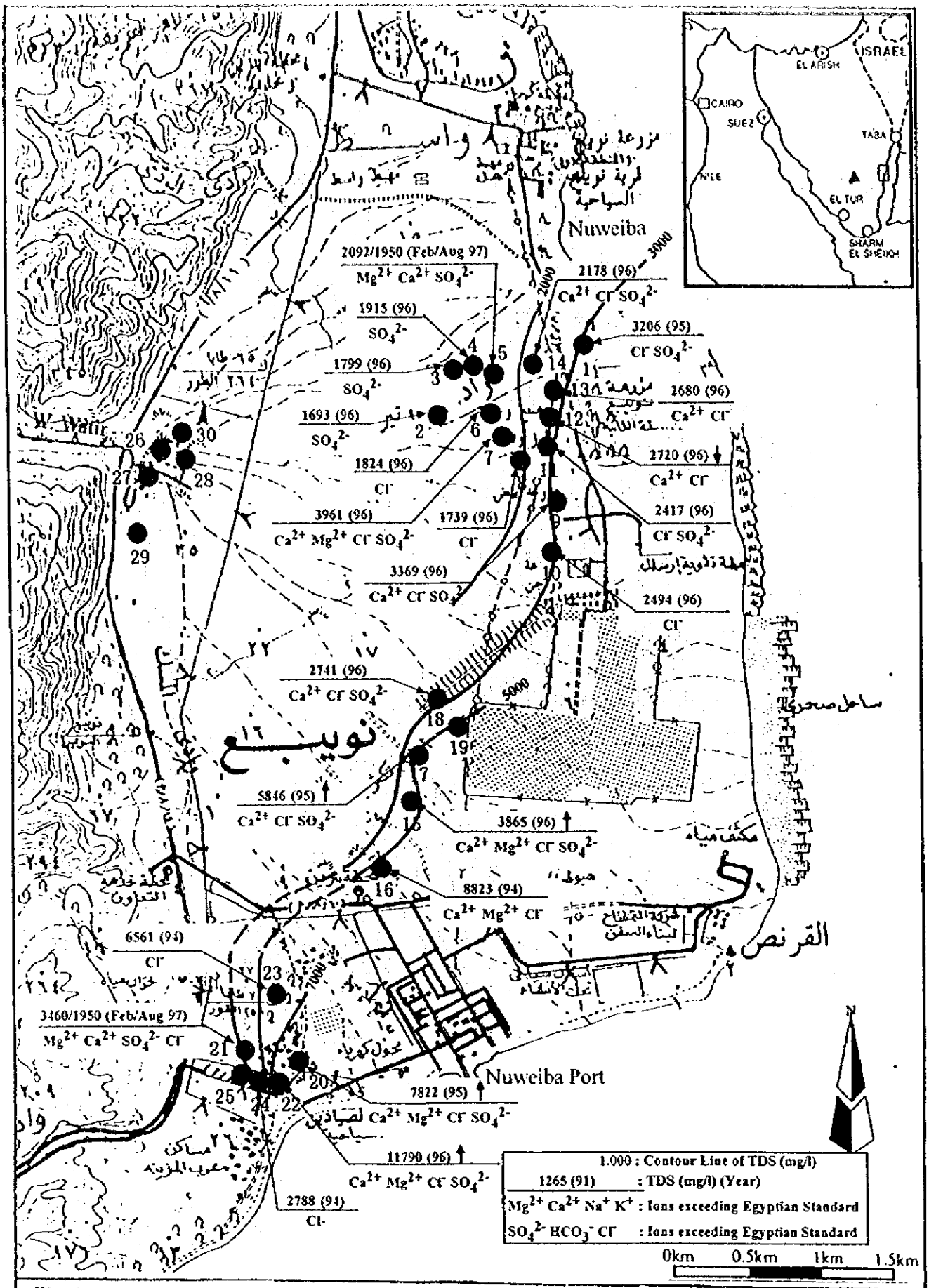

Fig. 8.2.10-4 Groundwater Quality: Dug Well of Nuweiba Coastal Plain

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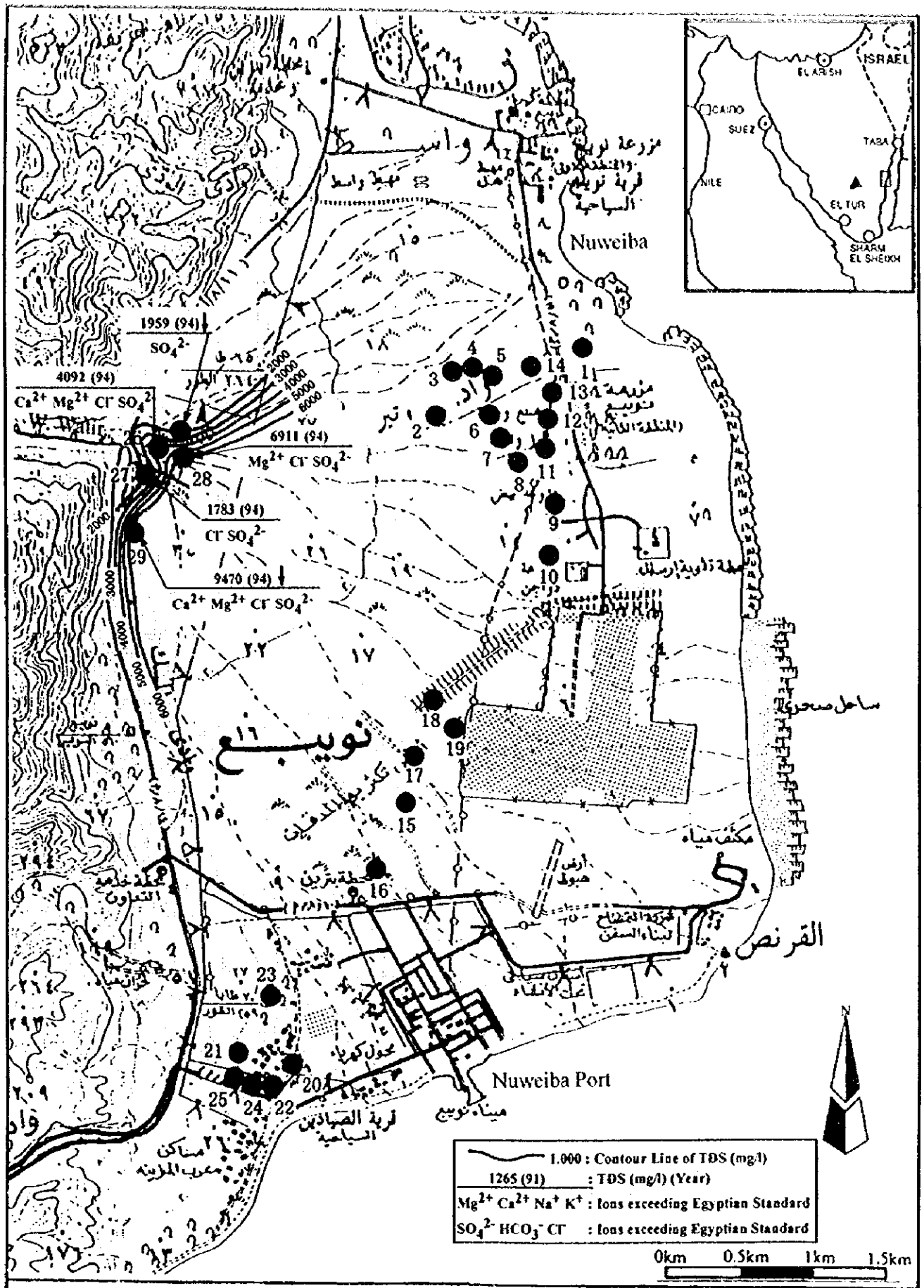

