

Figure 4.2.4 Interpretation Sections of VES (1/4)

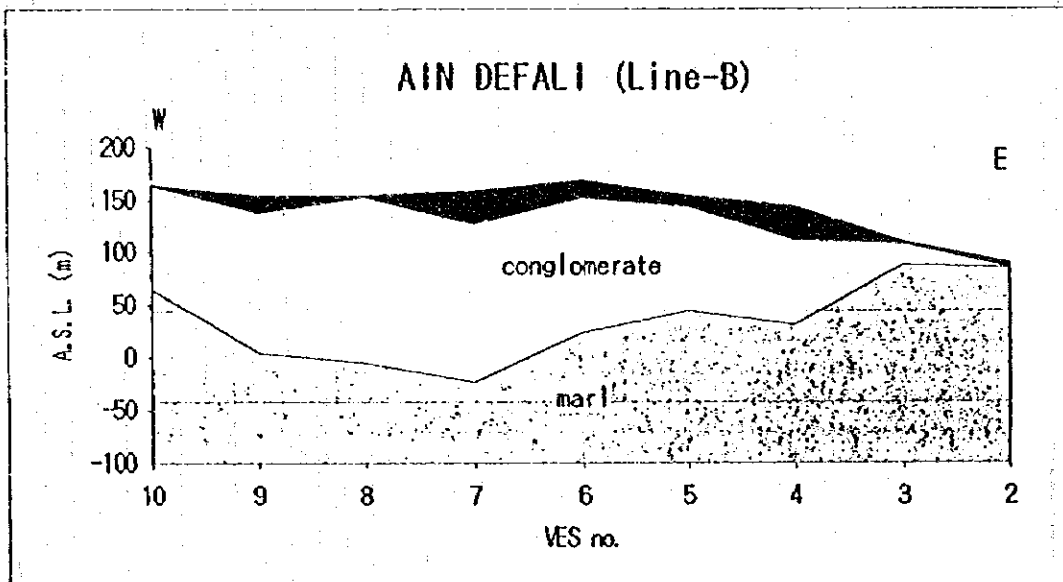
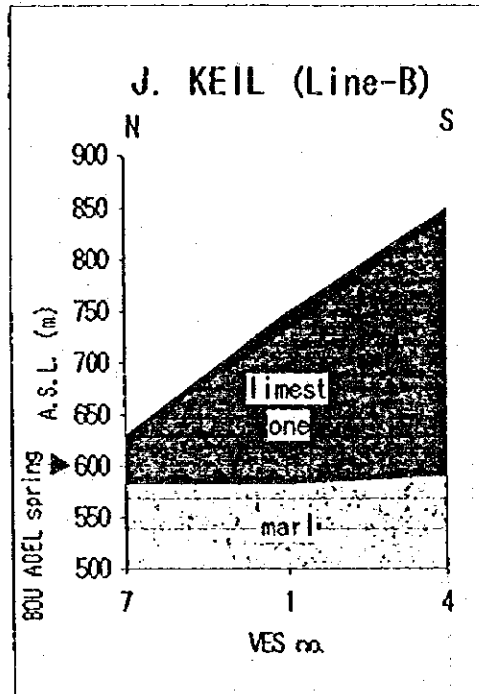


Figure 4.2.4 Interpretation Sections of VES (2/4)

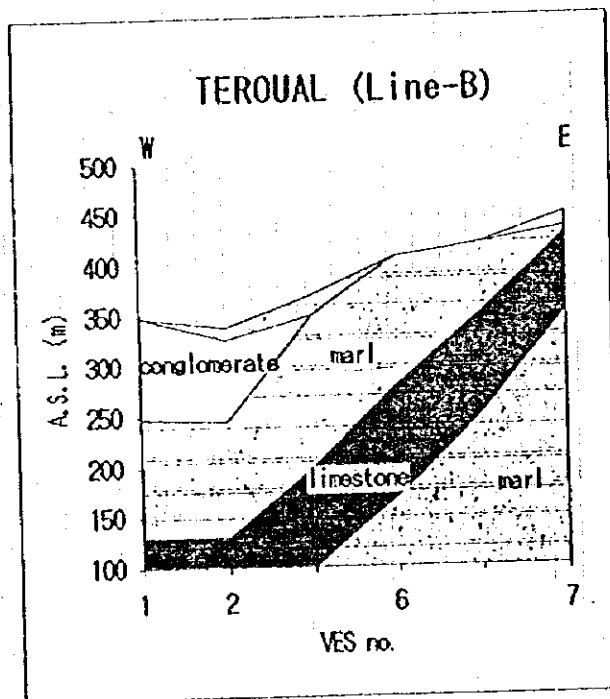
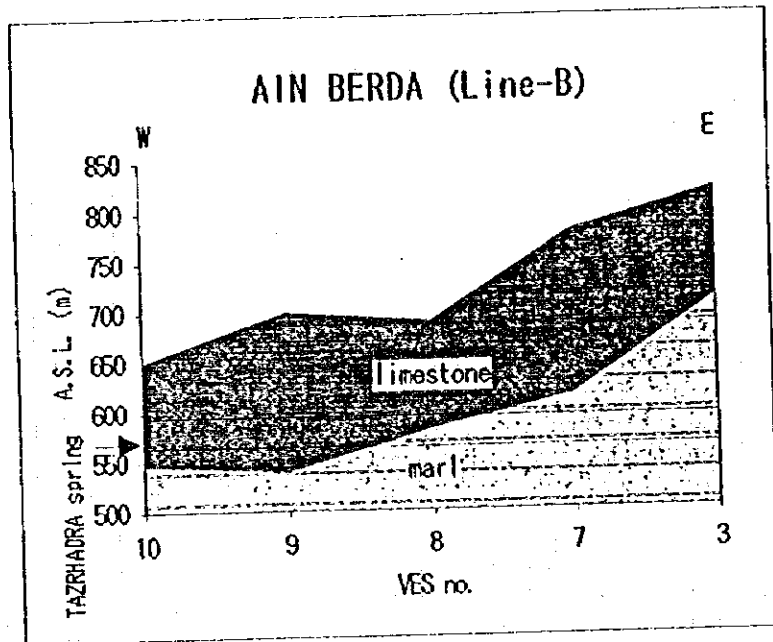


Figure 4.2.4 Interpretation Sections of VES (3/4)

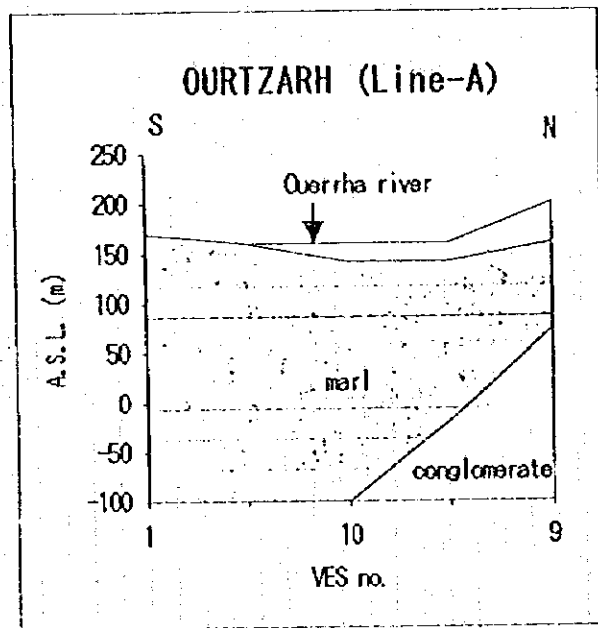
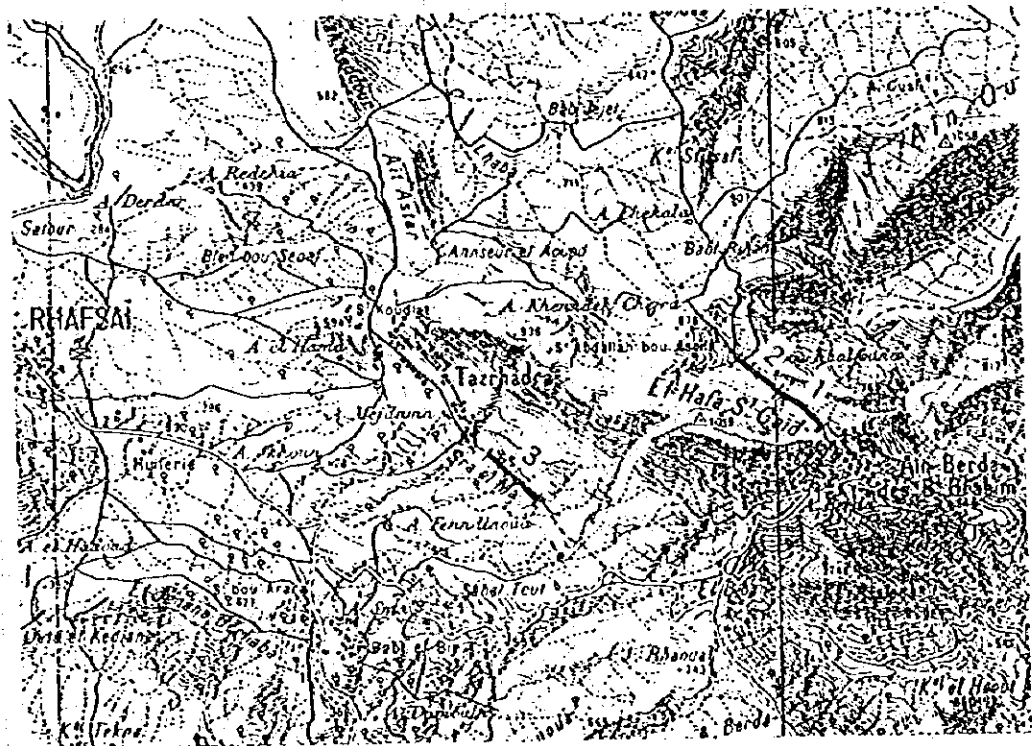


Figure 4.2.4 Interpretation Sections of VES (4/4)



Ain Berda

Figure 4.2.5 Location of Electromagnetic Sounding

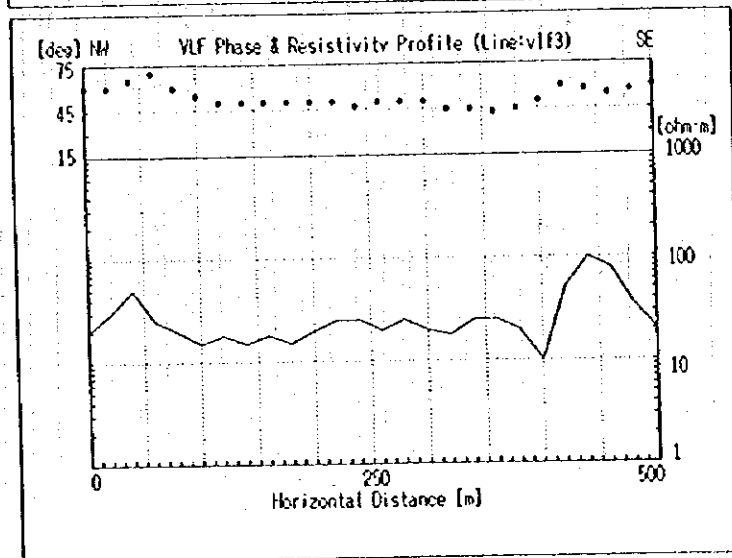
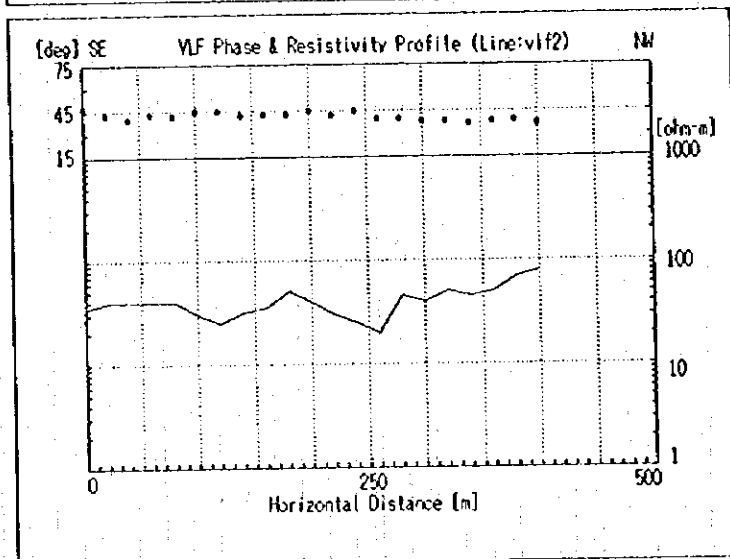
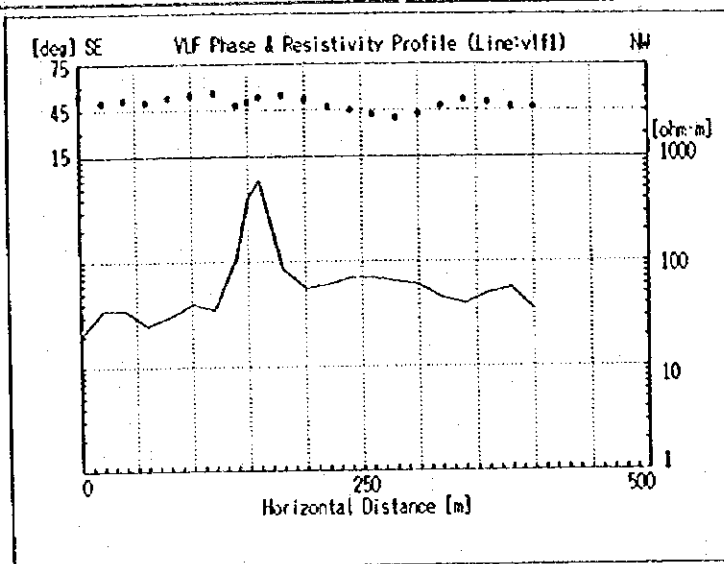


Figure 4.2.6 Resistivity and Phase Angle Profiles

4.3 Inventory of Groundwater Sources

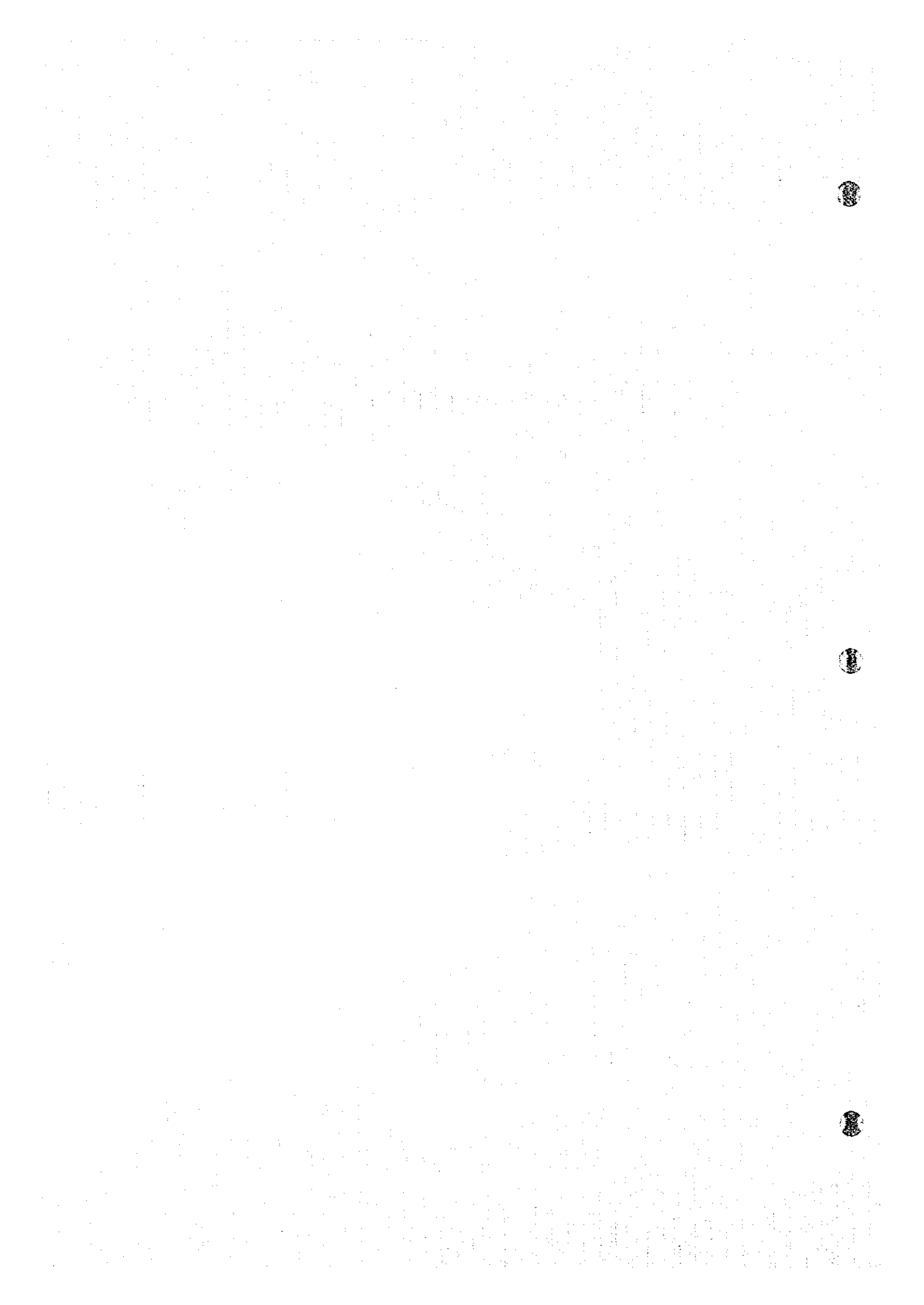


Table 4.3.1 Inventory of Existing Dugholes in the Study Area (1/15)

Reference Map	Dughole N°	Location / Douar	Coordinates			Geological Character			Borehole		Pumping Test	
			X	Y	Z (m)	Geol. Epoch	Lithology	Dia. (m)	Depth (m)	Flow (l/s)	Absolute S.W.L. (m)	
Had Court	IRE 166/8	Ouled Messoud	469,950	451,200	70	Quaternary	Alluvium	1.3	8.1	—	63.00	
	IRE 1998/8	Oulad Noual	470,500	434,500	75	"	"	1.8	7.9	—	71.80	
	IRE 3228/8	El-Aouaoucha	480,050	434,550	103	"	"	1.2	2.98	—	101.00	
	IRE 3229/8	Daff Laghbari	477,700	435,075	115	"	"	1.4	4.65	—	114.80	
	IRE 3047/8	Haddada-Rdat	469,700	444,050	100	"	"	1.7	10	—	92.58	
	IRE 3142/8	Oulad Mousa	472,450	438,300	41	"	"	1.6	4.65	—	39.50	
	IRE 3143/8	Ouled Jellol	470,000	437,500	55	"	"	1.5	2.8	—	53.60	
	IRE 3297/8	Grouna (Naji L.)	453,850	470,275	120	Quaternary	Alluvium	1.25	8.45	—	106.48	
Arbaoua	IRE 3298/8	Grouna (Habach H.)	454,050	470,375	110	"	"	1.15	12.50	—	98.30	
	IRE 3301/8	Grouna (Baira B.)	455,425	471,175	110	"	"	1.80	9.62	—	108.03	
	IRE 3302/8	Grouna (Zeghli M.)	455,225	471,425	120	"	"	1.23	17.62	—	103.08	
	IRE 408/9	Sk.El Thine	489,720	432,340	70	Quaternary	Alluvium	—	18.17	—	55.65	
Khnichete Ouerrha	IRE 409/9	Si El Ameri	489,850	429,100	38	"	"	—	8.10	—	30.25	
	IRE 903/8	Nicoulcant	483,760	429,620	34	"	"	—	6.72	—	28.05	
	IRE 1183/9	Sk.El Thine	489,400	431,500	40	"	"	2.30	2.75	—	37.87	
	IRE 1184/9	Pis.Guerraba	488,850	431,720	38	"	"	2.30	1.20	—	37.35	
	IRE 1186/9	El Fdoul	485,900	431,350	32	"	"	1.80	11.35	—	24.55	
	IRE 1187/9	El Fdoul	486,100	430,900	31	"	"	1.00	9.20	—	23.25	
	IRE 1188/9	El Thine	490,200	429,950	44	"	"	3.00	10.40	—	34.80	
	IRE 1189/9	Dom.El Thine	488,900	430,250	40	"	"	4.00	8.35	—	32.80	
	IRE 1432/9	Bir Chantai	489,800	432,900	60	"	"	1.60	10.00	—	52.20	
	IRE 3133/8	Bahala	469,500	427,250	30	"	"	1.10	16.24	—	15.70	
IRE 3134/8	Bahala	469,000	427,250	50	"	"	1.30	15.80	—	36.15		
	Kariat Douadi	472,750	429,400	40	"	"	1.30	3.30	—	39.80		
	Mhircha	470,660	429,750	85	Quaternary	Alluvium	1.15	1.35	—	84.00		
	El Bachara	471,650	432,800	60	"	"	1.10	2.70	—	59.47		

Table 4.3.1 Inventory of Existing Dugholes in the Study Area (2/15)