Fig.8.2.10-5 Groundwater Quality: Tube Well of Nuweiba Coastal Plain

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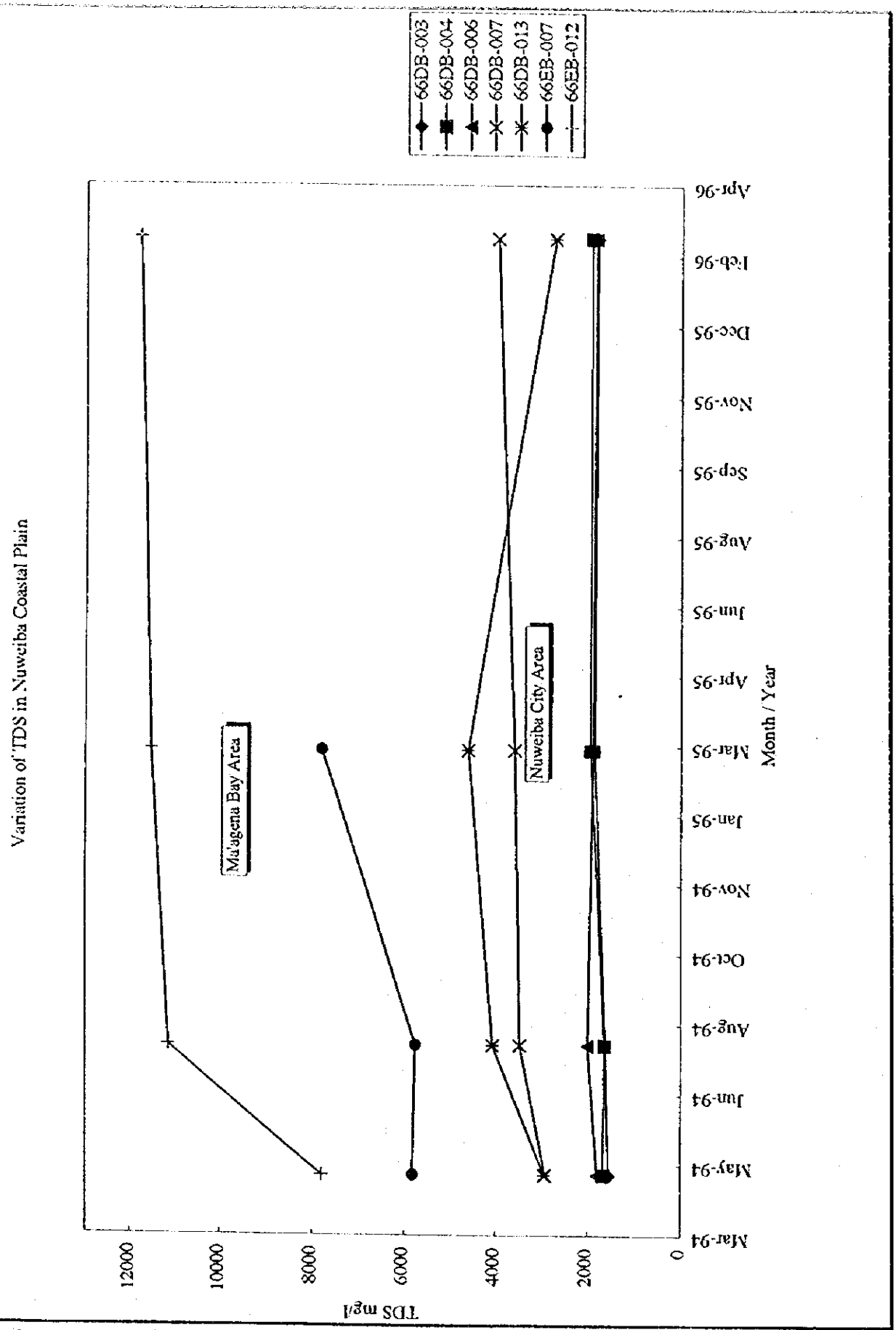

Fig.8.2.10-6 Variation of TDS of Dug Well (Nuweiba Coastal Plain)

8.2.11 Wadi Zalaga

1) General Features of Basin

The Wadi Zalaga is one of the main tributaries of Wadi Watir. It originates from the foot of Egma Plateau near Gebel Dalal and flow to northeastward. Ain Umm Ahmed spring and seven (7) dig wells were observed in the Wadi Zalaga. Upstream area of the wadi is underlain by Precambrian Basement Rocks and Paleozoic and/or Lower cretaceous sandstone. Most sandstone distributed along the wadi seems to be mainly Paleozoic Sandstone. ,

2) Well Inventory

As mentioned above, Ain Umm Ahmed spring occurs in the down stream of the wadi and eight (8) dug wells were constructed, concentrating near Ain Umm Ahmed Village. Inventory and location map are shown in Table 8.1.1-1 (11) and Fig. 8.2.11-1 respectively.

3) Supplementary Geological Survey

In the W. Zalaga, two (2) profiles of Line-Q and Line-R were established as shown as Fig. 8.2.11-2. These figures consist of analyzed layered model in the resistivity block profile and resistivity inversion.