Reference Map	Dughole No	Location / Douar	Coordinates			Geological Age & Lithology			Borehole		Pumping Test	
			X	Y	Z (m)	Geol. Epoch	Lithology	Dia. (m)	Depth (m)	Flow (l/s)	Absolute S.W.L. (m)	
Khnichete Ouerrha	IRE 3140/8	Oulad Kadour	470,900	432,500	70	Quaternary	Alluvium	1.20	3.96	—	69.92	
	IRE 3230/8	O. Khraïn (Karia)	475,700	432,250	70	"	"	1.10	12.00	—	58.60	
	IRE 3232/8	O. Bou Abane	478,250	430,750	81	"	"	1.55	9.50	—	72.90	
	IRE 3234/8	Zemmamra	481,050	433,000	80	"	"	1.80	9.60	—	79.40	
	IRE 3236/8	Oulad Ichou	482,600	430,400	46	"	"	0.80	9.30	—	39.00	
	IRE 3238/8	Oulad Ziâne	483,450	430,800	35	Quaternary	Alluvium	0.95	8.15	—	29.05	
Teroual	IRE 3239/8	Sidi Ameur	483,800	430,500	39	"	"	1.05	7.60	—	34.40	
	IRE 3244/8	Rabani Med.	477,000	432,100	32	"	"	1.00	16.40	—	17.95	
	IRE 3246/8	O.Sellam (Karia)	474,450	422,500	30	"	"	0.95	15.40	—	16.70	
	IRE 3249/8	O.Bouazza Touil	472,600	422,150	32	"	"	0.95	14.30	—	20.50	
	IRE 3251/8	Chaouia	476,000	422,850	31	"	"	0.95	14.15	—	18.70	
	IRE 71/9	Gare Mjaara	512,800	442,500	95	Quaternary	Alluvium	1.5	12	—	85.00	
	IRE 657/9	Oued Ouerrha	511,400	443,700	131	"	"	1.4	10.8	—	126.00	
	IRE 658/9	Ain Dourif	509,950	446,000	158	"	"	1.2	5.2	—	147.80	
	IRE 868/9	Sk. Ain Dourij	511,150	443,820	135	"	"	1.8	10.9	1.14	130.60	
	IRE 1210/9	Ain Dourij	510,060	445,720	148	"	"	0.75	8.2	—	140.40	
	IRE 1211/9	Oued Ouerrha	511,830	441,550	98	"	"	1.5	7.2	—	92.80	
	IRE 1212/9	Oued Ouerrha	511,900	441,200	96	"	"	1.5	9.1	—	87.80	
Tamorot	IRE 1214/9	Kharrouba	512,400	444,550	138	Quaternary	Alluvium	—	7.9	Dry	—	
	IRE 1342/9	Oued Ouerrha	511,800	443,600	130	"	"	1.8	22.5	—	118.20	
	IRE 1343/9	Oued Ouerrha	511,600	437,900	81	"	"	1.6	8.2	—	78.90	
	IRE 1344/9	Oued Ouerrha	511,700	437,900	81	"	"	1.6	8.0	—	74.30	
	IRE 1345/9	Oued Ouerrha	512,800	440,500	92	"	"	1.2	9.0	—	86.80	
	IRE 1346/9	Chaab	510,600	438,350	180	"	"	1.5	4.6	—	92.80	
IRE 1369/9	Oued Ouerrha	511,400	438,000	81	"	"	1.6	8.8	—	71.40		

Table 4.3.1 Inventory of Existing Dugholes in the Study Area (3/15)

Reference Map	Dughole No	Location / Douar	Coordinates		Geological Age & Lithology			Borehole		Pumping Test	
			X	Y	Z (m)	Geol. Epoch	Lithology	Dia. (m)	Depth (m)	Flow (l/s)	Absolute S.W.L (m)
Tamorot	IRE 211/9	Chkoui	521,600	420,570	132	Quaternary	Alluvium	1.5	5.25	—	126.70
	IRE 268/9	Hamdou	540,900	463,050	440	"	"	1.6	7.10	—	433.00
	IRE 269/9	Beni Majzoub	451,550	464,070	575	"	"	1.5	10.75	—	564.50
	IRE 272/9	Ratba	542,080	464,640	675	"	"	1.4	10.05	0.08	665.00
	IRE 274/9	Ratba Souk	542,800	464,700	650	"	"	1.7	4.75	0.70	666.70
	IRE 276/9	Ratba	541,900	464,700	605	"	"	1.6	9.5	0.09	595.50
	IRE 1014/9	Taourda	542,240	464,200	625	"	"	0.53	8.5	Dry	—
	IRE 1015/9	M' Fadel Siliam	541,060	463,400	580	"	"	0.7	5.6	—	575.00
	IRE 1016/9	Taourda	542,050	464,200	600	"	"	1.0	8.6	—	591.00
	IRE 1018/9	Bir Kasouai	540,540	463,220	475	"	"	0.93	2.5	0.2	473.00
Bni Ahmed	IRE 1019/9	Harak Ahmed	452,220	462,920	433	Quaternary	Alluvium	1.06	6.8	—	462.40
	IRE 1024/9	Bir Mchaoulin	540,760	463,260	520	"	"	1.1	10.2	—	511.70
	IRE 1028/9	O. Ouerrha	540,150	464,600	375	"	"	1.0	1.78	—	373.60
	IRE 1031/9	O. Ouerrha	540,700	463,900	510	"	"	0.86	3.7	—	508.80
	IRE 1040/9	O. Ouerrha	541,150	465,180	370	"	"	0.6	8.6	—	362.30
	IRE 1047/9	Maisra	541,460	464,850	418	"	"	0.6	5.3	—	415.90
	IRE 1051/9	O. Ouerrha	541,570	463,920	550	"	"	0.7	6.07	—	544.80
	IRE 1054/9	Tayfrah	536,900	563,500	386	"	"	0.75	7.9	—	378.90
	IRE 1058/9	Suirri Med.	535,100	463,320	465	"	"	0.55	13.02	—	454.85
	IRE 1059/9	Daoui A.	534,900	462,960	438	"	"	0.75	5.32	—	435.35
Rhafsai	IRE 1061/9	Zarouti Med.	536,170	461,400	408	"	"	0.60	8.24	—	401.40
	IRE 1062/9	Akhalouf L.A.	536,600	461,800	330	"	"	0.80	11.14	—	319.89
	IRE 1063/9	Boâouad Larbi	535,700	462,230	462	Quaternary	Alluvium	0.60	14.81	—	448.08
	IRE 1065/9	M'Fadel Hmido	535,470	463,750	495	"	"	0.71	9.64	—	486.30
	IRE 1066/9	Aïn Marchili	535,740	463,900	480	"	"	0.56	7.68	—	474.37

Table 4.3.1 Inventory of Existing Dugholes in the Study Area (4/15)

Reference Map	Dughole No	Location / Douar	Coordinates			Geological Age & Litholog			Borehole		Pumping Test	
			X	Y	Z (m)	Geol. Epoch	Lithology	Dia. (m)	Depth (m)	Flow (l/s)	Absolute S.W.L. (m)	
Rhafsai	IRE 1154/9	Abbich Ali B. Med	524,780	461,250	270	Quaternary	Alluvium	0.20	8.65	—	261.40	
	IRE 1156/9	Ben Ahmed Med.	526,330	462,400	505	"	"	1.25	9.50	—	499.10	
	IRE 1157/9	Gharsa Eddafia	526,750	461,760	595	"	"	0.85	16.60	—	578.50	
	IRE 298/9	Rhafsai	544,320	448,040	307	"	"	1.2	3.0	0.05	305.00	
	IRE 523/9	Oulad Ahnia	550,800	435,300	280	"	"	0.9	6.5	0.1	273.50	
	IRE 810/9	Dahmouni	555,180	434,200	231	"	"	1.0	7.5	0.08	224.30	
	IRE 883/9	Dahmouni	550,700	446,450	675	"	"	0.62	5.1	0.09	670.90	
	IRE 884/9	Lahlimi	550,530	446,660	726	"	"	0.82	5.0	1.0	723.00	
	IRE 885/9	Azzabi	550,675	447,450	725	"	"	1.0	2.1	0.8	723.90	
	IRE 806/9	Naamani	557,280	433,850	200	"	"	0.75	5.0	0.3	193.30	
	IRE 820/9	Said	538,780	455,595	488	"	"	1.0	7.4	0.4	484.40	
	IRE 821/9	Dhar Harbi	539,170	455,260	485	"	"	0.5	3.9	0.3	481.90	
	IRE 823/9	El Boujadi	541,335	451,340	440	"	"	1.0	8.1	0.9	723.20	
	IRE 829/9	Hanidou Awar	541,355	451,470	442	"	"	0.8	8.6	0.07	432.70	
	IRE 830/9	D' Rhero	540,680	451,100	370	"	"	0.7	4.9	1.0	366.40	
IRE 832/9	Rhers	540,315	451,095	325	"	"	0.6	5.1	0.8	323.80		
IRE 833/9	Sidi El Bekkali	540,660	453,070	440	"	"	0.8	7.1	0.6	434.90		
Kaala des Sies	IRE 835/9	Bir Ain Azoraz	540,750	453,260	420	Quaternary	Alluvium	0.7	5.2	0.4	416.90	
	IRE 638/9	Faiz Duboz	535,260	438,020	145	"	"	0.6	10.5	0.3	136.60	
	IRE 840/9	Feddán Echouk	540,770	454,030	400	"	"	0.8	5.3	0.08	437.30	
	IRE 841/9	Med. Hdji	540,740	453,920	375	"	"	0.5	5.2	0.3	371.55	
	IRE 861/9	Lamaikra	541,740	448,540	310	"	"	0.9	13.8	1.0	201.00	
	IRE 862/9	Bir Jamâa	541,885	448,360	315	"	"	1.1	6.1	0.7	309.90	
	IRE 896/9	Ben Mouktar	547,000	445,775	405	"	"	0.7	7.5	0.4	398.20	
	IRE 1086/9	Dahbi Med.	547,460	447,450	515	"	"	0.8	14.8	0.2	501.50	
	IRE 1258/15	Bir Zitouni	559,250	411,900	245	"	"	1.2	4.00	—	241.20	
	IRE 1277/15	Bir Ain Tilissa	556,350	412,350	305	"	"	1.3	4.50	—	301.00	

Table 4.3.1 Inventory of Existing Dugholes in the Study Area (S/15)

Reference Map	Dughole No	Location / Douar	Coordinates			Geological Age & Lithology			Borehole		Pumping Test	
			X	Y	Z (m)	Geol. Epoch	Lithology	Dia. (m)	Depth (m)	Flow (l/s)	Absolute S.W.L. (m)	
Kaala des Sles	IRE 1283/15	Bir Msous	555,440	413,860	375	Quaternary	Alluvium	1.2	3.70	—	372.00	
	IRE 1286/15	Ain El Araïss	555,050	411,900	370	"	"	2.0	4.00	—	366.50	
	IRE 1288/15	Bir El Hajja	554,820	414,300	400	"	"	2.1	2.85	—	397.20	
	IRE 1289/15	Bir El Hajja	554,600	414,040	370	"	"	1.4	2.40	—	369.40	
	IRE 1290/15	Bir Ain Mellah	552,970	413,680	360	"	"	1.3	0.90	—	360.00	
	IRE 1291/15	Bir Ain Ahmar	553,200	413,730	400	"	"	1.2	3.10	—	399.60	
	IRE 1295/15	Bir My. Ahmed	553,400	414,500	395	"	"	1.3	5.40	—	391.00	
	IRE 1300/15	Bir Sof	550,780	412,950	420	"	"	1.0	2.00	—	420.00	
	IRE 1301/15	Bir Serij	551,550	412,500	405	"	"	1.4	0.80	—	405.00	
	IRE 1393/15	Bir Ain Safsafa	559,470	414,630	349	"	"	0.9	4.80	—	345.00	
	IRE 2026/15	Kerma- Douhan	558,910	413,800	340	"	"	1.2	4.60	—	335.80	
	IRE 562/15	Bir Ain Kabel	558,750	416,250	248	"	"	1.2	3.60	—	247.80	
	IRE 570/15	Bir Sijt	557,000	418,300	400	"	"	2.00	2.00	—	499.70	
	IRE 571/15	Bir L'Harr	552,950	419,150	325	"	"	2.00	2.00	—	325.00	
	IRE 577/15	Bir Taouai	550,900	419,400	410	"	"	2.00	2.00	—	409.06	
	IRE 592/15	Bir Abdellah	551,700	417,350	295	"	"	2.5	0.4	—	295.00	
	IRE 598/15	Bir Jenan-Daïa	552,000	417,000	325	"	"	2.00	4.00	—	323.00	
	IRE 609/15	Bir Rahai	554,650	416,200	245	"	"	1.7	5.00	—	245.00	
	IRE 610/15	Bir Mimouna	555,300	416,200	275	"	"	1.5	6.00	—	275.00	
	IRE 1391/15	Public Park	568,000	410,350	190	"	"	1.2	6.80	—	186.10	
IRE 1392/15	Bir Mellah	559,470	414,850	292	"	"	1.3	3.80	—	289.00		
IRE 1394/15	Bir Jemâa	558,480	414,300	330	"	"	1.4	6.00	—	325.00		
IRE 1395/15	Bir Ben Zerhoun	558,970	414,150	350	"	"	1.4	4.25	—	346.25		
IRE 581/15	Bir Mouilha	550,050	418,800	338	Cretaceous	Marl. Schist	1.2	4.2	0.5	—	—	
IRE 582/15	Bir L'Mseder	549,400	418,980	365	"	"	2.00	1.5	0.03	—	363.00	
IRE 586/15	Bir L'Fraoua	549,650	418,000	460	Quaternary	Alluvium	2.1	4.6	0.5	—	460.00	
IRE 1229/15	Bir Rioui	550,120	407,600	380	"	"	1.3	3	Dry	—	—	

Table 4.3.1 Inventory of Existing Dugholes in the Study Area (6/15)

Reference Map	Dughole No	Location / Douar	Coordinates		Geological Age & Lithology			Borehole		Pumping Test	
			X	Y	Z (m)	Geol. Epoch	Lithology	Dia. (m)	Depth (m)	Flow (l/s)	Absolute S.W.L. (m)
Kaala des Sics	IRE 1465/ 15	Souk El Oulja	541,120	409,380	115	Quaternary	Alluvium	1.1	7.67	2.5	110.10
	IRE 2749/ 15	Bir O. Yamani	544,800	406,550	124	"	"	1.83	10.85	6.14	117.35
	IRE 2767/ 15	Bir Dardara	540,400	409,500	112	"	"	1.80	6.10	11.03	108.87
	IRE 2768/ 15	Ouljat El Bzidor	538,950	410,250	112	"	"	1.84	7.85	4.93	107.95
	IRE 1236/ 15	O. Mamidou	552,530	408,800	417	"	"	1.2	5.10	—	413.50
	IRE 1267/ 15	Bir Mzoussa	556,500	410,440	390	"	"	—	1.20	Dry	—
	IRE 1268/ 15	Bir O. Hassen	556,370	410,280	405	"	"	1.3	4.30	—	40.10
	IRE 1303/ 15	Bir Kasba	554,420	410,900	380	"	"	0.9	7.10	—	376.20
	IRE 1305/ 15	Bir Jemel	554,900	409,430	260	"	"	1.1	6.00	—	258.00
	IRE 145/ 9	El Biar	558,650	419,500	412	"	"	1.6	1.50	—	411.50
	IRE 155/ 9	Jnenane	550,000	420,750	450	"	"	2.0	0.40	Dry	—
	IRE 160/ 9	L'Annasr	550,050	421,650	305	"	"	2.0	1.3	—	348.00
	IRE 161/ 9	L'Hajra	550,450	422,000	363	"	"	1.1	6	—	362.00
	IRE 162/ 9	Gaada	550,650	421,930	355	"	"	1.2	6	—	355.00
	IRE 164/ 9	Kaaddour	552,000	422,800	435	"	"	2.1	3	—	433.00
IRE 165/ 9	Oulad Hassen	552,300	423,500	395	"	"	1.2	6	—	432.00	
IRE 158/ 9	Dhar Rou Azza	549,850	420,000	515	"	"	1.6	1.8	—	514.20	
Karia Ba Mohamed	IRE 163/ 9	Oued Izar	549,350	423,030	290	Quaternary	Alluvium	—	—	—	288.00
	IRE 527/ 9	Si.Talb Ben Larbi	556,300	432,700	208	"	"	2.1	6.75	—	201.30
	IRE 531/ 9	Fernandez	549,060	432,500	205	"	"	0.9	16.15	—	190.99
	IRE 606/ 9	A. I	539,600	432,500	390	"	"	1.7	2.40	—	389.00
	IRE 644/ 9	Jemmaa Kella	536,900	431,650	280	"	"	1.2	8.85	—	278.70
	IRE 645/ 9	Bir Bourcadya	537,900	431,250	248	"	"	2.0	3.85	—	247.90
	IRE 1425/9	Ain Guettara	555,500	430,000	210	"	"	1.60	14.80	—	195.60
	IRE 85/ 9	Ain Beida	528,000	420,200	220	"	"	1.2	4.20	—	219.10
	IRE 86/ 9	Zitoun-Zouinet	527,150	420,050	155	"	"	1.7	4.30	—	—

Table 4.3.1 Inventory of Existing Dugholes in the Study Area (7/15)

Reference Map	Dughole No	Location / Douar	Coordinates		Geological Age & Lithology		Borehole		Pumping Test		
			X	Y	Z (m)	Geol. Epoch	Lithology	Dia. (m)	Depth (m)	Flow (l/s)	Absolute S.W.L. (m)
Karia Ba Mohamed	IRE 91/9	El Harr	529,280	419,870	235	Quaternary	Alluvium	1.8	2.90	—	235.00
	IRE 179/9	El Altar	524,490	424,820	175	"	"	1.7	1.90	—	173.40
	IRE 181/9	El Harza	526,170	425,350	245	"	"	1.3	2.5	—	7.90
	IRE 185/9	J Did	526,970	425,120	290	"	"	1.3	6.70	—	289.30
	IRE 187/9	Hetek	526,800	424,300	300	"	"	1.8	1.30	—	296.80
	IRE 228/9	Seb El Aïoun	527,000	421,000	210	"	"	1.4	4.00	—	210.00
	IRE 231/9	El Bouair	528,370	424,200	310	"	"	2.0	4.00	—	310.00
	IRE 232/9	Bridia	528,920	423,800	288	"	"	1.9	3.00	—	288.00
	IRE 251/9	Cheikh El Hamrane	525,550	422,800	230	"	"	1.8	4.00	—	230.00
	IRE 212/9	El Klab	522,300	420,380	172	"	"	1.2	6.65	—	165.40
	IRE 215/9	El Arar	523,020	422,170	160	"	"	1.3	4.00	—	166.10
	IRE 217/9	Scm	524,320	421,940	165	"	"	1.3	4.80	—	164.20
	IRE 218/9	Koutbat	524,640	422,150	155	"	"	1.0	3.70	—	153.10
	IRE 1244/9	N. My.Bouchia	524,750	432,700	410	"	"	1.0	3.5	—	40800
	IRE 242/9	El - Harr	532,100	420,570	190	"	"	1.2	6.90	—	187.40
	IRE 246/9	Saddouk	530,500	421,100	225	"	"	1.3	2.80	—	224.20
	IRE 247/9	Chilil	530,470	421,250	220	"	"	1.0	4.30	—	220.00
	IRE 248/9	Ben Aouar	528,930	421,320	200	"	"	1.4	3.50	—	200.00
	IRE 249/9	Oued Abdellah	526,050	422,300	255	"	"	2.0	0.70	—	255.00
	IRE 253/9	El Harr	526,000	423,050	265	"	"	1.8	3.40	—	265.00
IRE 254/9	M'Amer	526,400	422,020	290	"	"	1.2	3.80	—	290.00	
IRE 255/9	El Asiri	526,550	422,920	300	"	"	1.6	6.50	—	298.80	
IRE 256/9	Behou	526,690	422,880	310	"	"	1.2	7.10	—	310.00	
IRE 302/9	Aouina Haddada	533,020	424,180	450	"	"	2.0	0.80	—	—	
IRE 325/9	Souk Had Cheraga	532,820	421,850	278	"	"	1.2	1.2	—	—	
IRE 326/9	Aouina Haddada	532,450	423,170	300	"	"	1.1	0.80	—	299.90	
IRE 203/9	Lalla Fatima	521,280	422,640	187	"	"	—	—	—	—	

Table 4.3.1 Inventory of Existing Dugholes in the Study Area (3/15)

Reference Map	Dughole No	Location / Douar	Coordinates			Geological Age & Litholog			Borehole		Pumping Test	
			X	Y	Z (m)	Geol. Epoch	Lithology	Dia. (m)	Depth (m)	Flow (l/s)	Absolute S.W.L. (m)	
Karia Ba Mohamed	IRE 223/9	Zitoun -Tatani	526,450	422,100	242	Quaternary	Alluvium	1.2	9.20	-	242.00	
	IRE 224/9	Si Abdslam M.	526,400	421,550	220	"	"	1.0	1.10	-	220.00	
	IRE 227/9	Giitheia	526,700	422,300	265	"	"	1.0	7.10	-	259.50	
	IRE 233/9	El Mar (low)	529,700	422,860	260	"	"	1.0	1.00	-	260.00	
	IRE 234/9	El Mar (high)	529,750	422,750	270	"	"	0.9	3.40	-	270.00	
	IRE 235/9	Klia (high)	532,150	422,050	235	"	"	2.0	3.50	-	235.00	
	IRE 236/9	Klia (low)	532,170	421,950	230	"	"	1.0	1.45	-	230.00	
	IRE 239/9	Ouled B. Allal	531,720	421,020	220	"	"	2.0	0.50	-	220.00	
	IRE 240/9	Grehet	531,780	420,880	210	"	"	1.7	3.90	-	210.00	
	IRE 241/9	O. Si Abslem	531,850	420,570	200	"	"	1.1	7.30	-	197.10	
	IRE 252/9	Jaid	525,850	423,000	255	"	"	2.3	4.10	-	253.50	
	IRE 258/9	Ain Zraout	526,620	423,650	330	"	"	2.1	7.40	-	330.00	
	IRE 282/9	Kouk	526,060	427,180	195	"	"	1.2	3.30	-	192.00	
	IRE 285/9	Moulay Bouchta	525,030	427,580	185	"	"	1.1	3.4	-	184.00	
	IRE 286/9	El Mouh	525,880	428,060	190	"	"	1.3	5.60	-	185.00	
	IRE 287/9	Rkaiss	526,900	427,700	240	"	"	1.9	4.30	-	334.80	
	IRE 288/9	Moulay Bouchta	525,220	427,260	166	"	"	2.0	8.00	-	158.50	
	IRE 1428/9	Oulad Mundane	531,900	427,700	340	"	"	1.80	10.30	-	329.80	
	IRE 1434/9	Hamra Ain Beida	528,600	422,930	300	"	"	1.80	16.00	-	287.00	
	IRE 652/15	Bir Hamara (Beida)	514,700	413,930	100	"	"	2.00	0.30	-	100.00	
IRE 660/15	Oued Mellah	522,420	417,670	112	"	"	1.1	7.30	-	110.10		
IRE 1443/15	Thami-Bni Ouhelli	520,050	416,160	88	"	"	1.2	7.10	-	81.15		
IRE 1444/15	Bni Ouhelli	519,860	416,220	85	"	"	2.1	4.80	-	81.00		
IRE 221/15	N° 252	502,350	367,400	585	"	"	0.8	30.50	-	570.40		
IRE 615/15	Rabot	520,570	418,100	135	"	"	2.1	5.40	-	135.00		
IRE 620/15	Rocher 1	520,730	419,010	178	"	"	1.2	3.5	-	7.00		
IRE 621/15	Rocher 2	520,520	419,300	162	"	"	0.7	10.40	-	152.10		