Four (4) layers were identified by TEM survey. Lithology of each layer is estimated as follows;

Layer	Resistivity Rang (ohm-m)	Estimated Lithology	Hydrogeological Interpretation
(I)	80 - 120	wadi deposit in surface, weathered plutonic rocks at lower	Quaternary Wadi Deposits Precambrian Rocks
(II)	300 - 700	basement rocks	Precambrian Rocks
(III)	> 1,000	basement rocks	Precambrian Rocks
(IV)	150 - 400	basement rocks	Precambrian Rocks

The layer (I) seems to be an aquifer and is estimated to be in a range from 40 to 80 m in thickness.

4) Groundwater Level

Static water level was measured at seven (7) wells (Fig. 8.2.11-3). Among them, one (1) well is located at the confluent point to the Wadi Watir.

In Ain Umm Ahmed Village, static water level is from 2.77 to 10.20 mBGL averaging 5.21 mBGL.

The highest water level is 684.8 mASL at the most upstream of Ain Umm Ahmed Village and the lowest one is 420.99 mASL at the merge point to the Wadi Watir. Water level gradient in this section is steep, 13/1000.

5) Groundwater Quality

(1) Obtained Data

JICA Study Team has carried out field water quality survey for 7 Dug Wells (1997). The depth of the Dug Wells is 5m to 10m.

(2) TDS Distribution

The groundwater map of the area is provided as shown as Fig. 8.2.11-3. TDS value of groundwater is 1286 mg/l at the confluent point and in a range from 1568 to 2061 mg/l averaging 1812 mg/l in Ain Umm Ahmed Village. On the other hand, TDS value of Ain Umm Ahmed spring is 2234 mg/l and it is higher than that of dug wells.

6) Hydrogeological Characteristics of Aquifer

The Wadi Zalaga flows in the outcrop area of Paleozoic and Lower Cretaceous Sandstone. Flood water occurred in this wadi will infiltrate into these sandstone. Therefore, the catchment area of the wadi is one of the recharge area to sandstone.

The quaternary aquifer consists of sand and gravel, and is from 20 to 80 m thick.

Groundwater yield of No. 6 dug well is 30 m^3/hour. According to the owner of this well, it is possible to extract groundwater continuously. Draw down is 0.25 m.

Water depth (from the static water level to the bottom of the well) of No. 4 dug well is 1.5 m. Groundwater of this well is dried up after 25 minutes of pumping and water level recovers after 2 hours: This extraction rate is estimated at 25.4 m^3/hour.

7) Groundwater Extraction

All the wells are for domestic and irrigation use. No data is available on actual extraction rate. However, following fact was confirmed by interview during the survey. At Dug well No.4, about 0.8 m^3 of groundwater is extracted in 25 minutes and groundwater level recovers in 2 hours. It is equals to 1.9 m^3/hour. Furthermore, Dug well No. 6 yields 60 m^3/hour of groundwater. This well fills up a 120 m^3 of water tank

in 2 hours with 25 cm of drawdown and it is possible to pump 24 hours. Yield potential of this well is estimated as 1440 m^3/day.

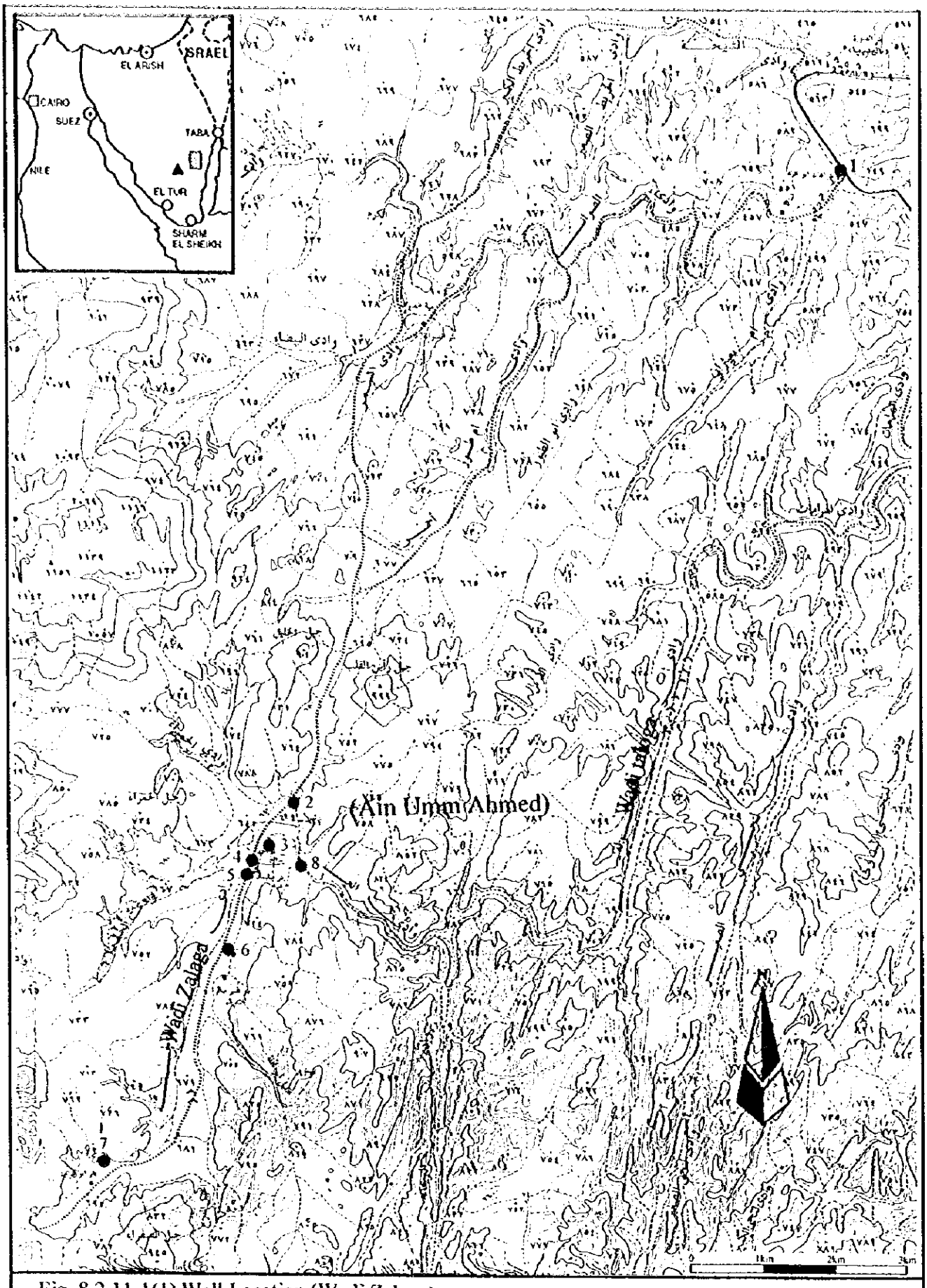

Fig. 8.2.11-1(1) Well Location (Wadi Zalaga)

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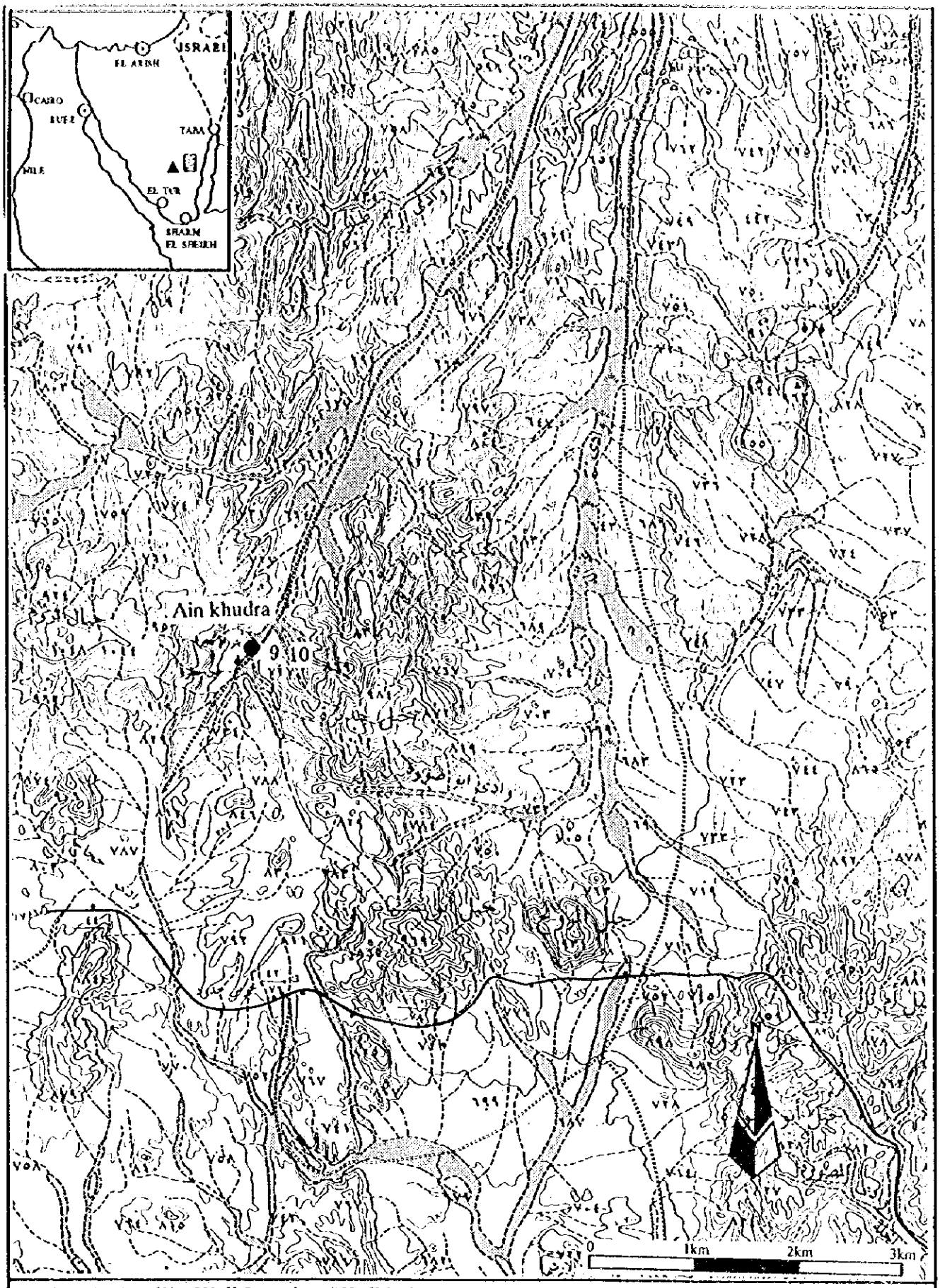

Fig.8.2.11-1 (2) Well Location (Wadi Zalaga)