Table 4.3.1 Inventory of Existing Dugholes in the Study Area (9/15)

Reference Map	Dughole No	Location / Douar	Coordinates			Geological Age & Lithology			Borehole		Pumping Test	
			X	Y	Z (m)	Geol. Epoch	Lithology	Dia. (m)	Depth (m)	Flow (l/s)	Absolute S.W.L. (m)	
Karia Ba Mohamed	IRE 662/15	Subtier	520,520	417,980	125	Quaternary	Alluvium	2.0	3.10	—	125.00	
	IRE 623/15	Bir Mjara	518,920	418,780	131	"	"	1.2	6.85	—	124.20	
	IRE 630/15	Bir Matthaidi	514,760	418,320	130	"	"	1.8	2.0	—	130.00	
	IRE 633/15	Bir Oulad Mekki	516,160	417,330	162	"	"	1.2	9.40	—	157.70	
	IRE 636/15	Mzaoura	519,250	417,300	125	"	"	1.1	7.3	—	122.50	
	IRE 638/15	Sabathier	521,080	416,660	100	"	"	1.2	7	—	96.60	
	IRE 639/15	Sabathier	521,180	416,880	106	"	"	2.0	3.40	—	106.00	
	IRE 644/15	Oued Habara	517,210	413,120	110	"	"	1.8	6.10	—	104.00	
	IRE 645/15	Oued Habara I	516,750	413,690	150	"	"	1.7	4.10	—	143.30	
	IRE 646/15	Pont Bertin (signal)	516,690	413,700	149	"	"	1.6	8	—	143.00	
	IRE 648/15	Bir Zaara	515,350	415,350	132	"	"	1.8	6.50	—	131.00	
	IRE 82/9	Jdid Slatam	521,370	419,870	142	"	"	1.2	5.40	—	141.40	
	IRE 83/9	Ben Dours	520,650	420,050	140	"	"	1.7	3.20	—	138.10	
	IRE 84/9	Alalou	520,950	420,450	118	"	"	1.3	2.8	—	147.20	
	IRE 89/9	Jdid	523,980	420,200	200	"	"	1.7	5.90	—	199.50	
IRE 191/9	El Abbas	522,920	423,280	140	"	"	1.2	2.1	—	140.00		
Taounate	IRE 192/9	Oulad Driss	522,420	423,870	165	Quaternary	Alluvium	2.0	2.80	—	165.00	
	IRE 198/9	Melha	521,170	425,200	160	"	"	1.3	2.50	—	159.50	
	IRE 202/9	Tatania	520,660	422,640	165	"	"	2.0	1.10	—	164.60	
	IRE 204/9	El Trick	521,420	422,700	160	"	"	1.2	3.1	—	159.10	
	IRE 207/9	El Biad	521,250	421,820	170	"	"	1.4	5.70	—	164.60	
	IRE 208/9	Dib	520,800	421,370	119	"	"	1.0	2.55	—	116.50	
	IRE 209/9	El Haouane	521,750	420,730	122	"	"	1.3	5.70	—	117.50	
	IRE 210/9	Jdid	521,870	420,520	145	"	"	1.2	6.90	—	139.15	
	IRE 349/9	El Babra	570,750	454,500	790	"	"	1.1	7.00	—	787.70	
IRE 354/9	Zitouna	571,750	447,850	200	"	"	1.6	3.37	—	197.65		

Table 4.3.1 Inventory of Existing Dugholes in the Study Area (10/15)

Reference Map	Dughole No	Location / Douar	Coordinates			Geological Age & Lithology			Borehole		Pumping Test	
			X	Y	Z (m)	Geol. Epoch	Lithology	Dia. (m)	Depth (m)	Flow (l/s)	Absolute S.W.L. (m)	
Taounate	IRE 355/9	B. Haoufa	572,625	448,425	660	Quaternary	Alluvium	1.3	3.60	—	656.95	
	IRE 356/9	Zghimine	571,000	452,500	735	"	"	1.2	6.32	—	731.80	
	IRE 774/9	Markouma 1	572,640	450,725	575	"	"	0.9	5.10	—	572.69	
	IRE 776/9	Markouma 2	572,800	450,750	685	"	"	1.3	2.60	—	683.82	
	IRE 777/9	Markouma 3	572,780	450,580	655	"	"	1.4	4.52	—	650.48	
	IRE 782/9	Miloud Maouzi	571,000	448,800	553	"	"	1.7	3.20	—	552.65	
	IRE 783/9	Driss B. Bar	570,770	447,860	630	"	"	1.6	4.45	—	650.48	
	IRE 1190/9	Zahrine	570,600	453,220	790	"	"	2.00	6.20	—	784.47	
	IRE 1191/9	Taïssi Mohamed	570,500	453,260	805	"	"	0.70	5.80	—	799.75	
	IRE 1192/9	Hrifach Ali	570,570	453,420	825	"	"	1.10	6.80	—	818.55	
	IRE 1194/9	Lamkadour Aïlach	570,550	452,900	780	"	"	1.00	5.50	—	775.70	
	IRE 717/9	Ben EL Mamoun	564,300	442,350	—	"	"	1.2	3.00	—	514.30	
	Tissa	IRE 719/9	Seda	565,900	444,050	—	Quaternary	Alluvium	0.8	9.25	—	354.20
		IRE 762/9	Ahmed Ben Ali	566,300	444,850	—	"	"	1.0	6.92	Dry	—
		IRE 812/9	Hamouni	560,450	433,550	—	"	"	1.3	5.02	—	224.32
		IRE 1195/9	Souk El Khelalfa	570,500	452,750	770	"	"	2.00	6.00	—	764.00
		IRE 1196/9	Souk El Khelalfa	570,550	452,650	780	"	"	1.60	5.50	—	775.75
IRE 1198/9		Teubi Abdeslam	570,800	452,450	735	"	"	1.0	5.40	—	732.30	
IRE 1362/9		Markouma	572,500	450,850	690	"	"	1.1	4.10	—	689.10	
IRE 753/15		Oulad Tahar	575,000	410,450	310	"	"	0.8	5.60	—	308.65	
IRE 758/15		Ben Jilali	577,900	400,550	410	"	"	1.0	5	—	410.00	
IRE 761/15		Mohamed Loukili	575,800	411,000	260	"	"	0.9	10	—	251.50	
IRE 762/15	Sergeant Mohamed	576,020	410,970	305	"	"	1.2	5.45	—	302.75		
IRE 764/15	Rghoui	575,150	410,750	253	"	"	1.2	6.30	—	251.00		
IRE 768/15	Bel Hachmi	574,720	410,850	220	"	"	0.8	10.40	—	217.25		
IRE 769/15	Hayoun	574,650	411,050	219	"	"	1.3	6.80	—	219.00		

Table 43.1 Inventory of Existing Dugholes in the Study Area (11/15)

Reference Map	Dughole No	Location / Douar	Coordinates			Geological Age & Lithology			Borehole		Pumping Test	
			X	Y	Z (m)	Geol. Epoch	Lithology	Dia. (m)	Depth (m)	Flow (l/s)	Absolute S.W.L. (m)	
Tissa	IRE 770/ 15	Loukili	575,425	411,150	240	Quaternary	Alluvium	0.9	9.40	—	231.80	
	IRE 772/ 15	Janati Med. II	568,800	409,750	199	"	"	1.2	6.10	—	194.85	
	IRE 774/ 15	Haj Mekki	568,450	410,450	199	"	"	1.4	4.90	—	194.60	
	IRE 775/ 15	Ben Sedik	560,570	410,250	205	"	"	1.3	5.40	—	200.90	
	IRE 776/ 15	Ben Sedik I	568,300	410,250	191	"	"	1.1	5.15	—	187.00	
	IRE 2037/ 15	Myriam	577,250	418,280	385	"	"	1.2	5	—	382.50	
	IRE 267/ 15	Ahmed Laqhal	569,200	411,100	192	"	"	1.4	2.90	—	189.80	
	IRE 771/ 15	Janati M' Hamed	568,620	409,800	193	"	"	1.2	5.00	—	189.85	
	IRE 773/ 15	Adel Abderrahman	568,580	409,380	187	"	"	1.3	4.80	—	185.60	
	IRE 1315/ 15	Bir Nekhia Hajra	569,350	413,350	242	"	"	2.0	2.60	—	242.00	
	IRE 1317/ 15	Bir Khriba	570,790	413,540	310	"	"	1.7	3.10	—	308.00	
	IRE 1319/ 15	Bir Ain Safsaf	572,470	413,700	350	"	"	1.1	4.10	—	348.00	
	IRE 1328/ 15	Bir Bel Abbas	575,240	414,280	390	"	"	1.2	4.70	—	389.40	
	IRE 1330/ 15	Bir Ahra	575,280	414,870	380	"	"	0.9	2.90	—	379.30	
	IRE 1398/ 15	Tissa-Aval	569,980	408,780	176	"	"	0.8	6.85	—	169.75	
	IRE 1496/ 15	Ahra II	575,260	414,900	385	"	"	2.1	4.80	—	384.20	
	IRE 1497/ 15	Bourar	573,590	413,260	382	"	"	2.2	4.5	—	379.90	
	IRE 1240/ 15	El Mennzel	562,850	408,200	173	"	"	0.8	9.25	—	166.65	
	IRE 1250/ 15	Ouader	562,900	411,200	290	"	"	1.2	5.10	—	285.20	
	IRE 1253/ 15	Bir Zreri	562,400	411,500	310	"	"	1.1	6.00	—	304.60	
IRE 1307/ 15	Bir Kbib	566,400	413,850	238	"	"	1.3	3.60	—	236.00		
IRE 1344/ 15	B. Ain Mourouj	563,870	413,900	370	"	"	0.9	4.20	—	390.00		
IRE 1370/ 15	Bir A. Magmarane	562,400	414,050	435	"	"	0.9	5.20	—	421.80		
IRE 1371/ 15	Bir Oulad Allal	562,760	413,950	370	"	"	1.0	3.30	—	367.30		
IRE 1372/ 15	Bir Harsa Ouled Allal	562,740	413,770	395	"	"	1.2	5.50	—	393.20		
IRE 1378/ 15	Bir Jemaa	563,260	413,650	280	"	"	0.8	9.80	—	274.10		
IRE 1382/ 15	Blanc-Ferne	565,750	416,080	250	"	"	1.0	8.60	—	235.05		

Table 4.3.1 Inventory of Existing Dugholes in the Study Area (12/15)

Reference Map	Dughole N°	Location / Douar	Coordinates		Geological Age & Lithology			Borehole		Pumping Test	
			X	Y	Z (m)	Geol. Epoch	Lithology	Dia. (m)	Depth (m)	Flow (l/s)	Absolute S.W.L (m)
Tissa	IRE 1384/15	Bir Ain El Haj	566,340	411,600	305	Quaternary	Alluvium	1.2	6.34	—	303.15
	IRE 126/9	Haj Arimouka	563,250	423,650	365	"	"	1.2	7.5	—	364.00
	IRE 127/9	L'Aouina	562,650	423,650	350	"	"	1.3	6	—	—
	IRE 129/9	El Kef	562,100	424,400	320	"	"	1.8	2	—	319.00
	IRE 1371/9	Zrizar	571,400	443,500	350	"	"	1.9	3.10	—	347.90
	IRE 1372/9	Ben Halal	542,500	433,200	500	"	"	2.0	4.00	—	497.60
	IRE 373/9	Salah B. Houmada	561,200	430,000	250	"	"	1.4	7.20	—	243.00
	IRE 374/9	Gljoun	560,500	430,800	250	"	"	1.3	5.95	—	244.00
	IRE 376/9	Oued Kaddour	563,600	427,550	250	"	"	1.2	7.30	—	243.80
	IRE 378/9	T. P	564,500	428,000	243	"	"	1.4	11.65	—	234.25
	IRE 390/9	Mehdi Bentahar	563,900	429,300	310	"	"	1.1	3.35	—	306.75
	IRE 394/9	Jilali Oulad Arbia	566,460	431,700	240.50	"	"	1.2	4.65	—	236.75
	IRE 94/9	Fure Pacally	572,360	429,320	313	"	"	0.7	16.85	—	290.00
	IRE 397/9	Aiachi Ben Med.	571,000	431,700	258	"	"	1.3	4.15	—	254.05
	IRE 388/9	Bouchta Madani	577,300	432,440	340	"	"	1.2	4.05	—	337.00
	IRE 1217/9	Oued	564,700	428,800	230	"	"	0.9	4.0	—	228.00
	IRE 1229/9	Ain Aicha	566,900	431,100	242	"	"	0.8	10.80	—	238.00
	IRE 1316/9	Ain Aicha	565,600	429,400	238	"	"	2.0	8.49	—	236.00
	IRE 1474/9	ONEP Ain Aicha	568,350	431,150	250	"	"	2.0	9.30	—	244.70
	IRE 1245/9	Karia Ba Mohamed	524,700	432,450	375	"	"	1.50	12	—	373.00
IRE 1246/9	Karia Ba Mohamed	524,700	432,440	372	"	"	1.50	8	—	372.00	
IRE 1247/9	Taounate (P1)	571,950	439,350	305	"	"	2.00	17.05	—	300.40	
IRE 1361/9	El Khalfa	571,500	452,975	680	"	"	1.2	11.30	—	678.10	
IRE 507/15	Bir Si Daoud	564,850	418,850	340	"	"	2.0	0.30	—	—	
IRE 560/15	Bir Mehich	561,850	419,500	320	"	"	1.8	1.70	—	—	
IRE 561/15	Bir Foukania	561,750	419,400	328	"	"	1.7	4.00	—	—	
IRE 2035/15	Aouina	565,540	417,920	335	"	"	1.2	3.00	—	—	

Table 4.3.1 Inventory of Existing Dugholes in the Study Area (13/15)

Reference Map	Dughole No	Location / Douar	Coordinates		Geological Age & Litholog			Borehole		Pumping Test		
			X	Y	Z (m)	Geol. Epoch	Lithology	Dia. (m)	Depth (m)	Flow (l/s)	Absolute S.W.L. (m)	
Tissa	IRE 1353/15	Bir Mtalsa	564,700	417,950	340	Quaternary	Alluvium	1.4	3.40	—	348.20	
	IRE 1363/9	O. Haj Hmidou	563,850	424,675	350	"	"	1.4	4.30	—	522.58	
	IRE 140/15	O. Haj Hmidou	490,300	366,750	538	"	"	1.2	20.70	—	221.00	
	IRE 733/15	Charef Med.	576,950	413,750	240	"	"	1.8	1.9	—	233.79	
	IRE 734/15	Med. Ben Tahar	576,900	413,600	235	"	"	2.0	4.90	—	228.00	
	IRE 735/15	Ben El Hanafi	575,700	412,350	230	"	"	2.1	4.45	—	244.65	
	IRE 736/15	Ben Amara	577,000	413,680	250	"	"	1.8	6.90	—	262.60	
	IRE 738/15	Med. Douich I	577,300	413,500	270	"	"	1.8	8.3	—	254.40	
	IRE 739/15	Med. Douich II	577,170	413,650	255	"	"	2.0	4.30	—	295.80	
	IRE 740/15	Douar Bratla	577,500	413,850	300	"	"	1.7	6.40	—	220.45	
	IRE 741/15	Haj Krioiat	577,350	414,250	238	"	"	0.7	18.10	—	230.00	
	IRE 742/15	Driss B' Lahcen	577,300	414,400	230	"	"	1.2	2.10	—	—	
	Tafrant Ouerrha	IRE 743/15	Abdelkader	578,050	414,450	270	Quaternary	Alluvium	1.1	7.50	—	264.40
		IRE 744/15	Douar Bratla	577,880	414,300	300	"	"	2.0	2.10	—	297.90
IRE 745/15		Ben Ayad	577,550	414,450	230	"	"	1.8	3.15	—	228.40	
IRE 748/15		A. Ben Messoud	577,400	411,900	250	"	"	1.2	6.50	—	247.75	
IRE 750/15		Driss Krioiat	578,330	412,380	—	"	"	0.2	18.55	—	373.80	
IRE 751/15		Sfira Factory I	577,960	411,750	240	"	"	2.0	3.45	—	237.55	
IRE 752/15		Sfira Factory II	577,950	411,600	245	"	"	1.8	3.50	—	241.15	
IRE 592/9		Si Med. Khribech	519,200	447,150	140	"	"	1.4	2.15	—	138.25	
IRE 603/9		Khadija B. Larbi	514,600	448,800	350	"	"	1.5	5.60	—	347.55	
IRE 1104/9		Bir Med. Trezo	522,380	444,570	110	"	"	1.20	6.30	—	104.90	
IRE 1331/9	Ain Bouissa	517,750	454,900	400	"	"	1.5	7.50	—	442.75		
IRE 1064/9	Amezri	535,700	460,560	575	"	"	0.75	3.13	—	573.48		
IRE 1087/9	Bir d'Eljabba	524,300	448,040	120	"	"	0.80	4.40	—	116.80		
IRE 1088/9	Bir Aoudour	523,700	447,320	117.50	"	"	1.85	6.12	—	113.20		

Table 4.3.1 Inventory of Existing Dugholes in the Study Area (14/15)

Reference Map	Dughole No	Location / Douar	Coordinates			Geological Age & Lithology			Borehole		Pumping Test	
			X	Y	Z (m)	Geol. Epoch	Lithology	Dia. (m)	Depth (m)	Flow (l/s)	Absolute S.W.L. (m)	
Tafrant Oucerrha	IRE 1089/9	Bir Med.El Kouchi	527,200	451,700	174	Quaternary	Alluvium	1.03	4.75	—	170.90	
	IRE 1091/9	Bir Ahmed Kouchi	527,800	451,350	178	"	"	0.75	6.90	—	172.49	
	IRE 1092/9	Bir S. A. Ben Tahar	528,760	450,700	410	"	"	0.93	7.95	—	403.55	
	IRE 1098/9	Bir A. Ben Lahssan	527,100	448,260	147	"	"	0.90	7.15	—	140.50	
	IRE 1108/9	Bir Ahamri Srijja	520,500	444,500	115	"	"	1.23	5.79	—	109.95	
	IRE 1112/9	Bir Abdelouared	524,280	449,910	290	"	"	0.90	9.87	—	280.82	
	IRE 1153/9	A. Med. Benslam	524,140	460,630	190	"	"	0.84	7.50	—	182.80	
	IRE 1168/9	M'Fadci O. Lahcen	531,800	458,040	460	"	"	0.60	5.00	—	456.20	
	IRE 1174/9	Bir El Tahti	527,020	459,480	280	"	"	0.80	3.40	—	277.70	
	IRE 1175/9	Si Med. B. Ali Hadj	528,100	459,050	350	"	"	1.20	2.80	—	248.70	
	IRE 1178/9	Jamâa El Messaf	528,260	457,380	443	"	"	0.83	30.55	—	412.90	
	IRE 1181/9	Benchrif Lahcen de	525,740	458,510	177	"	"	0.80	6.13	—	171.12	
	IRE 1331/9	Ain Bouissa	517,750	454,900	450	"	"	1.2	7.50	—	442.75	
	IRE 33/9	P/S Aoudour	524,100	447,350	127	"	"	—	10.10	0.5	2.05	
IRE 544/9	Maj Ahmed	528,250	444,200	380	"	"	—	6.40	Dry	373.80		
IRE 546/9	Jamâa Beni Kissane	527,750	444,500	300	"	"	—	9.30	Dry	291.30		
IRE 550/9	A. Ben. Bouchta	513,900	443,400	99	"	"	—	2.90	Salty	97.10		
IRE 551/9	A. Abdeslam Caïdi	514,300	443,550	101	"	"	—	5.70	Dry	96.75		
Beni Frassene	IRE 553/9	Bir Mouilka	517,850	442,950	115	Quaternary	Alluvium	—	1.10	Dry	114.10	
	IRE 562/9	Khmar B. Mourad	515,100	445,150	98	"	"	—	7.75	Dry	90.80	
	IRE 563/9	Jemâa Aoula	514,050	444,750	103	"	"	—	7.60	Dry	95.80	
	IRE 572/9	Ahmed Ben Tahir	524,200	449,250	265	"	"	—	5.15	"	260.10	
	IRE 582/9	Oulad M Fidal	520,150	444,600	140	"	"	—	4.75	Dry	155.30	
	IRE 584/9	Oulad My. Ahmed	521,400	445,250	135	"	"	—	3.85	"	133.00	
	IRE 548/16	Souk Telata	590,720	407,000	495	"	"	0.7	5	—	493.00	
	IRE 562/21	Oued El Kell	452,350	358,800	162	"	"	0.8	3	Dry	—	

Table 4.3.1 Inventory of Existing Dugholes in the Study Area (15/15)