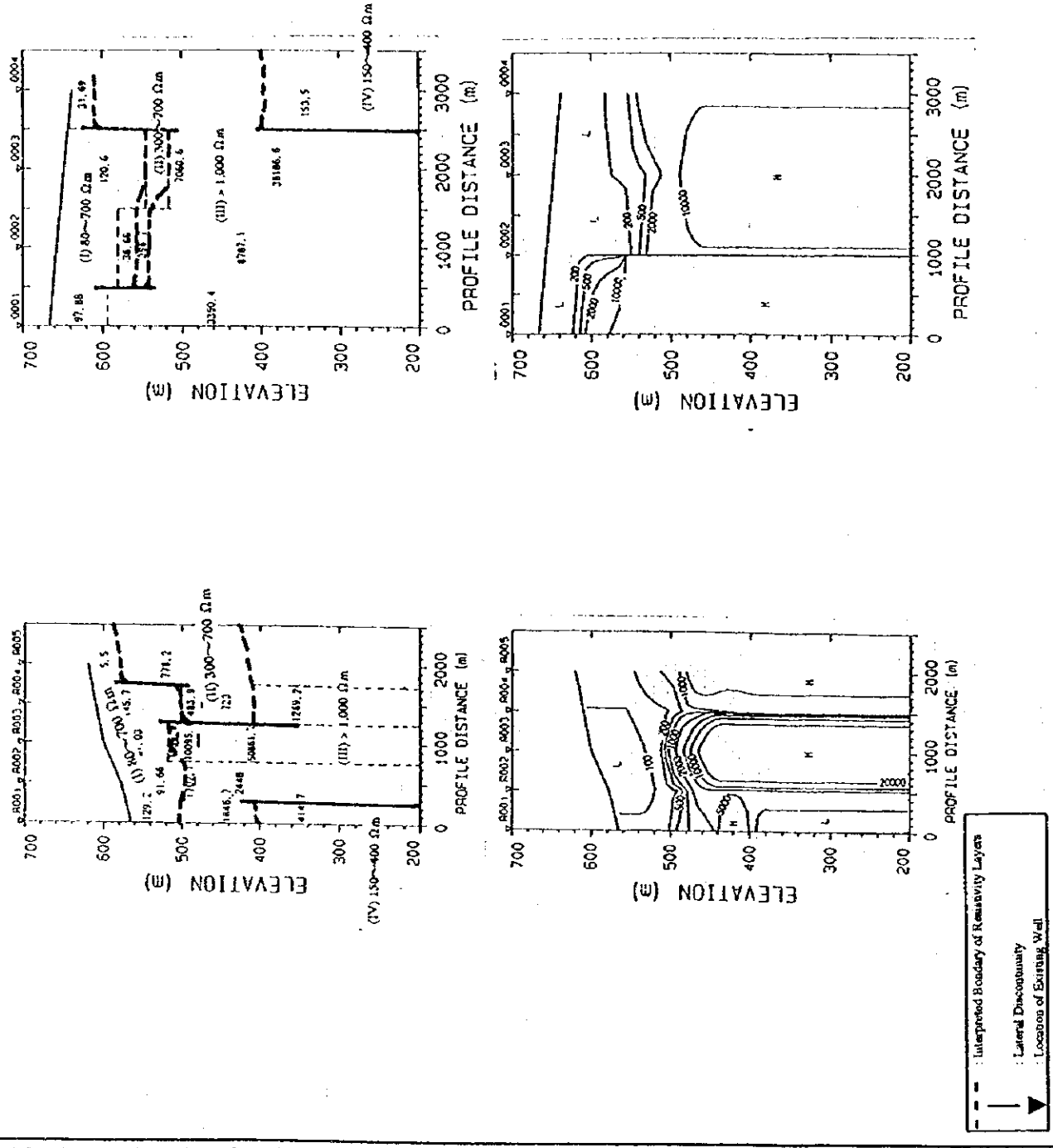

Fig. 8.2.11-2 Geoelectric Profile (Line Q and R: W. Zalaga)

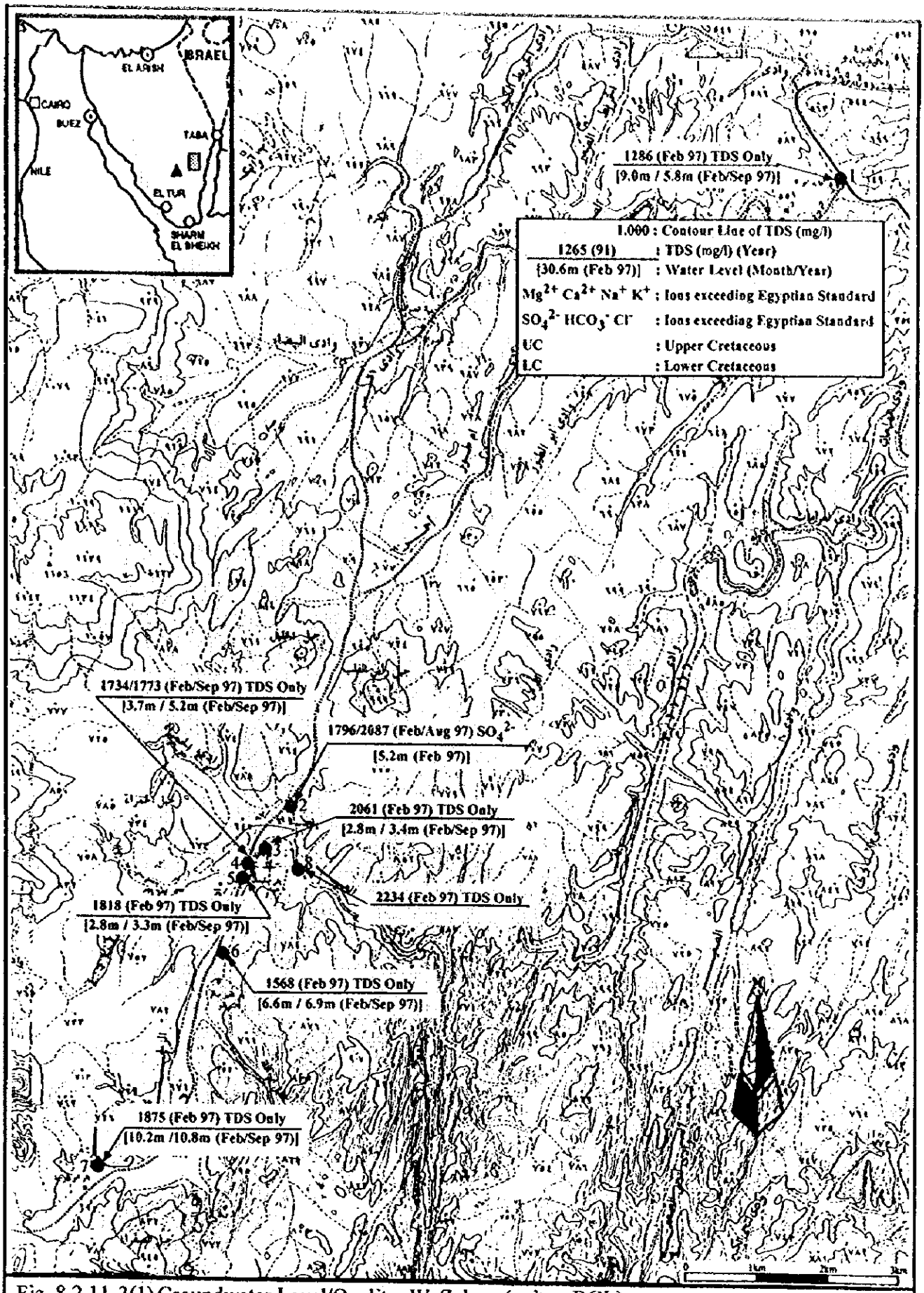

Fig. 8.2.11-3(1) Groundwater Level/Quality: W. Zalaga (unit: mBGL)

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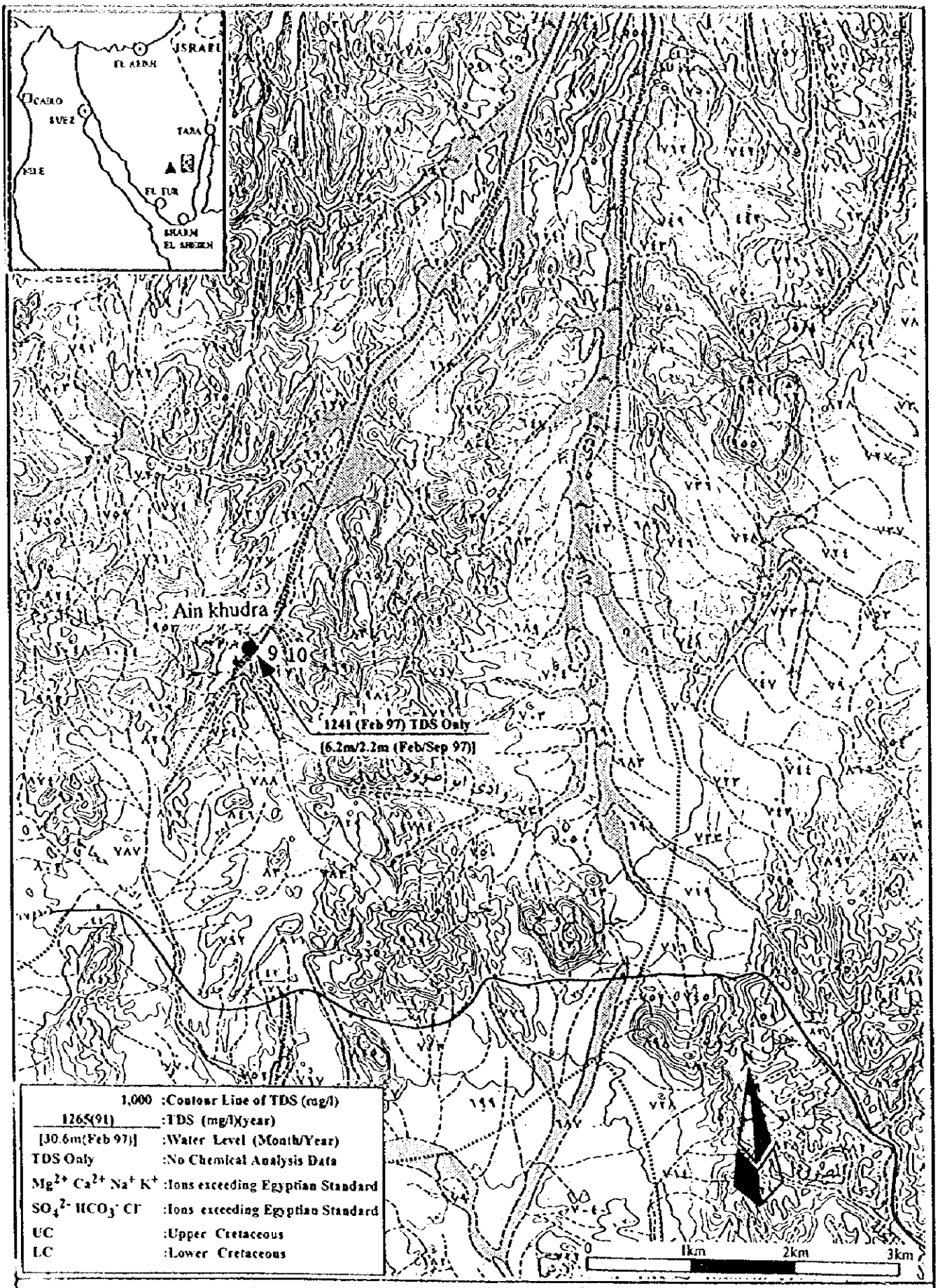

Fig.8.2.11-3 (2) Groundwater Level/Quality : W.Zalaga (Unit: mBGL)

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8.2.12 Wadi Zaghara and Wadi Nasb

1) General Feature of Basin

The Wadi Zaghara originates from the area near St. Catherine and confluent to the Wadi Dahab near the National Highway to Nuweiba. Wadi Nasb merges to this wadi.

The Precambrian Basement Rocks are distributed in the total area of the basin.

The groundwater is lead from the dug well (Zaghara Well) to the tank in the down stream by small diameter of pipes for domestic water use in Dahab City.

In the area, there is only one (1) village in the Wadi Nasb where about 50 people make a community, migrating here about 60 years ago.

2) Well Inventory

There are two (2) dug wells in the main stream of the Wadi Zaghara and six (6) dug wells in the Wadi Nasb (Fig. 8.2.12-1). The well inventory was newly constructed by the Study Team (Table 8.1.1-1 (12)).

Some wells in the Wadi Nasb were filled by wadi deposits due to flood occurred in April 1997. On the one hand new dug wells are under construction.

3) Supplementary Geological Survey

The TEM survey was conducted by the Study Team in the areas including W. Nasb as shown in Fig. 6.2.3-16. The number of section allocated are two (2). The results are shown as geoelectric Profile (Fig. 8.2.12-2).

In the area, two (2) profiles of Line-K and Line-L were established as shown in Fig. 8.2.12-2.

In this profiles, two (2) layered model is applied based on the apparent resistivity. The area is covered by Precambrian Rocks. The interpretation of the each geoelectrical profiles are as follows;

Layer	Resistivity Rang (ohm-m)	Estimated Lithology	Hydrogeological Interpretation
(I)	100 - 300	weathered basement rocks	Precambrian Basement Rocks
(II)	> 1,000	basement rock	Precambrian Basement Rocks

4) Groundwater Level

Static water level is 11.0 mBGL and 4.9 mBGL in the Wadi Zaghara and is in a range from 2 to 11.7 mBGL in the Wadi Nasb (Fig. 8.2.12-3).

5) Groundwater Quality

In the Wadi Zaghara and Wadi Nasb area, JICA Study Team has carried out field water quality survey for 5 Dug Wells (1997). Chemical analysis for the sample taken from a well of Zaghara-1 was carried out by JICA Study Team (1997). A range of depth of Dug Wells is 2 m to 12m.

A groundwater quality map of shallow aquifer in the area is provided as shown as Fig. 8.2.12-3.

All the wells show relatively low TDS value less than 1000 mg/l of standard: They are 880 and 900 mg/l in the Wadi Zaghara, and from 609 to 627 mg/l (Fig. 8.2.12-3).