Reference Map	Dughole No	Location / Douar	Coordinates		Geological Age & Lithology			Borehole		Pumping Test	
			X	Y	Z (m)	Geol. Epoch	Lithology	Dia. (m)	Depth (m)	Flow (l/s)	Absolute S.W.L. (m)
Beni Frassene	IRE 575/16	Bab Charane	594,840	411,470	573	Quaternary	Alluvium	0.4	5.85	"	779.00
	IRE 581/16	Bir Zaïm	596,215	412,340	787	"	"	0.5	10.41	"	771.90
	IRE 582/16	Bir Abdeslam	596,360	412,290	775	"	"	0.7	6.28	"	717.80
	IRE 583/16	Sidi ben Allal	593,510	412,520	723	"	"	0.8	5.91	"	416.50
	IRE 625/16	Had Oulad	599,340	410,080	420	"	"	1.0	6.14	"	
Taher Souk	IRE 626/16	Had O. Zbaïr	599,450	410,300	424	Quaternary	Alluvium	1.30	8.00	"	418.85
	IRE 627/16	O. Zbaïr School	599,380	410,520	424	"	"	1.00	9.00	0.7	428.70
	IRE 629/16	Had Oulad Zbaïr	599,450	419,295	424	"	"	1.30	17.56	0.6	418.00
	IRE 635/16	Had O. Zbaïr Center	599,328	410,075	420	"	"	1.80	13.50	1.0	"
	IRE 1/10	Tahar Souk	602,200	451,200	492	"	"	1.8	14.45	"	"
Taineste	IRE 35/10	P.T.T	603,000	451,000	503	"	"	2.0	7	"	496.50
	IRE 38/10	Boured	603,000	462,000	500	Quaternary	Alluvium	1.6	7.1	14	442.50
	IRE 49/10	Beni Oulid	590,410	441,900	455	"	"	1.0	14	"	534.50
	IRE 73/10	Tahar Souk	602,600	451,600	499	"	"	1.1	7.35	"	"
	IRE 79/10	S. Abder. School	594,500	449,150	540	"	"	1.2	7.40	"	"
	IRE 202/10	Ziama 2	589,850	443,600	420	"	"	2	6.0	"	"
	IRE 206/10	Louta Aïn Ziama	589,800	444,150	375	"	"	1.1	14.40	Dry	362.41
	IRE 214/10	Ramnioui Med.	589,290	442,000	660	"	"	0.70	5.15	"	655.10
	IRE 233/10	Souk El Trine	592,090	448,100	432	"	"	1.3	4.2	"	430.20
	IRE 746/15	Lazrak	577,250	414,850	229	"	"	1.1	8.85	"	224.00
	IRE 747/10	Taghzouti	577,050	414,700	225	"	"	1.3	6.35	"	221.80
	IRE 749/15	Ben Hamad	577,900	412,800	300	"	"	1.2	5.40	"	298.80

Table 4.3.2 Inventory of Existing Wells in the Study Area (1/5)

Reference Map	Well No	Location	Coordinates			Geological Age & Lithology		Drilling		Casing		Pumping Test		Transmissivity m ² /s (x 1/1,000)
			X	Y	Z	Geol. Epoch	Lithology	Size (inch)	Depth (m)	Size (inch)	Depth (m)	Flowrate (l/s)	Absolute S.W.L. (m)	
Had Kourt	IRE 1750/8	L'Oued Rdat	470,200	439,000	30	Quaternary	Alluvium Deposits	17.5	21	--	--	--	--	--
	IRE 1751/8	Dr. Launaza	469,600	437,600	50	"	Fluvial Deposits	17.5	17	--	--	--	--	--
	IRE 1456/9	Ain Defali	485,850	444,550	122	"	Alluvium Deposits	7	28	5	26	2	97.2	0.05
	IRE 1458/9	Ain Defali	486,650	444,450	100	"	"	6	"	--	--	Dry	82.1	--
	IRE 1459/9	Ain Defali	487,300	443,850	85	"	Fluvial Deposits	6	"	--	--	Dry	82.1	--
Teroual	IRE 1452/9	Teroual	511,600	452,700	420	Miocene +	Marl	12	52	7	52	11.38	402.2	50
	IRE 1453/9	Teroual	511,450	452,450	470	Oligocene	Siltstone	6.5	52-82	--	--	1.5	403.3	--
	IRE 1465/9	Sidi Redouane	495,350	453,950	195	Oligocene	Siltstone	6.5	100	--	--	Dry	192.4	--
	IRE 1466/9	Sidi Redouane	495,100	454,550	200	Cretaceous	Marlstone	6	54	--	--	"	197.7	--
	IRE 1467/9	Sidi Redouane	495,400	454,800	215	Jurassic +	Limestone	6	54	--	--	"	207.3	--
Khenichet	IRE 1468/9	Sidi Redouane	495,550	453,700	200	Cretaceous	Marlstone	6	54	--	--	"	207.3	--
	IRE 1461/9	Jorf El Melha	490,050	432,650	70	Quaternary	Recent Alluv. Deposits	6	15.50	--	--	Dry	--	--
	IRE 1462/9	Jorf El Melha	489,600	432,000	80	"	"	6	17	--	--	"	--	--
	IRE 1463/9	Jorf El Melha	488,750	431,550	35	"	"	6	20	4	16	2.8	30.30	3.5
	IRE 1464/9	Jorf El Melha	489,950	429,700	37	"	Fluvial Deposits	8	22	6	21	10	29.16	0.55
Arbaoua	IRE 1911/8	Trine Srafi	454,750	466,550	150	Quaternary	Alluvium Deposits	7	37	--	--	2	145.7	--
	IRE 1514/8	Sidi Bou Jamaa	467,215	421,834	27	Quaternary	Alluvium Deposits	7	28	--	--	--	21	--
	IRE 1515/8	Sidi Bou Jamaa	467,294	421,879	26	"	"	--	27	--	--	Dry	12.7	--
	IRE 1516/8	Dr. Bou Tabet	465,575	423,335	25	"	"	16	50	--	--	--	12.7	--
	IRE 1732	Dr. Zri Ouid	460,700	429,000	21	"	"	13.75	22	8	17	0.6	13	--

Table 4.3.2 Inventory of Existing Wells in the Study Area (2/5)

Reference Map	Well No	Location	Coordinates			Geological Ages & Lithology		Drilling		Casing		Pumping Test Flowrate (Us)	Pumping Test Absolute S.W.L (m)	Transmissivity m ² /s (x 10,000)
			X	Y	Z	Geol. Epoch	Lithology	Size (inch)	Depth (m)	Size (inch)	Depth (m)			
Karda Ba Mohamed	IRE 2154/15	SO 414	534,970	410,970	111	Quaternary + Eocene	Alluvium Deposits + Marly limestone & Marl	6	21	--	--	Dry	--	--
	IRE 2155/15	SO 413	534,072	410,908	109	"	"	8	12	6	0-12	"	--	--
	IRE 2156/15	SO 412	533,994	410,846	105	"	"	6	23	6	12-23	0.5	100.8	--
	IRE 2157/15	SO 411	533,913	410,786	104	"	"	6	13-32	6	5.8	0.3	102	--
	IRE 2158/15	SO 410	534,200	410,750	104	"	"	6	5.8-178	6	9	0.3	101.60	--
	IRE 2159/15	SO 409	534,297	410,828	113.50	"	"	6	9-33	6	29	Dry	103.40	--
	IRE 2160/15	SO 408	534,216	410,767	105.5	"	"	6	16.2	--	--	--	103	--
	IRE 2161/15	SO 407	534,138	410,705	105.5	"	"	6	11.4	6	11.4	--	101.85	--
	IRE 2162/15	SO 406	534,058	410,623	104.5	"	"	6	11.4-40	6	7.2	--	101.10	--
	IRE 2163/15	SO 405	534,980	410,582	103	"	"	6	7-19	--	--	--	99.7	--
	IRE 1230/9	Bouchabel	535,400	419,900	180	"	"	5	19-25	--	--	--	--	--
	IRE 1231/9	Bouchabel	535,000	420,200	160	"	"	6	89.5	--	--	--	--	--
	IRE 1232/9	Bouchabel	535,000	420,300	160	"	"	6	9.7	--	--	1.0	154.25	--
	IRE 1269/9	Well of Moulay Bouchta	524,190	432,125	330	Jurassic (Jm)	Schist	6	8	--	--	Dry	--	--
	IRE 1478/9	Dolle's Farm	532,250	381,000	384.73	Quaternary	Alluvium Deposits	5	51.7	--	--	0.5	383.3	--
	IRE 2164/9	SO 404	534,390	410,666	105	Quaternary + Eocene	Alluvium Deposits and Marl	5	20	--	--	Dry	--	--
	IRE 2165/9	SO 403	534,308	410,592	105	"	"	5	39	--	--	--	--	--
IRE 2166/9	SO 402	534,240	410,526	102	"	"	8	13	6	17	0.5	101.3	--	
IRE 2167/9	SO 401	534,132	410,410	102	"	"	6	13-32	6	5.8	Dry	--	--	
							6	5.8-18	6	5.8	Dry	--	--	

Table 4.3.2 Inventory of Existing Wells in the Study Area (3/5)

Reference Map	Well No	Location	Coordinates			Geological Age & Lithology		Drilling		Casing		Pumping Test		Transmissivity m ² /s (x 10,000)
			X	Y	Z	Geol. Epoch	Lithology	Size (inch)	Depth (m)	Flowrate (l/s)	Absolute S.W.L. (m)			
												Size (inch)	Depth (m)	
Kalaas des Sites	IRE 2474/15	Bouarous	551,150	419,350	390	Oligocene	Silty Marl	7	29	-	-	-	-	
	IRE 2475/15	Bouarous	552,400	418,700	270	-	-	6	19	-	-	-	-	
Tafraint Ouerguha	IRE 665/9	Tafraint SO 1	527,190	449,765	132	Quaternary	Fluvial Deposits	10	30	-	131.70	-	-	
	IRE 702/9	My.Bouchta OR 2	518,650	446,750	142	Quaternary + Miocene	Fluvial Deposits & Marl	6	400	-	-	-	-	
Fes East	IRE 1266/9	Amergou	525,500	433,180	460	Cretaceous	Marlstone	7	41	-	-	-	-	
	IRE 1267/9	Abdaous	527,200	433,300	360	"	"	6.5	23	-	-	-	-	
	IRE 1268/9	Jebel Amergou	524,200	433,179	450	Jurassic (Jm)	Schiste + Marl	6.5	56	-	-	-	-	
	IRE 1270/9	Khenmedek El Hamoura	532,825	441,800	144	Oligocene	Silty Marl & Siltstone	6.5	25	-	-	-	-	
	IRE 1844/15	Koudiat El Kherba kraa	555,755	401,566	324	Quaternary + Cretaceous	Alluvium Deposits Marlstone & Schist	7	20	-	-	-	-	
Rhaissal	IRE 1841/15	Koudiat El Kherba kraa	555,583	401,441	314	"	"	7	15	-	-	-	-	
	IRE 1842/15	Koudiat El Kherba kraa	555,610	401,373	324	"	"	7	14	-	-	-	-	
	IRE 675/9	Ourtzagh S.R.D.1	540,531	437,540	170	Quaternary	Fluvial Deposits	10	40	-	-	-	-	
	IRE 676/9	Ourtzagh S.R.D.1	540,260	437,798	228	"	"	10	50	-	192	-	-	
	IRE 677/9	Ourtzagh S.R.G. 1	540,734	437,524	159	"	"	10	81	-	-	-	-	
Rhaissal	IRE 678/9	Ourtzagh S.R.G. 2	540,947	437,140	228	Quaternary + Miocene	Fluvial Deposits Marl	10	160	-	-	-	-	
	IRE 679/9	Ourtzagh S.E.C. 1	540,258	437,491	194	Quaternary	Fluvial Deposits	10	38	-	-	-	-	
	IRE 680/9	Ourtzagh S.E.C. 2	540,258	437,491	194	"	"	10	40	-	-	-	-	
	IRE 681/9	Ourtzagh S.E.C. 3	540,207	437,271	169	"	"	10	30	-	-	-	-	
	IRE 682/9	Ourtzagh S.E.C. 4	540,150	436,981	150	"	"	10	52	-	-	-	-	
	IRE 683/9	Ourtzagh S.B.A.M.1	540,771	437,625	141	"	"	10	18	-	-	-	-	
IRE 684/9	Ourtzagh S.B.A.M.2	540,790	437,618	141	"	"	10	20	-	-	-	-		

Table 4.3.2 Inventory of Existing Wells in the Study Area (4/5)

Reference Map	Well No	Location	Coordinates			Geological Age & Lithology		Drilling		Casing		Pumping Test		Transmissivity m ² /s (x 1/1,000)
			X	Y	Z	Geol. Epoch	Lithology	Size (inch)	Depth (m)	Size (inch)	Depth (m)	Flowrate (l/s)	Absolute S.W.L. (m)	
Rhaifal	IRE 685/9	Ourtzagh S.B.A.M.3	540,812	437,595	141	Quaternary	Fluvial Deposits	10	21	--	--	Dry	--	--
	IRE 686/9	Ourtzagh S.O. 1	540,660	437,411	141	"	"	10	30	--	--	"	--	--
	IRE 687/9	Ourtzagh S.O. 2	540,614	437,402	141	"	"	10	18	--	--	"	--	--
	IRE 688/9	Ourtzagh S.O. 3	540,644	437,438	140	"	"	10	15	--	--	"	--	--
	IRE 689/9	Ourtzagh S.O. 4	540,646	437,368	140	"	"	10	18	--	--	"	--	--
	IRE 690/9	Ourtzagh S.O. 5	540,683	437,405	141	"	"	10	20	--	--	"	--	--
	IRE 691/9	Ourtzagh S.O. 6	540,208	437,531	141	"	"	10	16	--	--	"	--	--
	IRE 692/9	Ourtzagh S.O. 7	540,729	437,520	140	"	"	10	21	--	--	"	--	--
	IRE 693/9	Ourtzagh S.O. 8	540,738	437,486	141	"	"	10	16	--	--	"	--	--
	IRE 694/9	Ourtzagh S.O. 9	540,544	437,318	141	"	"	10	16	--	--	"	--	--
	IRE 695/9	Ourtzagh S.O. 10	540,545	437,304	141	"	"	10	15	--	--	"	--	--
	IRE 696/9	Ourtzagh S.O. 11	540,567	437,284	141	"	"	10	19	--	--	"	--	--
	IRE 697/9	Ourtzagh S.B.A.V. 1	540,402	437,185	140	"	"	10	20	--	--	"	--	--
	IRE 698/9	Ourtzagh S.B.A.V. 2	540,424	437,159	140	"	"	10	26	--	--	"	--	--
	IRE 699/9	Ourtzagh S.B.A.V. 3	540,455	437,130	140	"	"	10	25	--	--	"	--	--
	IRE 700/9	Ourtzagh O.R.I	540,300	437,350	190	Miocene	Marl + Conglomerates	9	250	--	--	2.5	180	--
	IRE 1256/9	Ain Berda	550,660	446,925	140	Cretaceous	Schist & Marl	6	48	--	--	Dry	--	--
	IRE 1257/9	Ain Berda	550,660	446,700	120	"	"	6	52	--	--	"	--	--
	IRE 1258/9	Souk El Had	545,750	449,750	230	Miocene	Marl	6	8	--	--	"	--	--
	IRE 1259/9	Rhaifa	546,420	446,800	360	Cretaceous	Schist & Marl	6	22	--	--	"	--	--
IRE 1261/9	Ourtzagh	540,050	437,600	220	Miocene	Marl	6	90	--	--	"	--	--	
IRE 1262/9	Ourtzagh	538,000	438,500	200	"	"	6	28	--	--	"	--	--	
IRE 1276/9	El Oulij	543,625	449,525	200	"	"	7	56	--	--	"	196.5	--	
IRE 1277/9	Bab Tseesa	554,750	433,425	218	Quaternary	Fluvial Deposits	7	13	--	--	"	206	--	
IRE 1279/9	Si Hmed Chirsaone	540,350	437,250	160	"	"	6	70	--	--	"	148	--	

Table 4.3.2 Inventory of Existing Wells in the Study Area (5/5)

Reference Map	Well No	Location	Coordinates			Geological Age & Lithology		Drilling		Casing		Pumping Test		Transmissivity m ² /s (x 1/1,000)	
			X	Y	Z	Geol. Epoch	Lithology	Size (inch)	Depth (m)	Size (inch)	Depth (m)	Flowrate (l/s)	Pumping Test		
													Absolute S.W.L. (m)		---
Ribaftal	IRE 1280/9	Si Hamed Chitaoune	540,500	437,600	160	Quaternary + Cretaceous	Fluvial Deposits and Marlstone	7	68	---	---	---	---	---	
	IRE 1281/9	Izarra	540,350	437,150	155	"	"	7	81	---	---	---	---	---	
	IRE 1283/9	Izarra	540,600	437,275	150	"	"	7	50	---	0.2	139	---	---	
	IRE 1284/9	El Klia	542,750	438,300	158	Quaternary	Fluvial Deposits	7	13	---	1.5	---	---	---	
	IRE 1285/9	Kat Sadir Sebte	545,350	449,650	210	Miocene	Marl	7	49	---	Dry	---	---	---	
	IRE 1286/9	Khabara	549,950	453,700	225	Quaternary + Cretaceous	Fluvial Deposits and Marlstone	7	22	---	---	---	---	---	
Matmata	IRE 691/16	Of Inaouene S1	582,650	393,550	215	Quaternary	Fluvial Deposits	6	11.2	---	Dry	---	---	---	
	IRE 692/16	Of Inaouene S2	582,650	393,550	215	"	"	6	7.30	---	---	---	---	---	
	IRE 693/16	Of Inaouene S3	582,650	393,550	215	"	"	6	7.30	---	---	---	---	---	
	IRE 694/16	Of Inaouene S4	582,650	393,550	215	"	"	6	12	---	---	---	---	---	
Tasounate	IRE 362/9	Bridge of Sra S.R.D.1	572,500	442,000	315	Quaternary + Miocene	Alluvium and Conglomerates	6	49	---	Dry	---	---	---	
	IRE 363/9	Bridge of Sra S.O.2	573,000	442,000	306	"	"	6	38	---	---	---	---	---	
	IRE 364/9	Bridge of Sra S.O.3	573,000	442,000	306	"	"	6	38.6	---	---	---	---	---	
	IRE 365/9	Bridge of Sra S.O.4	573,000	442,000	306	"	"	6	9.1	---	---	---	---	---	
	IRE 366/9	Bridge of Sra S.O.1	573,000	442,000	306	"	"	6	35.5	---	---	---	---	---	
	IRE 367/9	Bab Ouender R.D.1	579,400	440,000	285	Jurassic (Jm)	Schist + Marl	6	80	---	---	---	---	---	
	IRE 368/9	Bab Ouender R.D.2	579,430	440,330	285	"	"	6	40.5	---	---	---	---	---	
	IRE 369/9	Bab Ouender R.D.3	579,400	440,000	285	"	"	6	70	---	---	---	---	---	
	IRE 370/9	Bab Ouender R.G.1	579,400	440,000	285	"	"	6	60	---	---	---	---	---	
	IRE 371/9	Bab Ouender S.O.1	579,400	440,000	285	"	"	6	30	---	---	---	---	---	
	IRE 372/9	Bab Ouender S.O.2	579,400	440,000	285	"	"	6	20	---	---	---	---	---	
	IRE 1236/9	Bouhouda	577,950	444,400	510	Oligocene	Silty Marl & Siltstone	6	50	---	---	---	---	---	
	IRE 1237/9	Bouhouda	577,950	444,000	480	"	"	6	7.5	---	---	---	---	---	
	IRE 1254/9	Bouhouda	578,950	447,100	780	"	"	6	24	---	---	---	---	---	
IRE 1255/9	Khemia Zruzer	571,900	443,310	330	Miocene	Marl	6	17	---	---	---	---	---		
IRE 1278/9	Well of Ain Medjouna	578,375	433,600	440	"	"	7	41	---	---	---	---	---		

Table 4.3.3 Inventory of Existing Springs in the Study Area (1/10)

Reference Map	Spring N°	Spring's Name	Coordinates			Flowrate (l/s)	Residue at 180°C
			X	Y	Z		
Arbaoua	IRE 3290/8	Aïn Addoul	456450	469350	120	---	---
Ouezane	IRE 1335/9	Ksil	489,000	467,950	300	0.2	---
	IRE 1999/8	Beroual	472,650	461,100	380	0.2	---
	IRE 3002/8	Beida	468,200	471,850	270	0.8	---
	IRE 3001/8	Jouaaba	468,450	472,050	265	0.5	---
	IRE 3006/8	Guissa	470,400	464,950	400	1.0	---
	IRE 3004/8	Tatra	471,050	466,500	300	0.5	---
	IRE 3005/8	Tamaa	472,000	466,350	325	0.1	---
	IRE 3006/8	Hamra	471,900	466,200	345	Dry	---
	Khenichet Ouergha	IRE 1185/9	Aïn Guerraba	488,780	431,850	38	0.2
IRE 3045/8		Aïn Lalla Rquia	475,250	431,950	70	0.1	---
IRE 3046/8		Aïn Djemaâ	477,450	430,800	70	0.1	---
Teroual	IRE 75/9	Oued - Ouerrha	511,800	442,800	110	0.5	494
	IRE 656/9	Oued - Ouerrha	511,450	444,250	130	0.2	558
	IRE 659/9	Aïn Berkrouch	507,650	448,200	180	0.7	1316
	IRE 660/9	Ouedi Ouerrha	507,650	448,600	195	0.4	1348
	IRE 661/9	Aïn Boughlil	507,700	449,000	225	0.1	1140
	IRE 662/9	Aïn Mejdamine	512,150	452,200	500	1.0	---
	IRE 663/9	Aïn Teroual (Caid)	511,300	452,650	400	30	---
	IRE 1213/9	Aïn Ansar El Mgazline	512,580	446,780	110	Dry	---
Teroual	IRE 1317/9	Aïn Ouarrada	501,100	443,150	318	0.2	---
	IRE 1318/9	Aïn Adouia	505,200	440,800	360	Dry	---
	IRE 1319/9	Oued Ouerrha	504,900	440,450	370	0.1	---
	IRE 1322/9	Aïn Zrarak	506,475	438,000	210	0.1	---
	IRE 1323/9	Aïn Ouanana	503,625	450,200	320	Dry	---
	IRE 1324/9	Aïn El Hafa	503,650	449,900	420	0.7	---
	IRE 1332/9	Aïn Bardi	490,600	455,750	268	0.2	---
	IRE 1333/9	Aïn Batbar	501,200	455,000	360	0.1	---
	IRE 1334/9	Aïn Kaitoune	501,075	455,200	385	0.9	---
	IRE 1336/9	Aïn Rdat	492,750	460,000	335	0.1	---
	IRE 1337/9	Aïn El Anasser	495,600	452,450	208	0.2	---
	IRE 1338/9	Aïn Jhof	495,550	452,150	185	0.1	---
	IRE 1339/9	Aïn El Kbir	498,100	451,600	200	0.2	---
	IRE 1340/9	Aïn El Chak	498,150	451,350	200	0.1	---
	IRE 1351/9	Aïn Bouazza	513,350	448,230	380	0.4	---
	IRE 1352/9	Aïn Lahouaouss	506,000	450,000	355	0.3	---
IRE 1353/9	Aïn Touila	503,550	441,200	310	0.5	---	
IRE 1354/9	Aïn Sidi Bou Sber	503,500	440,250	270	3.2	---	
Oulad Issa	IRE 1216/15	Allal Ben Hasul	491,250	413,300	60	0.5	1027
	IRE 1217/15	Sebou (Pumping station)	490,620	413,380	35	0.3	640
	IRE 2327/15	Aïn Flah	509,240	406,720	185	0.7	---
	IRE 2330/15	Aïn Balda	511,100	406,700	140	0.1	---
	IRE 2331/15	Aïn Bernoussi	510,640	407,350	80	0.7	---
Tamorot	IRE 266/9	A. Nazla	540,800	461,600	340	0.01	500
	IRE 267/9	Bled Rieud	541,150	462,800	510	0.1	295
	IRE 273/9	Bel Haj	542,550	464,800	580	0.05	525
	IRE 275/9	Daoua	542,800	463,800	550	0.07	470
	IRE 277/9	Aouina	541,750	463,870	475	0.53	600
	IRE 1017/9	M'mayala	450,550	463,360	510	0.08	---
	IRE 1020/9	Aïn Boublal	539,870	463,240	405	0.05	---
	IRE 1021/9	Oulad Si Moh	539,950	463,360	425	0.07	---
	IRE 1022/9	Aïn Agharday	539,900	463,600	410	0.03	---
	IRE 1023/9	Aïn Leânina	539,620	464,040	375	0.07	---

Table 4.3.3 Inventory of Existing Springs in the Study Area (2/10)

Reference Map	Spring N°	Spring's Name	Coordinates			Flowrate (l/s)	Residue at 180°C
			X	Y	Z		
Tamorot	IRE 1023/9	Aïn Laïnina	539,620	464,040	375	0.07	---
	IRE 1025/9	Aïn Assemhoun Gachor	540,370	463,320	470	0.09	---
	IRE 1026/9	Aïn Alazrane	540,300	463,100	440	0.07	---
	IRE 1027/9	Aïras El Henna	539,980	465,320	290	0.83	---
	IRE 1029/9	Aïn Fouah Abdeslam	540,280	464,680	415	0.07	---
	IRE 1030/9	Aïn Stetah M'Hamed	540,380	464,420	400	0.09	---
	IRE 1035/9	Aïn Louisa Hadj	541,160	464,300	500	0.07	---
	IRE 1037/9	Aïn d'Amakkou	542,370	466,530	365	0.07	---
	IRE 1038/9	Aïn Messaoud B. Saïd	542,200	466,680	398	0.07	---
	IRE 1041/9	Aïn Tamzaghourt	542,060	465,750	385	0.02	---
	IRE 1050/9	Aïn Boulima	541,340	463,950	520	0.07	---
	IRE 1067/9	Aïn Azlaf	538,270	464,320	300	0.25	---
	Rhafsaf	IRE 53/9	Rhafsai	544,450	447,920	335	0.1
IRE 54/9		Rhafsai	544,720	447,770	335	0.057	436
IRE 55/9		Karrouba Cadi	544,960	447,560	342	0.25	474
IRE 56/9		Cadi Aoal	544,960	447,500	360	0.18	330
IRE 60/9		Aïn Taourda	539,750	440,380	300	0.9	490
IRE 263/9		Fendlaoua	547,270	446,500	450	1.8	320
---		Aïn Berda	551,100	446,500	---	0.23	---
IRE 265/9		Merteb	548,600	446,320	590	1.11	220
IRE 267/9		Bled Rieud	541,150	462,800	510	0.1	295
IRE 327/9		Ghabri	547,180	447,360	480	4	---
---		Aïn Tzghadra	547,800	447,500	---	8.1	---
IRE 328/9		Mijab	547,400	447,200	506	0.6	---
IRE 329/9		Aouina l'Hadri	546,800	446,920	426	0.1	---
IRE 330/9		Ksour	546,980	446,540	394	2	---
IRE 331/9		Ansarcoucha	546,780	445,740	360	0.01	---
IRE 332/9		Jnane Bou Ghaba	546,300	446,280	378	0.6	---
IRE 334/9		Smia	547,140	446,020	423	1.6	---
IRE 502/9		Mohamed Hammadi	558,700	434,700	240	Dry	280
IRE 503/9		Aïn Alssa	557,980	434,220	208	0.1	520
IRE 505/9		Driss B. Abdellah	558,040	433,800	205	Dry	500
IRE 506/9		Aïn Chott	557,060	433,880	200	0.08	240
IRE 507/9		Aïn Hanni	555,660	433,700	222	1.0	480
IRE 508/9		Aïn Karma	555,240	434,300	248	0.25	540
IRE 509/9		Aïn Bebet	554,680	433,760	223	0.5	320
IRE 510/9		Aïn Boumerriem	554,220	434,100	220	0.3	---
IRE 511/9		Khandek Alssaoua	552,900	434,100	210	0.5	460
IRE 512/9		Aïn Bab El Arba	554,000	435,200	245	0.09	120
IRE 513/9		Aïoun	554,040	437,480	210	0.4	400
IRE 514/9		Aïn Galaz	554,640	438,500	255	0.09	1500
IRE 515/9		Aïn Bab El Had	554,060	439,600	290	0.1	660
IRE 516/9		Aïn Berri	555,220	439,120	215	0.09	280
IRE 517/9		Aïoun Taouati	556,040	439,300	250	Dry	380
IRE 518/9		Aïn Bouzabel	556,200	439,140	238	0.09	---
IRE 519/9		Aïn Seïd	556,800	439,800	340	0.1	180
IRE 521/9		Aïn Zouhar	552,300	434,700	189	5	540
IRE 522/9		Oued Amzez	551,600	434,200	180	2	1860
IRE 532/9		Aïn Cherrouf	548,120	432,580	195	1.2	540
IRE 533/9		Aïn Dagla	545,660	434,920	172	0.7	400
IRE 534/9		Aïoun Beni Ficrane	545,500	433,900	215	2	---
IRE 535/9		Aïn Chafra	543,750	436,500	200	Dry	500
IRE 536/9	Aïn Zena	539,020	435,020	158	0.09	420	
IRE 537/9	Aïn Mizab	539,600	440,040	350	1.7	540	
IRE 605/9	Aïn Bouchta	540,200	436,000	220	2	550	
IRE 640/9	Aïn Reïd	536,860	438,160	150	0.2	220	
IRE 641/9	Aïn Achbel	540,100	436,200	235	0.1	981	
IRE 654/9	Aïn Damna	541,950	435,600	580	0.8	330	

Table 4.3.3 Inventory of Existing Springs in the Study Area (3/10)

Reference Map	Spring N°	Spring's Name	Coordinates			Flowrate (l/s)	Residue at 180°C
			X	Y	Z		
Rhafsai	IRE 655/9	Aïn Sefia	541,080	434,600	400	0.6	1082
	IRE 792/9	Zorrat Sghira	552,470	433,360	190	0.95	---
	IRE 793/9	Aïn Msrz	554,650	433,450	220	0.07	---
	IRE 794/9	Aïn Bouirat	558,000	435,360	225	0.1	---
	IRE 795/9	Aïn Berria	557,450	434,780	223	1	---
	IRE 796/9	Ben Haouari	556,900	435,470	263	0.5	---
	IRE 798/9	Ansar El Hiat	545,080	448,120	242	0.07	---
	IRE 799/9	Aïn Rhodane	543,700	447,040	270	0.15	---
	IRE 800/9	Aïn Hioual	544,000	446,970	345	0.1	---
	IRE 815/9	Aïn Bachtouli	542,540	453,740	285	0.07	---
	IRE 817/9	Aïn Jamâa	547,760	452,725	412	0.07	---
	IRE 818/9	Aïn Njir	538,610	455,285	438	0.07	---
	IRE 819/9	Aïn Wintir	538,800	455,150	435	0.07	---
	IRE 822/9	Aïn Mounkhas	539,235	454,860	455	0.07	---
	IRE 824/9	Aïn Sefia	541,720	451,515	375	0.07	---
	IRE 825/9	Aïn Daroua	541,635	451,550	390	0.07	---
	IRE 826/9	Aïn Hailouf	541,550	451,740	417	0.07	---
	IRE 827/9	Aïn Lâarmena	542,720	451,635	335	0.07	---
	IRE 828/9	Aïn El Houari	541,140	450,980	390	0.07	---
	IRE 831/9	Aïn El Batma	540,480	451,090	340	0.09	---
	IRE 836/9	Aïn Azorar	540,650	453,280	430	0.07	---
	IRE 837/9	Aïn Tablia I	541,100	454,655	342	0.1	---
	IRE 838/9	Aïn Tablia II	541,040	454,750	342	0.1	---
	IRE 839/9	Aïn Ansar Ouled Malek	540,640	454,590	358	0.07	---
	IRE 843/9	Aïn Koudiat Sebâa	540,540	453,680	410	0.07	---
	IRE 844/9	Aïn B'eria El Rhars	540,360	453,700	435	0.07	---
	IRE 845/9	Aïn Bhirat El Moukhtar	541,080	453,425	340	0.09	---
	IRE 846/9	Aïn Faraji	540,385	449,270	310	2	---
	IRE 847/9	Aïn El Ferricha	540,220	449,210	336	0.1	---
	IRE 848/9	Aïn Dro	540,220	449,540	290	0.25	---
	IRE 849/9	Aïn Jir	540,285	449,360	295	0.05	---
	IRE 850/9	Aïn El Mtamar	540,130	449,730	260	0.07	---
	IRE 851/9	Aïn Mellaha	540,075	449,860	265	0.07	---
	IRE 852/9	Aïn M'riaj	540,470	448,960	350	0.07	---
	IRE 853/9	Aïn Hakma	540,610	449,070	318	0.5	---
	IRE 857/9	Aïn Ksab	541,300	447,265	450	0.09	---
	IRE 864/9	Aïn Arhyor	544,800	451,680	320	0.09	---
	IRE 865/9	Aïn Arhyor II	544,700	451,580	310	0.09	---
	IRE 866/9	Aïn Dling	543,255	453,850	238	0.09	---
	IRE 881/9	Caid Ali	550,300	446,575	760	0.07	---
IRE 882/9	Khat Aïssa	550,900	446,524	665	0.15	---	
IRE 890/9	Aïn Boumezdi	549,625	446,425	730	0.02	---	
IRE 892/9	Aïn Roual Ch'irge	549,050	444,800	625	0.10	---	
IRE 893/9	Aïn Sfar	550,040	445,320	585	0.04	---	
IRE 894/9	Aïn Zerouani	547,325	446,025	440	0.05	---	
IRE 898/9	Aïn Bouhsain	547,125	445,560	390	0.02	---	
IRE 1001/9	Aïn Bou R'sak	551,260	446,630	610	0.01	---	
IRE 1003/9	Aïn Lahjar	551,930	446,240	550	0.1	---	
IRE 1005/9	Aïn Sidi Ahmed	552,640	445,580	470	0.07	---	
IRE 1007/9	Aïn Tolba	552,700	445,700	435	0.01	---	
IRE 1009/9	Aïn Hammer	553,200	445,950	350	0.25	---	
IRE 1027/9	Aâros El Henna	539,980	465,320	290	0.83	---	
IRE 1041/9	Aïn Tamzaghrouit	542,750	465,750	385	0.02	---	
IRE 1067/9	Aïn Azlaf	538,270	464,320	300	0.25	---	
---	Aïn Bou Hassan	541,000	337,900	---	0.01	---	
---	Aïn El Demna	540,800	337,500	---	0.08	---	
---	Aïn El Haddada	541,400	337,200	---	0.01	---	
---	Aïn El Sakhra	540,500	337,200	---	0.03	---	

Table 4.3.3 Inventory of Existing Springs in the Study Area (4/10)

Reference Map	Spring N°	Spring's Name	Coordinates			Flowrate (l/s)	Residue at 180°C
			X	Y	Z		
Karia Ba Mohamed	IRE 87/9	Jeloul	524,500	419,950	200	0.003	---
	IRE 177/9	El Khatat (High)	524,920	425,130	185	0.005	---
	IRE 178/9	Sedra	525,150	424,550	235	0.007	---
	IRE 180/9	Beniaoun	524,480	424,400	195	0.1	---
	IRE 182/9	Kerma	527,850	425,540	360	0.035	---
	IRE 184/9	El Aouina	526,800	425,300	280	0.02	---
	IRE 257/9	Zraout	526,900	423,650	350	0.01	---
	IRE 283/9	House on the side of the road	525,400	427,320	170	0.006	5395
	IRE 193/9	Harrou	522,660	424,520	170	0.001	---
	IRE 194/9	El Hara	522,550	425,400	205	0.002	---
	IRE 195/9	Kerma	522,000	425,600	200	0.012	---
	IRE 197/9	Bissara	521,640	425,500	220	0.013	---
	IRE 1238/9	Ajn Talimat	523,600	432,950	370	0.001	---
	IRE 1239/9	Ajn Mentina	524,250	432,950	410	0.65	---
	IRE 1240/9	Ajn Sarak	524,650	432,850	440	0.001	---
	IRE 1241/9	Ajn Cheeqa	524,700	432,700	430	0.33	---
	IRE 1242/9	---	524,550	432,600	380	---	---
	IRE 229/9	Ben Hammane	527,700	421,530	235	0.002	---
	IRE 230/9	Zremret	527,600	421,100	225	0.01	---
	IRE 237/9	Kerma of Klia	532,100	421,850	245	0.005	---
	IRE 238/9	Kerma Graihalt	531,650	421,120	230	0.03	---
	IRE 243/9	Moulay Hamed	531,450	420,940	220	0.02	---
	IRE 245/9	Abbou (Caïd)	530,400	420,850	250	0.02	---
	IRE 250/9	Chara	525,870	422,250	220	0.009	---
	IRE 299/9	Sbaabra	533,030	424,080	460	0.001	525
	IRE 300/9	Kaddour Ben Taleb	533,120	422,900	330	0.01	1290
	IRE 304/9	Kebira Haddada	532,550	423,500	390	0.01	570
	IRE 625/15	Ajn Jaaba	516,220	418,900	140	0.5	628
	IRE 626/15	Sebt	517,500	418,770	140	1.4	665
	IRE 628/15	Ajn Msous	515,350	418,820	150	0.05	---
	IRE 629/15	Ajn El Keff	515,220	418,850	145	0.08	---
	IRE 631/15	Ajn Beïda	515,530	418,250	188	0.06	904
	IRE 632/15	Ajn Oul. Larbi Ben Hamam	515,970	418,100	190	0.002	670
	IRE 634/15	Ajn Issef	516,810	416,950	148	0.001	---
	IRE 635/15	Ajn Tleta	516,850	416,880	145	0.5	---
	IRE 640/15	Draa	522,000	416,450	121	0.03	---
IRE 647/15	Ajn Beni Azzou	516,330	415,010	116	0.002	480	
IRE 649/15	Bir El Oursel	510,970	414,800	108	0.005	4700	
IRE 651/15	Ajn Nouna	514,350	414,000	110	0.002	---	
IRE 654/15	Ajn Si Messaoud	514,910	414,470	192	0.001	---	
IRE 655/15	Ajn Berdi	515,370	414,130	91	0.035	2730	
Fes East	IRE 1654/15	Ajn Iabou	557,800	401,960	260	0.01	1095
	IRE 2823/15	Oued Inaouene	555,550	400,200	150	0.002	---
Tafrant de l'Ouerrha	IRE 31/9	Boumaïz	526,470	447,270	180	0.35	340
	IRE 540/9	Ajn Zemoura	529,700	445,550	340	0.5	280
	IRE 541/9	Ajn Mnajia	529,000	445,300	340	0.2	220
	IRE 542/9	Ajn El Hajar	528,750	445,100	340	0.2	160
	IRE 543/9	Ajn Sedra	527,500	444,050	260	0.1	460
	IRE 545/9	Ajn Kebir	527,800	444,800	240	0.2	560
	IRE 547/9	Ajn El Ouiz	527,550	444,400	270	0.07	400
	IRE 548/9	Ajn Kalitoune	528,450	443,450	300	0.1	---
	IRE 549/9	Sidi Mhamed Ben Ali	529,150	443,950	485	0.2	---
	IRE 555/9	Ajn Khoutba	518,800	443,050	130	2	880
	IRE 564/9	Ajn El Ouidane	524,350	445,450	120	0.3	500
	IRE 566/9	Ajn Chajara El Marbouha	524,050	446,200	120	0.1	260
	IRE 568/9	Ajn Aïla	524,400	448,600	200	0.1	200
	IRE 573/9	Ajn Bouzid	524,250	450,350	328	0.5	580

Table 4.3.3 Inventory of Existing Springs in the Study Area (5/10)

Reference Map	Spring No	Spring's Name	Coordinates			Flowrate (l/s)	Residue at 180°C
			X	Y	Z		
Tafrant de l'Querrha	IRE 574/9	Aïn Fraoua	525,100	450,400	315	0.2	280
	IRE 575/9	Aïn Rmel	522,650	448,050	166	0.2	400
	IRE 576/9	El Aouina El Hassani	522,350	447,250	160	0.1	340
	IRE 577/9	Aïn Menndria	522,400	446,250	143	0.1	240
	IRE 579/9	Aïn El Hajer	522,200	445,400	130	0.2	220
	IRE 580/9	Aïn Safsafa	522,450	444,500	108	0.1	320
	IRE 581/9	Aïn Khadir	521,450	443,850	111	0.5	260
	IRE 585/9	Aïn Zitouna	520,600	447,600	120	0.2	300
	IRE 586/9	Aïn Sejra	519,950	450,200	150	0.5	280
	IRE 588/9	Aïn Si Mhamed	519,200	450,150	210	0.1	180
	IRE 589/9	Ajoune Moulay Bouchta	520,250	449,200	130	0.2	260
	IRE 590/9	Aïn Rminia	519,850	448,850	143	0.1	160
	IRE 591/9	Aïn El Bor	519,400	448,000	140	0.1	300
	IRE 593/9	Aïn Khénnechouf	519,600	447,250	120	0.1	400
	IRE 594/9	Aïn Soltana	519,350	446,550	118	0.1	400
	IRE 595/9	Aïn Doukana	519,600	446,050	120	0.1	360
	IRE 596/9	Aïn Hammou	518,550	445,750	160	0.2	680
	IRE 597/9	Aïn Kodja	517,950	445,800	160	0.1	480
	IRE 598/9	Aïn Bajtaten	518,100	444,850	148	0.2	460
	IRE 599/9	Aïn Nessef	516,850	446,900	264	0.5	560
	IRE 600/9	Aïn Mkat	516,700	446,300	255	0.2	240
	IRE 601/9	Aïn Jamâa	516,050	448,700	296	0.3	560
	IRE 602/9	Aïn Oued Bensaka	515,150	448,350	315	0.6	160
	IRE 622/9	Aïn Bouchara	524,640	444,040	138	0.3	240
	IRE 1090/9	Aïn Dalya	528,020	452,400	255	0.1	---
	IRE 1093/9	Aïn Zakkouta	528,380	450,800	345	0.1	---
	IRE 1097/9	Aïn El Haoud	527,790	449,680	300	0.1	---
	IRE 1099/9	Aïn Chaïb	527,430	448,040	150	0.1	---
	IRE 1100/9	Aïn Dfali	522,180	447,570	160	0.1	---
	IRE 1101/9	Aïn Dhar d'El Foukra	522,150	446,900	185	0.1	---
	IRE 1105/9	Aïn Ahjer de Sria	521,000	445,160	128	0.06	---
	IRE 1106/9	Aïn Bou Kratche	524,650	449,060	198	0.3	---
	IRE 1109/9	Aïn Aoudiyar de Sria	520,070	444,930	115	0.1	---
	IRE 1113/9	Aïn Bou Haddou	523,720	450,540	390	0.1	---
	IRE 1115/9	Aïn Mzeyne	522,350	450,140	340	0.1	---
	IRE 1116/9	Aïn Azzourar	522,150	450,520	332	0.2	---
	IRE 1117/9	Aïn Sidi Abdelouali	524,020	450,650	370	0.07	---
	IRE 1119/9	Aïn Fouara de Doukkane	533,840	455,700	634	0.1	---
	IRE 1120/9	Aïn Doukkane	533,170	456,670	605	1.43	---
	IRE 1121/9	Aïn Crouche	532,720	457,240	665	0.1	---
	IRE 1122/9	Aïn Sidi Ahmed Cherif	531,620	456,450	695	0.1	---
	IRE 1123/9	Aïn Kehir de Zacuia	531,320	455,600	600	0.05	---
	IRE 1124/9	Aïn Baghla	533,080	453,820	550	3.3	---
	IRE 1125/9	Aïn Anacer	532,470	453,770	570	0.2	---
	IRE 1127/9	Aïn Maghrama	532,040	453,940	600	0.53	---
	IRE 1129/9	Aïn El Foukia de Bou Mlika	532,340	454,910	600	0.12	---
	IRE 1130/9	Aïn Bou Hamdane	533,050	454,600	560	0.14	---
	IRE 1132/9	Aïn Bou Mate	533,950	453,750	570	0.48	---
	IRE 1134/9	Aïn Kassara	534,920	456,200	688	0.5	---
	IRE 1135/9	Aïn Zenday	534,940	456,000	685	0.5	---
IRE 1136/9	Aïn EL Fhasse	534,100	455,150	630	0.1	---	
IRE 1137/9	El Mhahir d'Ennaïme	534,730	454,260	585	0.14	---	
IRE 1138/9	Aïn Tioulait	535,460	452,900	450	0.9	---	
IRE 1140/9	Aïn Sidi Mohamed Lahsalni	536,400	452,880	440	0.1	---	
IRE 1141/9	Aïn Mran de Sfassef	536,220	453,550	405	0.1	---	
IRE 1142/9	Aïn Aouana	536,180	454,060	485	0.5	---	
IRE 1150/9	Aïn El Hamma	535,410	455,500	600	0.05	---	
IRE 1159/9	Aïn Talehya	527,440	460,150	345	0.2	---	
IRE 1161/9	Azzourar de Makdate	527,020	460,700	405	1.8	---	