The groundwater salinity in the area is relatively low. A range of TDS value is 500 to 600 mg/l in the Wadi Nasb, 800 to 900 mg/l in Wadi Zaghara. Major component of ions are within the value of Egyptian drinking water standard.

6) Hydrogeological Characteristics of Aquifer

Precambrian rocks are dominant in the basin. Only two (2) dug wells were constructed in the upstream of the Wadi Zaghara. On the one hand, there are several dug well in the Wadi Nasb.

Since the wadi originates near St. Catherine, the annual precipitation is about 60 mm/year. Therefore, the Quaternary Wadi Deposits will receive some amount of recharge from rain and snow precipitated in the center part of Sinai Plateau.

7) Groundwater Extraction

Groundwater in the Wadis Zaghara and Nasb is used for both domestic and irrigation. However, no extraction data is available.

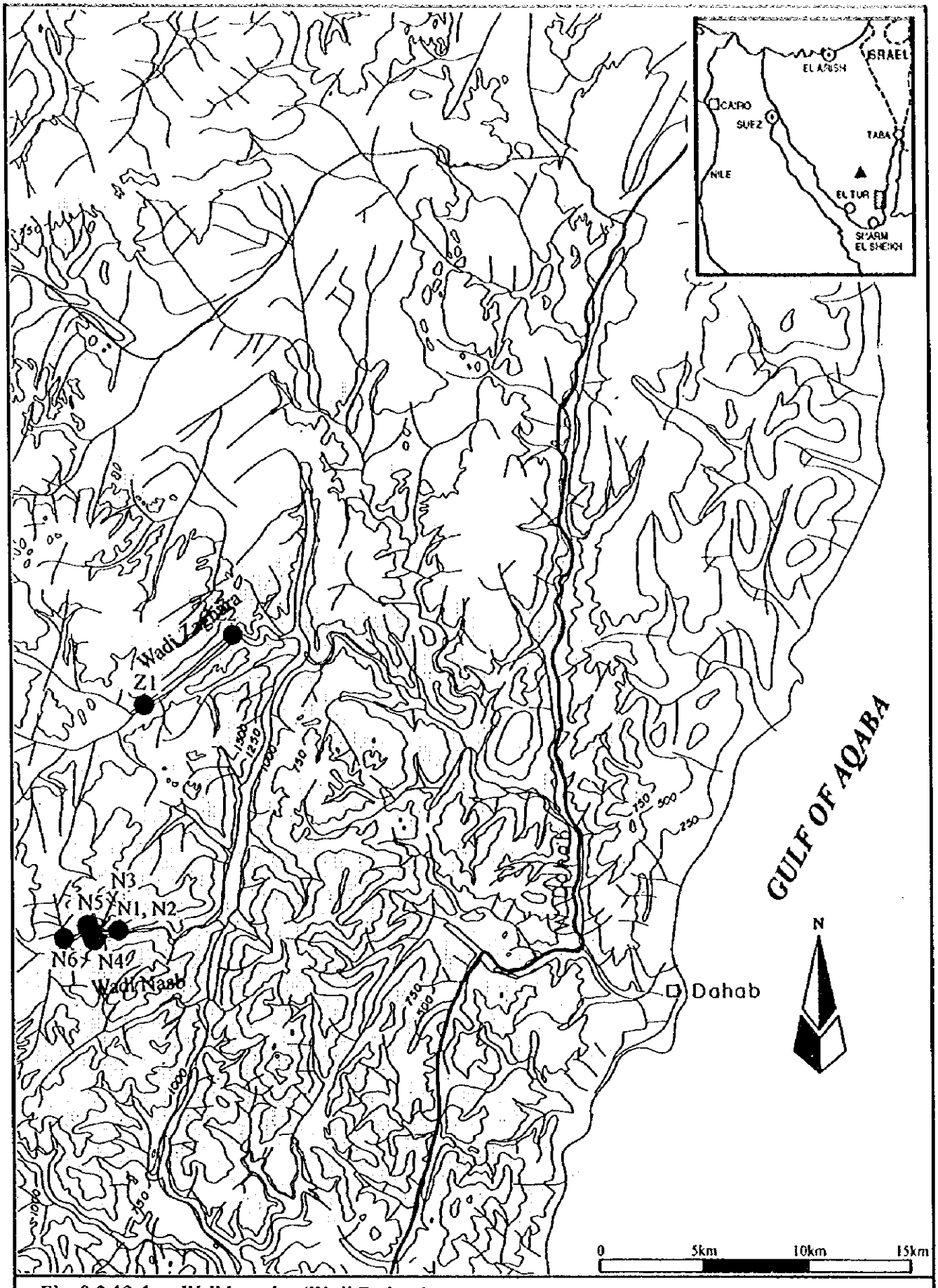

Fig. 8.2.12-1 Well Location (Wadi Zaghara)