Table 4.3.3 Inventory of Existing Springs in the Study Area (6/10)

Reference Map	Spring No	Spring's Name	Coordinates			Flowrate (l/s)	Residue at 180°C	
			X	Y	Z			
Tafrant de l'Ouerrha	IRE 1162/9	Aïn Sdsk d'El Msaf	527,170	456,300	295	0.05	--	
	IRE 1163/9	Aïn Essafia d'El Matmora	527,950	457,920	310	0.04	--	
	IRE 1166/9	Aïn Dmani	531,500	457,760	495	0.02	--	
	IRE 1169/9	Aïn Essafia	531,550	459,220	515	0.03	--	
	IRE 1170/9	Aïn Chakka	530,940	459,610	560	0.06	--	
	IRE 1171/9	Aïn Kahla	530,750	459,700	535	0.05	--	
	IRE 1172/9	Kassara d'El Hamma	530,620	459,650	520	0.05	--	
	IRE 1173/9	Aïn Rhaïssa d'Aouana	529,840	459,750	570	0.015	--	
	IRE 1176/9	Aïn Kraa	529,650	458,800	435	0.01	--	
	IRE 1180/9	Aïn El Gelta El Hayla	525,870	458,360	176	0.1	--	
	IRE 1288/9	Aïn Abkar de Tabouda	523,175	459,125	205	0.1	--	
	IRE 1327/9	Oued Benaka	514,600	448,700	353	0.3	--	
	IRE 1328/9	M'Rajah	514,200	449,200	380	0.1	--	
	IRE 1060/9	Aïn Lablak	536,530	461,480	390	0.1	--	
	IRE 1155/9	Aïn Dib	525,960	462,060	445	0.07	--	
	IRE 1158/9	Aïn El Mizab d'Eddouira	528,330	461,200	600	0.2	--	
	IRE 1215/9	Aoudour	524,250	461,600	180	Dry	--	
	IRE 1219/9	Aïn Mauzla	531,800	479,300	340	0.09	--	
	IRE 1220/9	Aïn Abenouar	531,150	479,300	340	0.2	--	
	Taounate	IRE 27/9	Tabliat	568,650	439,580	540	1.2	400
IRE 28/9		Merj	568,820	438,820	475	1.0	--	
IRE 30/9		Tabliat Taounate	569,020	439,000	510	0.8	406	
IRE 77/9		Jzara	541,190	437,160	300	0.2	270	
IRE 335/9		Fatria	568,650	439,820	565	0.15	--	
IRE 336/9		Khandag	568,600	440,220	565	0.8	--	
IRE 341/9		Sidi Bouzia	568,100	441,040	535	0.5	--	
IRE 342/9		Sidi Bouzia	567,960	440,900	558	0.5	--	
IRE 343/9		Hajali	567,300	440,600	500	0.5	--	
IRE 344/9		Zoaa Astar	567,650	440,160	580	Dry	--	
IRE 345/9		Jama Astar	568,200	439,300	555	0.6	--	
IRE 346/9		Annsar Si Sellem	568,400	439,150	335	0.15	--	
IRE 347/9		Smarra	568,600	439,100	440	Dry	--	
IRE 348/9		Tablia	568,800	439,350	500	0.01	--	
IRE 770/9		Aïn Zorzar	561,440	439,160	480	0.1	--	
IRE 772/9		Aïn El Bir	567,200	439,150	435	0.07	--	
IRE 802/9		Aïn Azmal	569,700	438,720	510	0.1	--	
IRE 314/9		Mezraoua	560,550	439,050	540	0.5	--	
IRE 315/9		Ayachi Deminet	561,520	440,700	445	0.02	604	
IRE 316/9		Boukani-Amont	561,770	438,120	410	0.1	--	
IRE 317/9		Boukani-Aval	561,770	438,020	402	0.01	--	
IRE 318/9		Leuh	560,500	441,250	476	0.05	1500	
IRE 319/9		Senia Mezraoua	560,850	439,350	610	0.05	320	
IRE 399/9		Aïn Zgani	561,640	434,500	225	0.7	820	
IRE 500/9		Aïn Jermouni	561,120	434,500	--	0.2	400	
IRE 714/9		Aïn Jarbna	566,000	442,350	380	0.1	350	
Taounate		IRE 758/9	Aïn Tajamourt	568,530	446,770	500	0.25	--
		IRE 759/9	Aïn Igaria	568,540	445,800	575	0.1	--
		IRE 760/9	Aïn Bourdoud	569,380	445,850	625	0.072	--
		IRE 761/9	Aïn Taniza	566,480	444,700	435	0.25	--
		IRE 763/9	Aïn Haman Hadj	566,850	446,030	515	0.7	--
		IRE 764/9	Aïn Bouhali	567,160	446,150	550	0.25	--
	IRE 765/9	Aïn Karkara	565,380	445,450	380	0.25	--	
	IRE 773/9	Timidouine	572,625	451,000	615	0.7	--	
	IRE 775/9	Merkouma 5	572,600	450,320	652	0.7	--	
	IRE 779/9	Bab M'takaf	572,800	449,300	601	0.7	--	
	IRE 780/9	Aïn Ahmed Amar	571,070	449,320	600	0.7	--	
	IRE 781/9	Miloud Maouzi	571,040	448,900	550	0.7	--	
	IRE 21/10	Aïn Neïla	581,580	442,140	340	0.5	--	

Table 4.3.3 Inventory of Existing Springs in the Study Area (7/10)

Reference Map	Spring No	Spring's Name	Coordinates			Flowrate (l/s)	Residue at 180°C
			X	Y	Z		
Taounate	IRE 64/ 10	Aïn Mennbaâ	582,080	454,000	700	0.8	1200
	IRE 81/ 10	Aïn Beni Mleh	589,900	441,800	730	1.3	400
	IRE 86/ 10	Aïn Cadi	581,381	454,700	745	1.9	600
	IRE 87/ 10	Aïn Jawad	581,500	454,500	750	0.5	400
	IRE 219/ 10	Aïn Chrif d'Akhalou	582,430	440,800	370	1.74	---
	IRE 220/ 10	Aïn Kbir	581,650	451,740	695	0.10	---
	IRE 221/ 10	Aïn Ben Rahma	582,000	451,730	750	0.11	---
	IRE 222/ 10	Aïn Brahim	581,340	454,110	640	0.25	---
	IRE 80/ 10	Nabaa Bou Abdoul	581,960	437,800	600	2.65	---
	IRE 211/ 10	Oueld Mimoun	581,700	437,700	600	5.0	---
	IRE 217/ 10	Aïn E. Rallala	581,800	437,750	620	1.7	---
	IRE 218/ 10	Aïn Jnak Mar	581,515	438,090	565	0.8	---
	---	Aïn Rhomari	577,550	434,700	---	0.70	---
	---	Aïn El Hout	577,850	434,550	---	0.17	---
	---	Aïn Marmar	576,500	435,150	---	0.46	---
	---	Aïn Zreizen	572,700	442,400	---	0.01	---
	---	Aïn Bou Adel	581,700	437,800	---	2.25	---
Kalaâ des Sics	IRE 563/ 15	Aïn Aouintig	559,000	417,000	270	0.03	---
	IRE 564/ 15	Aïn Hayad	558,750	418,000	305	0.06	---
	IRE 565/ 15	Aïn Stifa	558,500	418,300	365	0.03	---
	IRE 566/ 15	Aïn Mellah	569,250	419,250	370	0.02	---
	IRE 569/ 15	Aïn Sikha	557,250	418,550	360	0.11	---
	IRE 573/ 15	Aïn Kharrouba	552,250	419,300	345	0.03	---
	IRE 574/ 15	Aïn Dasch	551,750	419,000	325	0.2	---
	IRE 578/ 15	Aïn Tateb	550,000	419,300	435	0.01	---
	IRE 579/ 15	Aïn Safsaf	550,200	419,250	415	0.003	---
	IRE 580/ 15	Aïn Safsaf	550,250	419,000	330	0.003	---
	IRE 591/ 15	Aïn Bakach	553,150	418,900	290	0.003	---
	IRE 593/ 15	Aïn S. Smaine	550,800	416,900	440	0.1	---
	IRE 594/ 15	Aïn Jaj	550,900	416,700	425	0.1	---
	IRE 595/ 15	Aïn Braber	551,100	416,700	475	0.13	---
	IRE 596/ 15	Aïn Rahô	551,100	416,850	470	0.2	---
	IRE 597/ 15	Aïn Romane	557,650	416,800	560	0.01	---
	IRE 599/ 15	Aïn S. Abdellah	551,550	416,450	402	0.12	---
	IRE 1212/ 15	Sedina-Kebira	553,100	406,320	415	2.6	510
	IRE 1213/ 15	Sedina	553,050	406,300	415	0.7	865
	IRE 1214/ 15	Aïn Ofebel	552,950	406,820	450	---	865
	IRE 1219/ 15	Aïn Safsaf	552,470	407,900	457	0.2	850
	IRE 1221/ 15	Aïn El Karia	553,270	407,560	400	0.1	820
	IRE 1222/ 15	Aïn El Toumiat	553,750	406,900	365	---	365
	IRE 1223/ 15	Aïn Harsa	553,050	405,950	380	0.7	1095
	IRE 1232/ 15	Aïn Kchacha	552,300	408,800	420	---	430
	IRE 1233/ 15	Aïn Kchacha Toumiat	552,440	409,020	391	0.1	---
	IRE 1234/ 15	Aïn El Miah	552,420	409,430	360	0.2	---
	IRE 1269/ 15	Aïn Bourkhait	555,900	410,200	408	0.01	---
	IRE 1270/ 15	Aïn Bourkhait	555,780	410,030	360	0.1	---
	IRE 1271/ 15	Aïn Sedra Merraka	556,240	410,680	445	0.08	504
	IRE 1272/ 15	Aïn Kebira Merraka	556,100	410,850	475	0.07	504
	IRE 1273/ 15	Aïn El Hajel	556,700	410,860	340	0.02	---
	IRE 1274/ 15	Aïn Ben Zgunoun	557,050	411,020	300	0.01	---
IRE 1304/ 15	Aïn Dokhane	554,650	411,000	390	0.01	---	
IRE 1306/ 15	Aouina Bouzat	555,360	407,320	225	0.01	---	
IRE 1397/ 15	Aïn Amir	556,800	410,350	300	0.1	---	
IRE 1276/ 15	Aïn Mimoun	556,350	411,930	330	0.09	---	
IRE 1278/ 15	Aïn Bouriane	556,120	412,300	335	0.01	---	
IRE 1279/ 15	Aïn El Beida	555,080	411,740	380	0.01	---	
IRE 1280/ 15	Aïn Hojahi	554,380	411,780	340	2.2	---	
IRE 1281/ 15	Aïn Smar	554,350	412,100	375	0.09	---	

Table 4.3.3 Inventory of Existing Springs in the Study Area (8/10)

Reference Map	Spring No	Spring's Name	Coordinates			Flowrate (l/s)	Residue at 180°C
			X	Y	Z		
Kalaâ des Sles	IRE 1282/15	Aïn Briamoun	554,770	413,700	345	0.04	---
	IRE 1284/15	Aïn Zitoun Ahmaza	553,880	413,660	400	0.01	---
	IRE 1285/15	Aïn Ben Safd	555,650	413,100	280	0.11	2090
	IRE 1296/15	Aïn Snisal	553,760	414,500	355	0.08	625
	IRE 1297/15	Aïn Bagramane	553,570	412,730	390	0.01	---
	IRE 1298/15	Aïn Beïda Rhaïdat	553,200	412,670	360	0.003	---
	IRE 1299/15	Aïn Kebir	551,160	412,620	465	0.02	590
	IRE 146/9	Frime	558,050	420,350	410	0.05	---
	IRE 147/9	Barka	552,750	420,210	380	0.1	---
	IRE 148/9	Bou-Arrous	552,860	420,150	395	0.1	---
	IRE 149/9	Bou-Arrous (low)	552,820	420,000	385	0.02	---
	IRE 150/9	Dar	552,550	420,000	445	0.04	---
	IRE 152/9	Karma Bou Arrous	550,550	420,100	510	0.02	---
	IRE 159/9	Chakour	550,850	421,300	390	0.04	---
	IRE 166/9	Foukania	551,250	423,750	440	0.08	---
	IRE 167/9	Sferjela	551,350	423,850	430	0.07	---
	IRE 168/9	Bheir	550,960	423,950	370	0.03	---
	IRE 169/9	Aïn Zafr	550,320	424,000	340	0.04	910
	IRE 170/9	S. Tahla	550,330	424,200	310	0.05	620
	IRE 291/9	Aberdi	553,770	426,720	292	0.04	---
	IRE 647/9	Aïn Labghal	537,800	428,900	365	0.5	364
	IRE 648/9	Aïn Sidi Ghazi	540,650	429,750	260	---	1489
	IRE 650/9	Aïoun	542,700	430,700	370	1.0	---
	IRE 651/9	Aïn Khadem	542,600	430,250	330	0.7	384
	IRE 156/9	Jam	549,750	420,800	435	0.002	---
	IRE 157/9	Stelfa	549,350	420,700	455	0.003	---
	IRE 158/9	Flah	549,150	420,800	385	0.17	---
	IRE 171/9	Mouzerouala	549,490	424,700	340	0.035	---
	IRE 172/9	Snajj	549,400	425,000	390	0.03	285
	IRE 173/9	Khaulet (low)	548,950	425,260	375	0.002	1270
	IRE 174/9	Khaulet (high)	548,950	425,200	390	0.012	855
	IRE 175/9	Jemmla	548,600	424,650	420	0.002	1856
	IRE 520/9	A. Mousoilef Aïoun El Merhsel	552,440	431,440	200	2	300
	IRE 524/9	Aïn Zitouna	553,300	431,900	230	0.002	---
	IRE 525/9	Aïoun	553,640	431,480	230	0.7	---
	IRE 526/9	Aïn Ahmed Rifi	555,920	431,060	210	0.02	300
	IRE 528/9	Aïn Bou Zantar	556,920	432,380	202	0.003	---
	IRE 529/9	Onsar El Aïchi	551,660	432,080	190	0.03	820
	IRE 530/9	Aïn Zorar	550,580	433,040	188	0.3	480
	IRE 643/9	Aïn Tarhassa	539,600	433,000	290	2.5	394
IRE 646/9	Aïn Bou Amar	538,750	432,500	450	0.5	686	
IRE 649/9	Aïn Jebli	542,650	431,500	355	1.0	652	
IRE 652/9	Aïn Fournia	542,600	432,800	445	2.6	848	
IRE 791/9	El Mrhassel	552,350	433,200	200	2.0	---	
IRE 809/9	Fem Ben Jelloun	553,060	432,640	190	0.5	---	
IRE 583/15	Aïn Helel	549,400	418,600	340	0.003	---	
IRE 585/15	Aïn Hadadia	550,000	418,150	415	0.06	---	
IRE 587/15	(High) Aïn Annsar	550,250	417,400	420	0.05	---	
IRE 588/15	Aïn Drahana	550,100	417,000	515	0.11	---	
IRE 589/15	Aïn Taus	549,950	416,800	550	0.11	---	
IRE 590/15	Aïn Amara	550,300	416,800	520	0.07	---	
IRE 602/15	Aïn Auda	550,600	415,650	472	0.09	---	
IRE 1227/15	Aïn Karma	550,700	407,000	410	0.2	300	
IRE 1231/15	Aïn Nakass	549,970	408,400	315	0.1	3700	
IRE 2529/15	Aïn Regada	541,325	412,335	200	0.25	---	
Dhar Souk	IRE 22/10	Beni Oulid	586,400	443,100	510	2.9	200
	IRE 23/10	Zouahoua	590,700	447,000	510	1	---
	IRE 24/10	Dhar Souk Aïn Ali	603,200	451,100	500	0.2	398

Table 4.3.3 Inventory of Existing Springs in the Study Area (9/10)

Reference Map	Spring No	Spring's Name	Coordinates			Flowrate (l/s)	Residue at 180°C
			X	Y	Z		
Dhar Souk	IRE 74/10	AIn Ali	603,700	450,800	580	0.7	600
	IRE 77/10	AIn Kebira	587,900	445,850	640	6	200
	IRE 78/10	AInoua Tamnaonat	591,100	446,800	480	6	400
	IRE 82/10	AIn Mezab Mesker	588,400	440,300	750	0.6	600
	IRE 83/10	Onsar Bouronad	587,500	441,300	850	8	400
	IRE 85/10	AIn Hamra	585,400	441,500	785	2	400
	IRE 201/10	Ziama 1	588,700	444,450	365	2.3	---
	IRE 203/10	Oued Senda	590,100	443,800	380	Dry	---
	IRE 204/10	Oued Ziama	588,200	444,150	374	"	---
	IRE 210/10	Oued Blougl	622,600	435,600	725	"	---
	IRE 213/10	AIn Lebder	588,660	442,850	535	1.30	---
	IRE 215/10	AIn Hamma	589,700	442,100	640	0.30	---
	Bni Frassene	IRE 216/10	Ansar Bourouad	588,440	440,320	970	6.68
IRE 213/10		AIn Anzart	601,175	454,725	640	2.5	---
IRE 727/10		AIn N'Hiri	604,725	434,850	684	---	---
IRE 91/10		Ras El Ma	616,200	440,200	1150	1.2	300
IRE 97/16		Sidi Meziane	584,750	415,600	350	Dry	---
IRE 99/16		Rbiba	583,640	417,010	258	0.05	1250
IRE 100/16		AIn Deffa	582,900	416,420	288	0.003	980
IRE 564/16		AIn Jarnaâ	593,000	411,170	708	5	---
IRE 565/16		AIn Aïcha	592,800	411,130	732	1	---
IRE 571/16		AIn Hamoumou	592,275	411,800	740	0.5	---
---		AIn Chemise	599,000	428,800	---	5.8	---
---		AIn El Sefsaf	599,800	422,400	---	2.9	---
---		AIn Eshkha	600,000	428,150	---	0.23	---
---	AIn Khalouf	608,500	427,000	---	0.17	---	
Taineste	IRE 4/10	A. Inza	612,400	456,300	1195	0.5	---
	IRE 5/10	AIn Berda	612,100	456,800	1170	0.5	---
	IRE 65/10	Onsar Tamdit	610,000	454,100	920	6.0	1000
	IRE 66/10	AIn Ksour	611,300	455,000	1070	0.8	200
	IRE 67/10	AIn Sbaba	613,500	456,500	930	3.0	400
	IRE 68/10	AIn Berda	612,200	457,000	1130	1.0	200
	IRE 92/10	AIn ben Caïdine	616,200	440,200	1150	1.0	280
	---	AIn El Schira	615,500	440,350	---	0.86	---
	IRE 226/10	AIn El Atoun	615,250	440,550	1260	0.03	---
	IRE 227/10	AIn El Kbira	615,950	440,000	1100	0.98	---
	---	AIn El Ayoun (1)	615,900	440,750	---	0.63	---
	---	AIn El Ayoun (2)	615,850	440,200	---	0.40	---
	IRE 228/10	AIn El Manbaâ	625,700	435,150	900	0.03	---
	---	AIn El Sihine	615,350	440,000	---	0.17	---
	IRE 717/10	AIn Serrafa	614,500	434,675	840	0.01	---
	IRE 718/10	AIn Ouaddana	614,000	434,650	660	0.02	---
IRE 721/10	AIn El Ansar	615,275	440,225	1220	0.01	---	
Tissa	IRE 375/9	AIn Jaouna	561,900	428,250	300	0.1	160
	IRE 377/9	AIn El Aleg	563,500	428,080	235	0.7	1360
	IRE 383/9	AIn Graoune	570,200	430,600	300	0.004	560
	IRE 389/9	Oued Teheriss	573,500	430,540	270	0.002	400
	IRE 391/9	AIn Betda	563,800	430,020	305	0.001	440
	IRE 396/9	AIn Bou Harouch	568,480	431,700	245	0.005	380
	IRE 398/9	Tlouda	563,800	432,400	270	0.7	420
	IRE 1237/15	AIn Berdin	562,050	407,550	175	0.3	2420
	IRE 1238/15	A. Si Mohamed	562,150	407,200	169	0.2	2060
	IRE 1248/15	A. Beni Mechkour	562,150	410,850	485	---	670
	IRE 1249/15	AIn Rzaïoui	562,550	410,950	385	0.2	---
	IRE 1252/15	A. Zzeri	562,460	411,400	355	0.1	---
	IRE 1256/15	A. Mkliticha	562,300	410,450	490	0.1	---

Table 4.3.3 Inventory of Existing Springs in the Study Area (10/10)

Reference Map	Spring N°	Spring's Name	Coordinates			Flowrate (l/s)	Residue at 180°C
			X	Y	Z		
Tissa	IRE 1292/15	Aïn Skhouna	552,700	413,700	365	0.001	1250
	IRE 1293/15	Aïn Krouma	552,700	414,300	480	0.002	454
	IRE 1379/15	Aïn Krafa	563,850	412,850	240	0.004	620
	IRE 760/15	M'kadam Lahcen	576,000	411,350	250	0.4	1080
	IRE 1327/15	Aïn Merzou	575,650	414,360	305	0.1	---
	IRE 1337/15	Aïn Mellah	575,900	416,600	305	0.2	---
	IRE 1338/15	Aïn Ata	576,570	416,940	260	0.1	1520
	IRE 2381/15	Aïn Bou Ayad	580,800	406,550	505	0.1	---
	IRE 1316/15	Aïn Betha	569,600	413,000	250	0.001	---
	IRE 1324/15	Aïn Dîles	573,000	412,610	380	0.002	---
	IRE 1326/15	Aïn Bourar	574,590	413,110	310	0.003	---
	IRE 1331/15	Aïn Bounsfa	575,100	415,160	375	0.002	---
	IRE 1332/15	Aïn Beïda Rzaouma	575,570	415,450	315	0.3	---
	IRE 1335/15	Bir Aïn Gamra	574,970	417,100	290	0.2	---
	IRE 1336/15	Aïn Ksob-Rezag	575,100	416,900	305	0.002	---
	IRE 1339/15	El Oulja	574,040	411,800	211	0.001	---
	IRE 1355/9	Aïn Aziz	487,400	446,250	120	0.2	---
	IRE 1365/9	Aïn Betda	543,900	421,600	330	0.1	---
	IRE 133/9	Si Hamed	562,700	420,550	460	Dry	---
	IRE 134/9	Zaouia	562,500	420,000	450	3	---
	IRE 135/9	Ierri	562,050	420,250	450	5 - 10 m ³ /d	---
	IRE 136/9	Si Belkhir	561,800	420,250	490	5 - 15 m ³ /d	---
	IRE 505/15	Aïn Mzabi	561,500	418,700	410	20	1225
	IRE 557/15	Aïn Imkelicha	560,900	418,400	290	Dry	---
	IRE 559/15	Aïn Suns	561,360	419,000	450	5 - 15 m ³ /d	---
	IRE 680/15	Aïn Mzabi	561,050	418,750	365	5 - 15 m ³ /d	560
	IRE 1241/15	Aïn Tob	561,940	418,400	410	1.3 m ³ /d	---
	IRE 1242/15	Bsabsa	562,520	418,400	380	0.5 - 1 m ³ /d	---
	IRE 1243/43	Aïn Chdedua	561,470	417,550	350	1.3 m ³ /d	---
	IRE 1244/15	Aïn Smara	562,170	417,200	315	0.05	---

Table 4.3.4 Inventory of Existing Groundwater Sources and Exploratory Wells in the Model Areas (1/3)

Model Area	Douar	Type	Reference	Owner	Execution Date	Approx. Coordinates			Geological Character		Dimensions (m)		Flowrate		Water Level below G.L 15/7/95	
						X	Y	Z (m)	Epoch	Lithology	Dia.	Depth	Pump (Us)	Bucket (U/sec)		
Aïn Defail	Bent Seruana	Dughole	IRE 3387/8	Hamma Abdelmajid	1955	484900	444700	180	Quaternary	Alluvium and Conglomerate	1.5	15.0	—	dry	—	
		"	IRE 3388/8	Ouzzani Mohamed	1991	484250	445900	220	"	"	2.05	27.7	—	0.004	24.20	
		"	IRE 3389/8	"	1990	484100	445950	200	"	"	1.62	21.0	—	0.01	16.25	
		"	IRE 3390/8	"	1990	484250	446000	200	"	"	1.5	5.9	—	0.008	5.75	
		"	IRE 3391/8	"	1995	484350	445500	180	"	"	2.0	24.0	—	0.5	13.80	
		"	IRE 3392/8	"	1993	484450	445600	180	"	"	2.0	21.0	—	0.8	7.34	
		"	IRE 3393/8	"	1986	484500	445650	190	"	"	2.0	23.9	—	0.5	10.25	
		"	IRE 3394/8	"	1993	484550	445600	190	"	"	2.0	19.3	—	0.3	12.76	
		"	IRE 3395/8	"	1993	484300	445050	190	"	"	2.0	10.9	—	0.3	3.60	
		"	IRE 3396/8	"	1991	484200	445400	190	"	"	2.0	13.1	—	0.3	3.75	
		"	IRE 3382/8	Rayam A.	1991	484550	444975	180	"	"	1.4	9.4	—	0.05	9.00	
		"	IRE 3386/8	AL Aela M.	1992	484850	444800	190	"	"	1.5	14.6	—	0.08	14.35	
		"	IRE 1531/9	Ayash R.	1993	485250	444650	165	"	"	1.8	3.8	—	0.1	3.50	
		"	IRE 1532/9	Ayash R.	1993	485300	444600	165	"	"	2.5	3.3	—	0.05	3.00	
		"	IRE 1533/9	Bachir M.	1995	485400	446600	175	"	"	2.5	5.2	—	0.002	5.00	
		"	IRE 1534/9	Owmi Med.	1980	485100	444850	165	"	"	1.1	11.0	—	0.05	8.10	
		"	IRE 1535/9	Owmi Med.	1980	485150	444750	165	"	"	1.45	14.8	—	0.05	9.30	
		"	Spring	IRE 1536/9	Commune	—	485100	444750	180	"	"	—	—	—	0.25	—
		"	Exp. well	IRE 3384/8	"	—	484300	445550	185	"	"	—	—	—	0.33	—
		"	(ADF1)	IRE 3397/8	A.H.	1995	484500	445550	143.9	"	"	20"	GL-5	7	—	—
Lanarite		(ADF1)	IRE 1537/9	A.H.	1995	485225	445575	159.4	"	"	20"	GL-5	25	—	—	
		(ADF2)	IRE 1538/9	"	—	485925	445550	169.8	"	"	15"	5-76	25	—	—	
El Arba		(ADF3)	IRE 1539/9	Coop. Masira	—	486900	444200	110	"	"	20"	GL-5	—	—	—	
		Dughole Well	IRE 1530/9	Commune	—	486650	444450	100	"	"	15"	5-150	—	0.08	11.62	
										7"	28.0	2	—	closed		

Table 4.3.4 Inventory of Existing Groundwater Sources and Exploratory Wells in the Model Areas (2/3)

Model Area	Douar	Type	Reference	Owner	Execution Date	Approx. Coordinates			Geological Character		Dimensions (m)		Flowrate		Water Level below G.L 15/7/95
						X	Y	Z (m)	Epoch	Lithology	Dia.	Depth	Pump (Us)	Bucket (Uses)	
Terroual	El Jerrarah	Dughole	IRE 1509/91	Ezzahri M.	1985	512950	452760	430	Quaternary Miocene Oligocene	Marl and Conglomerate and siltstone	1.35	6.2	—	0.01	5.90
		"	IRE 1510/9	Hadrrouz A.	1993	513000	452750	430	Ditto	Ditto	1.55	8.3	—	0.02	7.95
Cald	Marja El Terclana	Dughole	IRE 1511/9	Chekn A.	1995	512950	453050	460	Miocene Oligocene	Conglomerate Marl+Siltstone	1.55	13.8	—	0.005	13.50
		Well	IRE 1512/9	A.H	—	511600	452700	420	Quaternary Miocene Oligocene	Alluvium + Marl and Silt and Siltstone	12" 6.5"	GL - 52 52 - 82	11.38	—	12.25
Lazeb	Terroual	Spring	IRE 663/9	Commune	—	511500	452600	405	Miocene Oligocene	Marl and Siltstone	—	—	—	0.73	—
		Exp. well (TRA2)	IRE 1514/9	A.H	1995	510900	452225	335.8	Quaternary Miocene Oligocene Eocene	Alluvium Limestone Siltstone Marlstone	24" 17" 12.25"	GL - 10 10 - 170 170 - 300	15	—	—
Khouader	Khouader	Exp. well (TRA3)	IRE 1515/9	A.H	1995	510650	452150	337.7	Miocene Oligocene	Marl-Gravel Siltstone	20" 15" 12.25"	GL - 10 10 - 120 120 - 150	15	—	—
		Exp. well (TRA1)	IRE 1513/9	A.H	1995	511300	425500	410	Miocene Oligocene Triassic	Marl and Siltstone Salt	20" 12.25"	GL - 10 10 - 250	Salt patch encountered in the Triassic formation. Well was backfilled and abandoned	—	—

Table 4.3.4 Inventory of Existing Groundwater Sources and Exploratory Wells in the Model Areas (3/3)

Model Area	Douar	Type	Reference	Owner	Execution Date	Approx. Coordinates			Geological Character		Dimensions (m)		Flowrate		Water Level below G.L. 15/7/95
						X	Y	Z (m)	Epoch	Lithology	Dia.	Depth	Pump (l/s)	Bucket (l/sec)	
Jbel Berda	Aln Berda	Dughole	IRE 1516/9	A.H	1983	550850	446950	740	Upper Cretaceous	Marlstone and Schist	1.67	15.5	—	0.005	15.00
	Ras El Kbour	Dughole	IRE 1517/9	Ferrassi M.	1984	550000	446700	775	"	"	2 x 2	11.3	—	0.005	11.20
		"	IRE 1518/9	Ferrassi Ali	1962	550100	446800	770	"	"	0.84x0.84	9.3	—	0.002	9.30
		"	IRE 1519/9	Kharar M.	1960	549900	446750	775	"	"	1 x 0.94	10.7	—	0.005	10.20
		"	IRE 1520/9	Haddadi A.	1982	549950	446700	770	"	"	1 x 0.8	10.2	—	0.005	10.00
		"	IRE 1521/9	Senon Haj	1989	549850	446650	760	"	"	1 x 1	16.3	—	0.005	15.95
		"	IRE 1522/9	Moulasem M.	1986	549900	446800	790	"	"	1 x 1	10.1	—	0.005	10.05
		"	IRE 1523/9	Ferrassi M.	1940	549950	446800	790	"	"	1 x 1	10.6	—	0.002	9.97
		"	IRE 1524/9	Ferrassi Ali	1965	550150	446850	780	"	"	1 x 1	17.5	—	0.002	13.97
		El Ain	Dughole	IRE 1525/9	Moulasem A	1940	550100	446850	765	"	"	1 x 1	10.6	0.1	—
Tazrhadra	Spring	IRE 292/9	Commune	—	547500	447800	550	Upper Cretaceous	Marlstone and Schist	Issuing from Jurassic	—	—	5.58	—	
A. Mertab	"	IRE 265/9	"	—	548650	446600	590	"	"	"	"	"	0.405	—	
A. Berda	"	IRE 41/9	"	—	550650	446850	740	"	"	"	"	"	0.092	—	
Khaloufa	"	IRE 886/9	"	—	549850	447500	770	"	"	"	"	"	0.113	—	
Aoumane	Exp. well (JDB3)	IRE 1526/9	A.H	1995	550150	446925	810.9	Quaternary Jurassic + Cretaceous	Limestone + Conglomerate	20" 15"	GL-10 10-100	2.5	—	34.20	
Douher	Exp. well (JBD2)	IRE 1527/9	A.H	1995	549450	446800	790	Ditto	Marlstone	20" 15"	GL-10 10-150	12	—	—	
Tazrhadra	Exp. well (JBD1)	IRE 1528/9	A.H	1995	548125	447100	57505	Jurassic + Cretaceous	Boulders + conglomerate + marly limestone	20" 15"	0-10 10-67	Hydrocarbon gas encountered at 67 m. Well backfilled and abandoned	—	—	

Table 4.3.5 Groundwater Levels of Dugholes and Exploratory Wells in the Model Areas (1/2)

Model Area	Douar	Type	Reference	Approx. Coordinates			Dimensions (m)		Groundwater level (from ground level)												
				X	Y	Z (m)	Dia.	Depth	July 1995		August 1995		September 1995								
									15	30	15	30	15	30							
Ain Deffail	Beni Sennana	Dughole	IRE 3387/8	484900	444700	180	1.5	15.0	Dry	24.20	24.12	Dry	Dry	24.26	24.29	Dry	Dry	24.35	24.35		
		"	IRE 3388/8	484250	445900	220	2.05	27.7	2.05	27.7	24.20	24.12	Dry	Dry	24.26	24.29	Dry	Dry	24.35	24.35	
		"	IRE 3389/8	484100	445950	200	1.62	21.0	1.62	21.0	16.25	15.97	Dry	Dry	15.55	15.17	Dry	Dry	15.19	15.19	
		"	IRE 3390/8	484250	446000	200	1.5	5.9	1.5	5.9	5.75	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
		"	IRE 3391/8	484350	445500	180	2.0	24.0	2.0	24.0	13.80	Deepening dughole	Deepening dughole	Deepening dughole	Deepening dughole	Deepening dughole	Deepening dughole	Deepening dughole	Deepening dughole	Deepening dughole	Deepening dughole
		"	IRE 3392/8	484450	445600	180	2.0	21.0	2.0	21.0	7.34	8.77	8.92	8.92	8.92	8.92	8.92	8.92	8.92	8.92	8.92
		"	IRE 3393/8	484500	445650	190	2.0	23.9	2.0	23.9	10.25	10.26	10.28	10.28	10.28	10.28	10.28	10.28	10.28	10.28	10.28
		"	IRE 3394/8	484550	445600	190	2.0	19.3	2.0	19.3	12.76	16.65	16.75	16.75	16.75	16.75	16.75	16.75	16.75	16.75	16.75
		"	IRE 3395/8	484300	445050	190	2.0	10.9	2.0	10.9	3.60	3.35	3.35	3.35	3.35	3.35	3.35	3.35	3.35	3.35	3.35
		"	IRE 3396/8	484200	445400	190	2.0	13.1	2.0	13.1	3.75	4.19	4.13	4.13	4.13	4.13	4.13	4.13	4.13	4.13	4.13
		"	IRE 3385/8	484550	444975	180	1.4	9.4	1.4	9.4	9.00	8.60	8.95	8.95	8.95	8.95	8.95	8.95	8.95	8.95	8.95
		"	IRE 3386/8	484850	444800	190	1.5	14.6	1.5	14.6	14.35	14.39	14.46	14.46	14.46	14.46	14.46	14.46	14.46	14.46	14.46
		"	IRE 1531/9	485250	444650	165	1.8	3.8	1.8	3.8	3.50	3.71	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75
		"	IRE 1532/9	485300	444600	165	2.5	3.3	2.5	3.3	3.00	3.05	3.08	3.08	3.08	3.08	3.08	3.08	3.08	3.08	3.08
		"	IRE 1533/9	485400	446600	175	2.5	5.2	2.5	5.2	5.00	4.70	4.85	4.85	4.85	4.85	4.85	4.85	4.85	4.85	4.85
		"	IRE 1534/9	485100	444850	165	1.1	11.0	1.1	11.0	8.10	10.10	10.96	10.96	10.96	10.96	10.96	10.96	10.96	10.96	10.96
		"	IRE 1535/9	485150	444750	165	1.45	14.8	1.45	14.8	9.30	10.40	11.83	11.83	11.83	11.83	11.83	11.83	11.83	11.83	11.83
		"	Exp. well (ADF1)	IRE 3397/8	484500	445550	143.9	20"	GL-5	5-55	—	4.03	4.03	4.03	4.03	4.03	4.03	4.03	4.03	4.03	4.03
Laamirate		Exp. well (ADF2)	IRE 1537/9	485225	445575	159.4	20"	GL-5	5-76	—	2.75	7.43	7.43	7.43	7.43	7.43	7.43	7.43	7.43		
		Exp. well (ADF3)	IRE 1538/9	485925	445550	169.8	20"	GL-5	5-150	—	—	—	—	—	—	—	—	—	—	—	
Et Arba		Dughole	IRE 1529/9	486900	444200	110	1.72	11.75	11.62	11.71	11.72	11.72	11.72	11.72	11.72	11.72	11.72	11.72	11.72		
		Exst. well	IRE 1530/9	486650	444450	100	7"	28.0	Under Exploitation	Under Exploitation	Under Exploitation	Under Exploitation	Under Exploitation	Under Exploitation	Under Exploitation	Under Exploitation	Under Exploitation	Under Exploitation	Under Exploitation		

Table 4.3.5 Groundwater Levels of Dugholes and Exploratory Wells in the Model Areas (2/2)

Model Area	Donar	Type	Reference	Approx. Coordinates			Dimensions (m)		Groundwater level (from ground level)											
				X	Y	Z (m)	Dia.	Depth	July 1995			August 1995			September 1995					
									15	30	15	30	15	30	15	30				
Tercoual	El	Dughole	IRE 1509/9	512950	452760	430	1.35	6.2	5.90	5.73	5.65	5.80	5.80	5.80	5.86					
	Jarrarah	"	IRE 1510/9	513000	452750	430	1.55	8.3	7.95	8.23	8.20	8.17	8.23	8.23						
	Marf El	Dughole	IRE 1511/9	512950	453050	460	1.62	21.0	13.50	13.67	13.70	13.26	13.06	13.10						
	Terciana	Exist. well	IRE 1512/9	511600	452700	420	12"	GI-52	Under Exploitation	Under Exploitation	Under Exploitation	Under Exploitation	Under Exploitation	Under Exploitation						
	Jarrarah	Exp. well (TRAI)	IRE 1513/9	511300	452550	460	6.5"	52-82	Dry	--	--	--	--	--						
	Khouder	Exp. well (TRAI)	IRE 1514/9	510900	452225	335.8	20"	GL-10	--	--	--	--	--	--						
	Lazeb	Exp. well (TRA2)	IRE 1514/9	484450	445600	180	12.25"	10-250	--	61.63	61.63	61.63	61.63	63.00	63.25					
		Exp. well (TRA3)	IRE 1515/9	510650	552150	337.3	20", 17"	GL-170	--	--	--	--	68.00	67.94	68.52					
							12.25"	170-300	--	--	--	--	--	--	--					
							12.25"	GI-120	--	--	--	--	--	--	--					
Jbel Berda	A. Berda	Dughole	IRE 1516/9	550850	446950	740	1.7	15.5	15.00	15.45	15.47	15.35	15.12	15.50						
	Ras El	Dughole	IRE 1517/9	550000	446700	775	2 x 2	11.3	11.20	11.22	11.19	10.87	10.90	10.95						
	Kbour	"	IRE 1518/9	550100	446800	770	0.84x0.84	9.3	9.30	Dry	Dry	Dry	Dry	Dry						
		"	IRE 1519/9	549900	446750	775	1 x 0.94	10.4	10.20	10.26	10.20	9.68	9.74	10.10						
		"	IRE 1520/9	549950	446700	770	1 x 0.8	10.2	10.00	Dry	Dry	Dry	Dry	Dry						
		"	IRE 1521/9	549850	446650	760	1 x 1	16.2	15.95	16.02	16.20	16.14	16.15	Dry						
		"	IRE 1522/9	549900	446800	790	1 x 1	10.1	10.05	Dry	Dry	Dry	Dry	Dry						
		"	IRE 1523/9	549950	446800	790	1 x 1	10.6	9.97	10.54	10.02	10.58	10.08	Dry						
		"	IRE 1524/9	550150	446850	780	1 x 1	17.5	13.97	13.30	13.45	17.12	15.77	15.50						
	El Aïn	Dughole	IRE 1525/9	550100	446850	765	1 x 1	10.6	10.28	10.35	10.42	Dry	Dry	Dry						
Aoumane	Exp. well (JBD3)	IRE 1526/9	550000	447200	810.9	20"	GL-10	--	--	34.29	34.68	34.76	34.68	34.72						
Douher	Exp. well (JBD2)	IRE 1527/9	549750	446925	810.5	15"	10-100	--	--	--	59.46	59.62	61.38	61.27						
Tazradra	Exp. well (JBD1)	IRE 1528/9	548125	447100	573.5	15"	10-150	--	--	--	--	55.70	--	--						

4.4 Exploratory Well Drilling and Pumping Test



Table 4.4.1 Hydrogeological Characteristics of Exploratory Wells

Model Area	Coordinates (Approx.)		Drilling		Casing & Screen			Geology		
	X	Y	Z (m)	Dia.	Depth	Dia.	Casing	Screen	Epoch	Strata
Teroual IRE 1531/9 (TRA 1)	511300	452550	420	20"	10 m	16"	10 m	—	Miocene Oligocene Triassic	Marl Siltstone Salt
				12.25"	10-250	—	—	—		
IRE 1514/9 (TRA 2)	510900	552225	335.8	24"	10 m	20"	10 m	36 m	Miocene Oligocene	Marl Siltstone Marl lime
				17"	10-170	14"	170 m	45 to 120 m		
IRE 1528/9 (TRA 3)	510650	452150	337.7	12.25"	170-300	14"	—	—	Miocene Oligocene	Marl & Gravel Siltstone
				20"	10 m	16"	10 m	36 m		
J.Berda IRE 1528/9 (JBD 1)	548125	447100	573.5	20"	10 m	16"	10 m	—	Jurassic Upper Cretaceous	Boulders Marlstone Schist
				15"	10-67	—	—	—		
IRE 1527/9 (JBD 2)	549450	446800	610.5	20"	10 m	16"	10 m	60 m	Jurassic Upper Cretaceous	Boulders Marlstone Schist
				15"	10-150	10"	150 m	62 to 144 m		
IRE 1526/9 (JBD 3)	550150	446925	810.9	20"	10 m	16"	10 m	36 m	Jurassic Upper Cretaceous	Boulders Marlstone Schist
				15"	10-100	10"	100 m	32 to 100 m		
Ain Defali IRE 15397/8 (ADF 1)	484500	445550	143.9	20"	5 m	16"	5 m	36 m	Quaternary Villafranchian	Conglomerate
				15"	5-76	10"	125 m	16 to 70 m		
IRE 1537/9 (ADF 2)	485225	445575	459.4	20"	5 m	16"	5 m	30 m	Quaternary Villafranchian	Conglomerate
				15"	5-55	10"	55 m	13 to 49 m		
IRE 1538/9 (ADF 3)	485925	445550	169.8	20"	5 m	16"	5 m	76 m	Quaternary Villafranchian	Conglomerate
				15"	5-125	10"	125 m	13 to 119 m		
				12.25"	125-150	10"	—	—		