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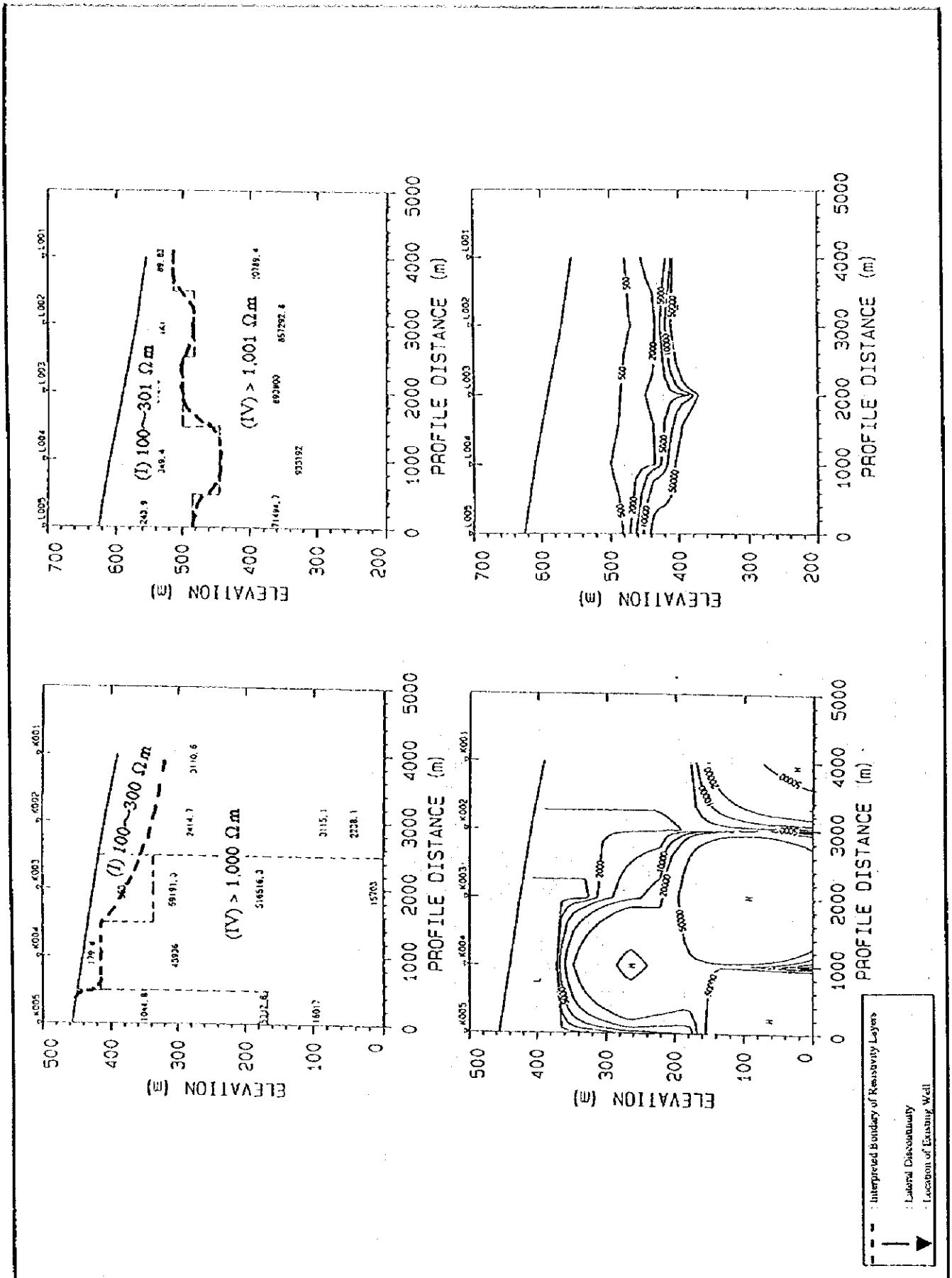

Fig. 8.2.12-2 Geoelectric Profile (Line K and L: W. Zaghara)

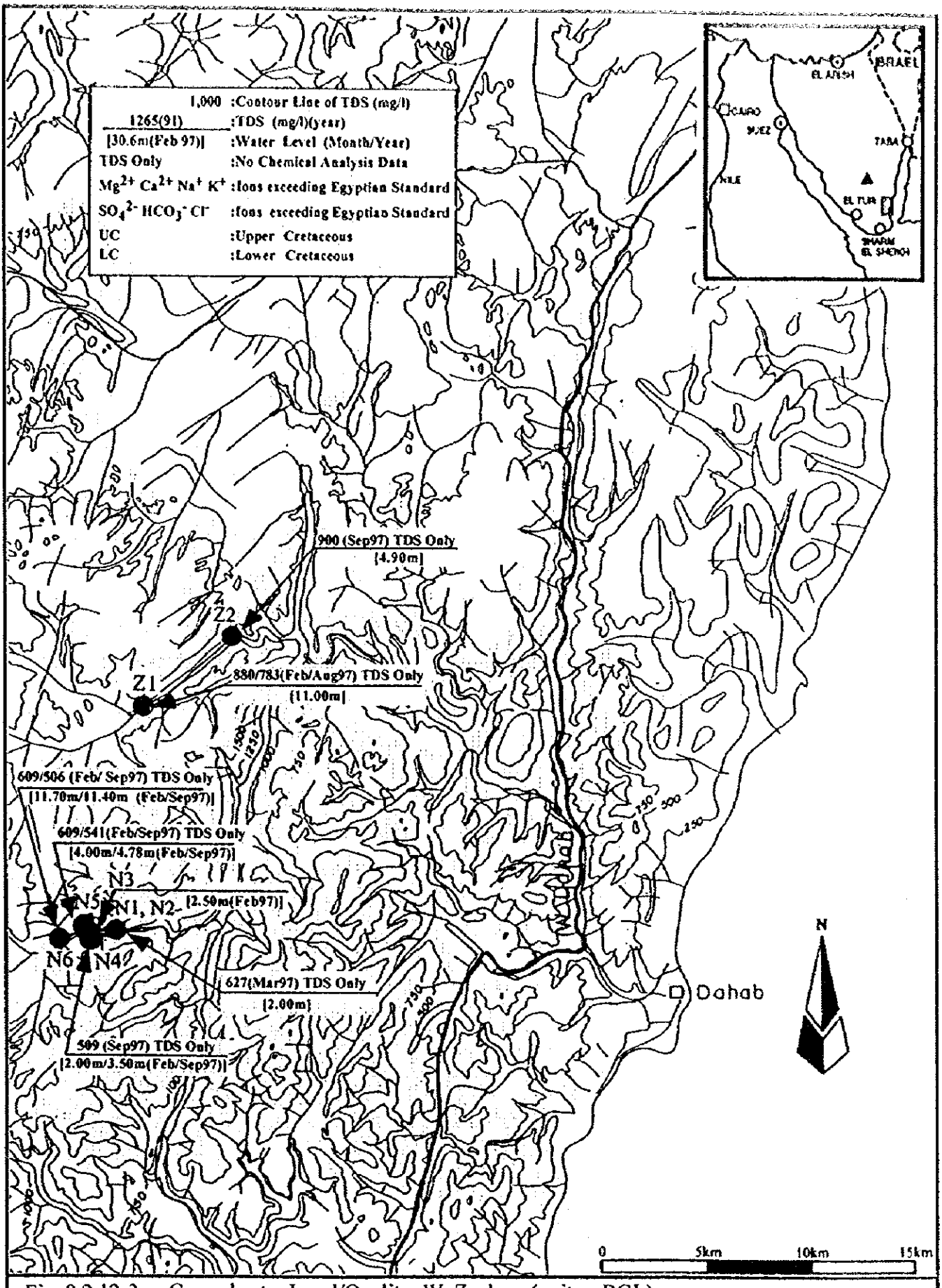

Fig. 8.2.12-3 Groundwater Level/Quality: W. Zaghara (unit: mBGL)

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