Table 4.4.2 Technical Details of Pumping Tests of Exploratory Wells

Model Area	Well Reference No.	Development Test						Pumping Test									
		Well Depth (m)	Date of Test	Time (hr)	Stage (Nos.)	SWL (m)	Yield (l/sec)	Draw-down (m)	Date	Time (hr)	Stage (Nos.)	SWL (m)	Yield (l/sec)	Draw-down (m)	Specific Drawdown (sec/m ²)	Well Loss (sec/m ⁵)	Formation Loss (sec/m ⁵)
Teroual	IRE 1531/9 (TRA1)	250	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	IRE 1514/9 (TRA2)	300	10/9/95 11/9/95	24	1	62.50	10	28.20	12/9/95	8	4	63.25	2.5 5.0 7.5 10.0	6.67 12.75 18.60 21.12	2668 2550 2480 2112	68000	1080
	IRE 1515/9 (TRA3)	150	20/9/95 21/9/95	10	1	38.36	10	4.02	2/9/95	8	4	68.46	2.5 5.0 7.5 10.0	0.05 0.12 0.20 0.34	20 24 26.6 34	500	17
J. Borda	IRE 1528/9 (JBD1)	67	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	IRE 1527/9 (JBD2)	150	13/9/95 14/9/95	24	1	61.45	10	32.52	14/9/95	8	4	61.38	2.5 5.0 7.5 10.0	4.49 10.57 17.27 26.40	1796 2114 2302 2640	250	25
	IRE 1526/9 (JBD3)	100	16/9/95 19/9/95	64	1	34.68	1.5	0.52	25/8/95	8	4	34.79	0.5 1.0 1.5 2.0	0.18 0.38 1.01 2.19	360 380 673 1095	360000	90
Ain Dehail	IRE 3397/8 (ADF1)	76	23/8/95 24/8/95	24	3 6 hrs each	4.03	10 15 18.5	7.39 12.35 16.14	26/8/95	8	4	8.51	5.3 10.6 15.0 17.6	10.76 13.85 16.59 18.54	2030 1307 1106 1053	10000	35
	IRE 1537/9 (ADF2)	55	3/8/95 18/8/95	12 12	2 2 x 6 hrs 1 x 12 hrs	2.75	4.5 6.0 9.5-7.6	10.12 14.70 44.15	21/8/95	8	4	3.10	2.0 4.0 6.0 7.6	7.57 15.03 27.38 42.55	3785 3757 4563 4599	270000	250
	IRE 1538/9 (ADF3)	150	15/9/95 16/9/95	24	1	32.38	10	38.28	16/9/95	8	4	32.50	2.5 5.0 7.5 10.0	2.97 7.28 13.37 32.28	1188 1456 1783 3228	70000	150

Table 4.4.3 Technical Details of Constant Rate Pumping and Recovery Tests of Exploratory Wells

Model Area	Well Reference No.	Pumping Test										Recovery				
		Well Depth (m)	Date of Test	Time (hr)	SWL (m)	Yield (l/sec)	Drawdown (m)	Transmissivity (m ² /sec)	Effective Permeability (m/sec)	Storage Coefficient	Original SWL (m)	Transmissivity (m ² /sec)				
													Constant Rate			
Teroual	IRE 1531/9 (TRA1)	250	---	---	---	---	---	---	---	---	---	---	---	---	---	
	IRE 1514/9 (TRA2)	300	24/6/95 27/9/95	72	63.97	10	21.60	9.8 x 10 ⁻⁴	1.63 x 10 ⁻⁵	4.36 x 10 ⁻⁴	40	6.09 x 10 ⁻⁴	---	---	---	
	IRE 1515/9 (TRA3)	150	22/9/95 23/9/95	37	68.52	10	0.68	8.73 x 10 ⁻³	2.49 x 10 ⁻⁴	4.8 x 10 ⁻³	14	1.81 x 10 ⁻²	---	---	---	---
J. Berda	IRE 1528/9 (JBD1)	67	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	IRE 1527/9 (JBD2)	150	15/9/95 18/9/95	60 12	61.45	8 11	25.05 31.42	4.88 x 10 ⁻⁴	1.83 x 10 ⁻⁵	2.5 x 10 ⁻³ (estimated)	41	1.56 x 10 ⁻³	---	---	---	---
	IRE 1526/9 (JBD3)	100	26/8/95 29/8/95	72 10	34.76	2 2.5	42.64 48.19	9.8 x 10 ⁻⁵	1.50 x 10 ⁻⁶	2.5 x 10 ⁻³ (estimated)	21	2.08 x 10 ⁻⁴	---	---	---	---
Ain Defail	IRE 3397/8 (ADF1)	76	27/8/95 30/8/95	72	8.8	15	14.35	1.8 x 10 ⁻³	1.8 x 10 ⁻⁵	1.5 x 10 ⁻³ (estimated)	72	1.14 x 10 ⁻³	---	---	---	---
	IRE 1537/9 (ADF2)	55	22/8/95 25/8/95	72	7.43	5	31.82	1.17 x 10 ⁻⁴	1.06 x 10 ⁻⁶	1.5 x 10 ⁻³ (estimated)	72	2.03 x 10 ⁻⁴	---	---	---	---
	IRE 1538/9 (ADF3)	150	17/9/95 20/9/95	72	32.5	10 12	23.45 23.41	9.14 x 10 ⁻⁴	1.08 x 10 ⁻⁵	1.5 x 10 ⁻³ (estimated)	26	1.35 x 10 ⁻³	---	---	---	---

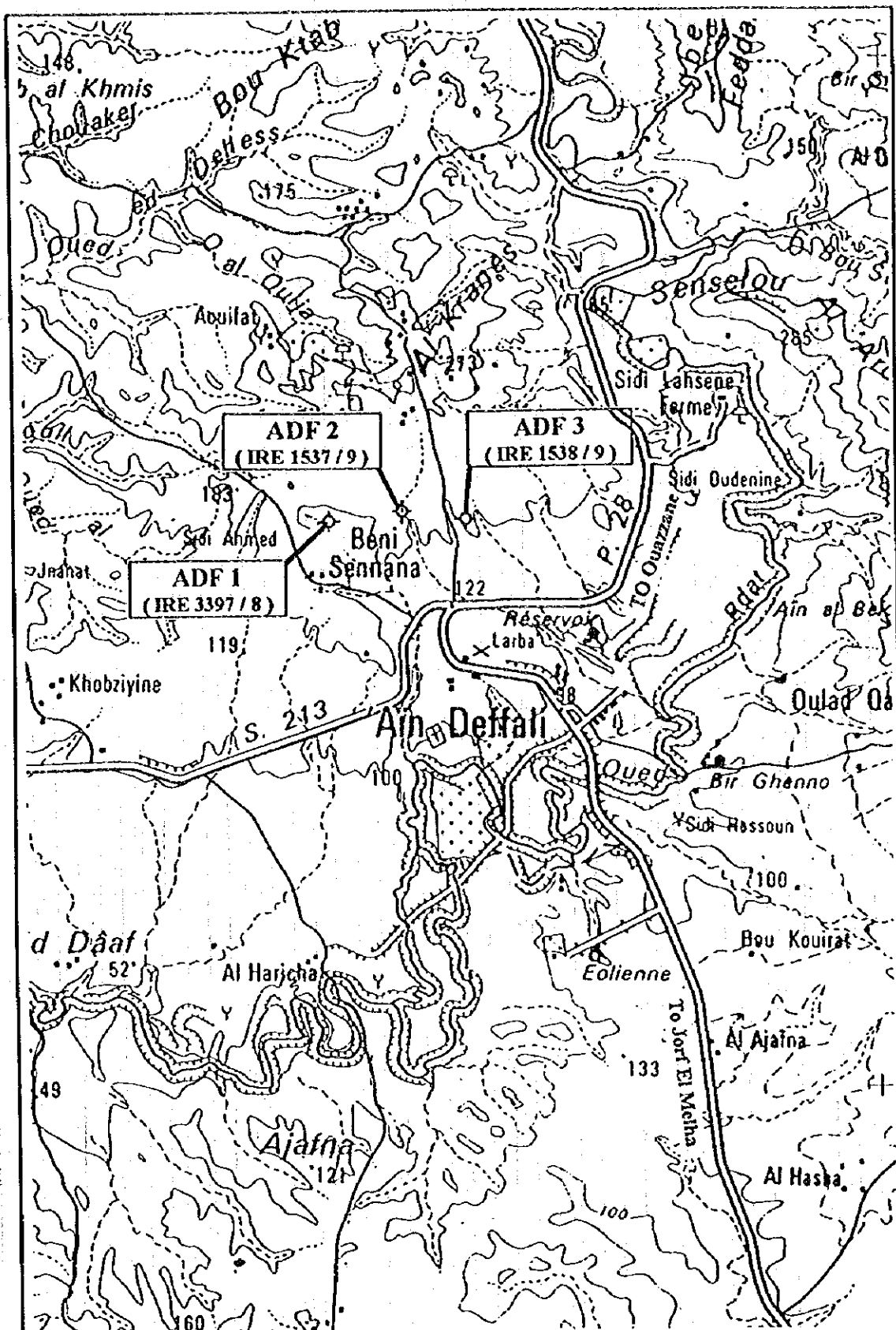
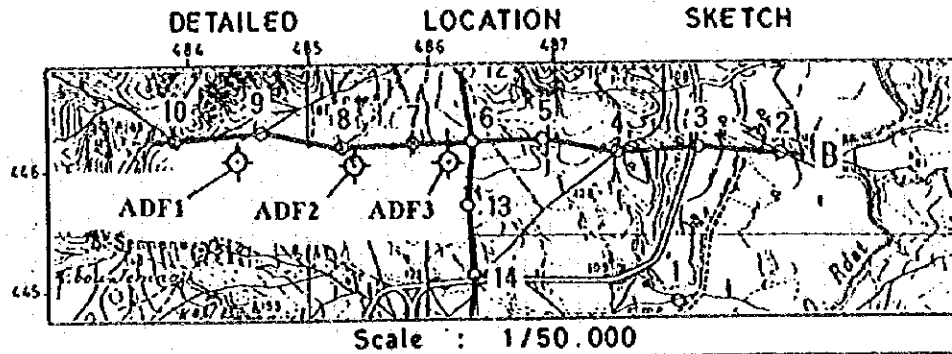


Figure 4.4.1 Location of Exploratory Well Sites - Aïn Defali



GEOLOGICAL AND TECHNICAL WELL CROSS SECTION

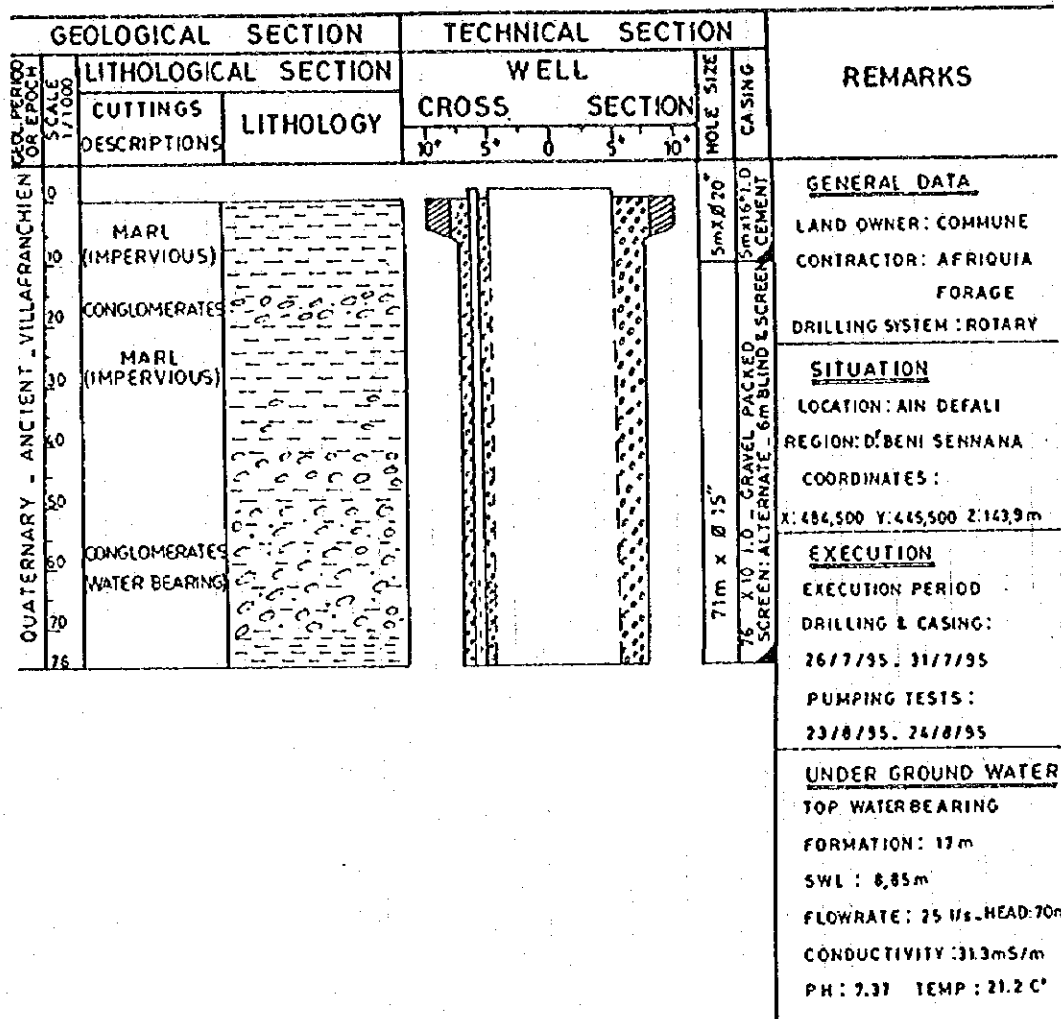


Figure 4.4.4
Geological and Technical Cross Sections of Exploratory Well (1/9)
- Ain Defali (ADF1)

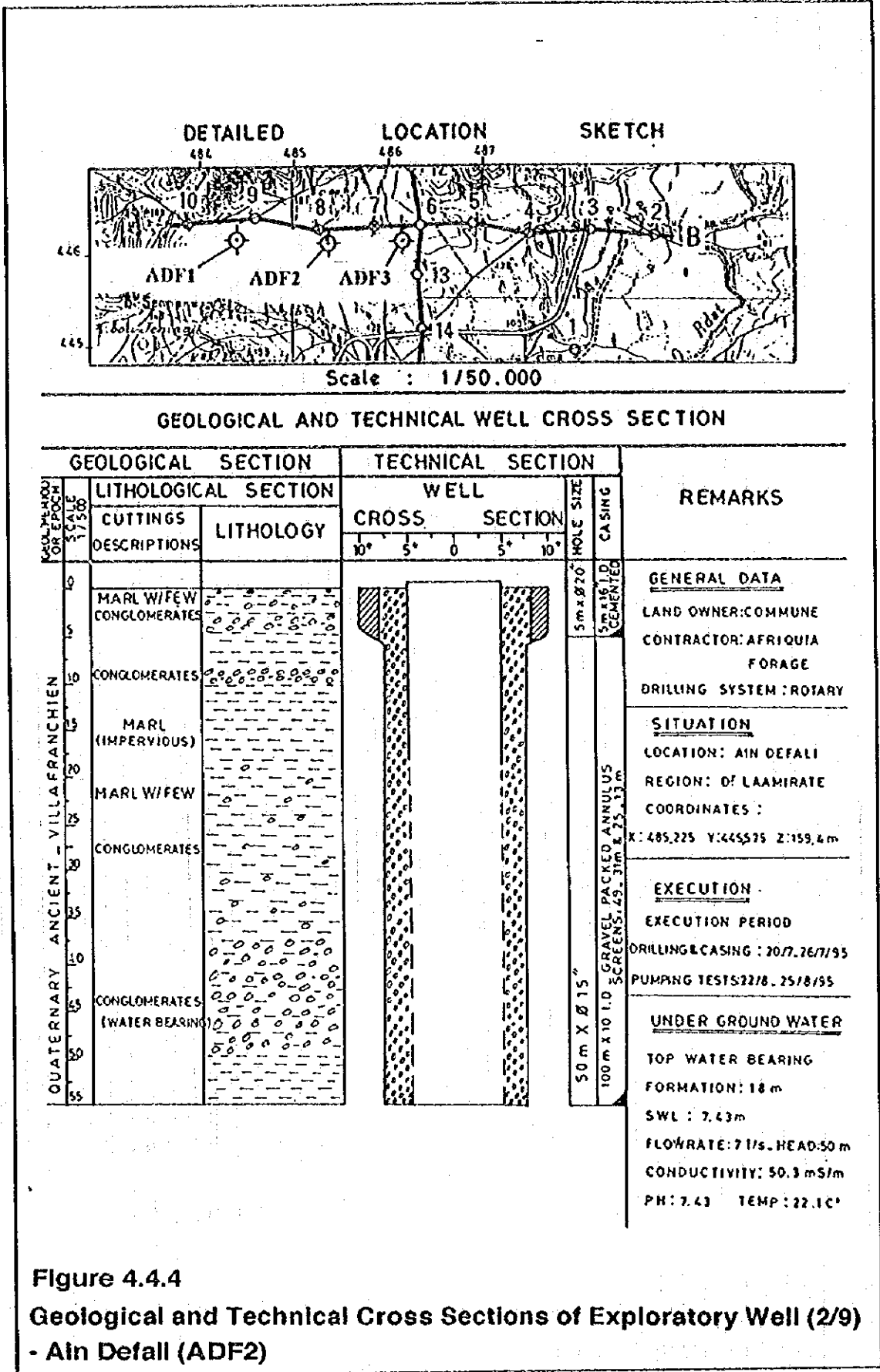
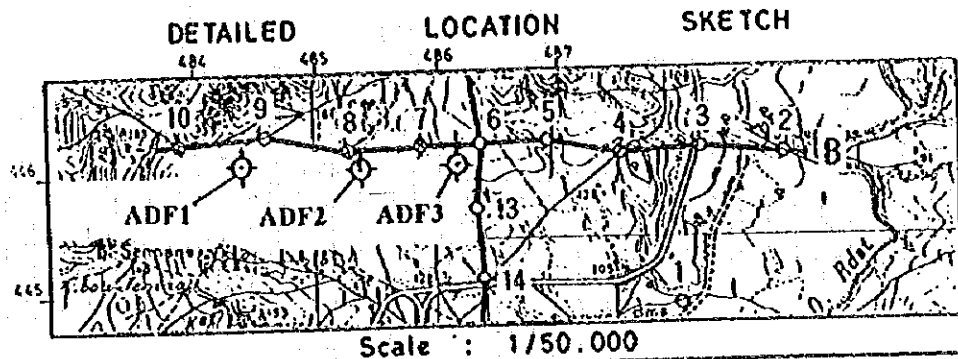


Figure 4.4.4
Geological and Technical Cross Sections of Exploratory Well (2/9)
- Ain Defali (ADF2)



GEOLOGICAL AND TECHNICAL WELL CROSS SECTION

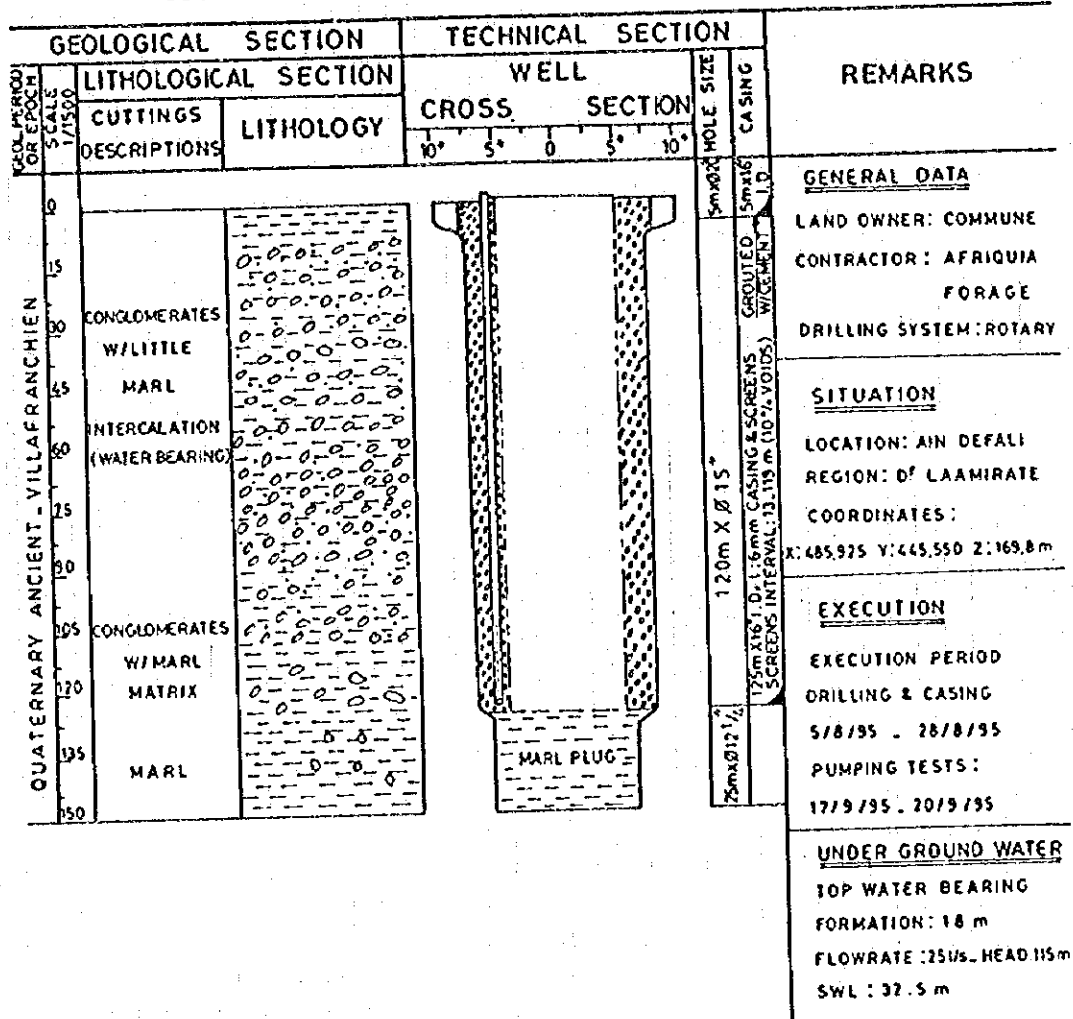
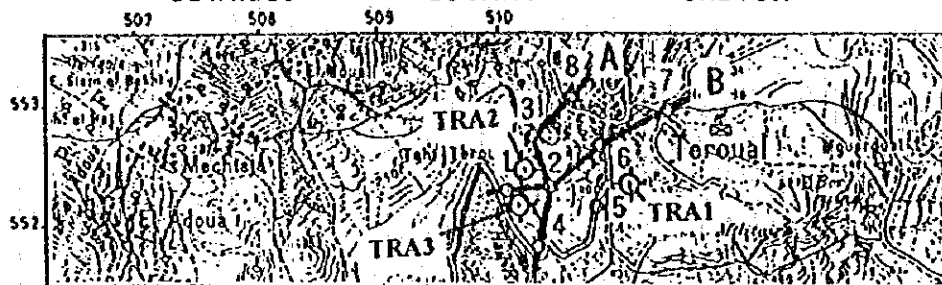


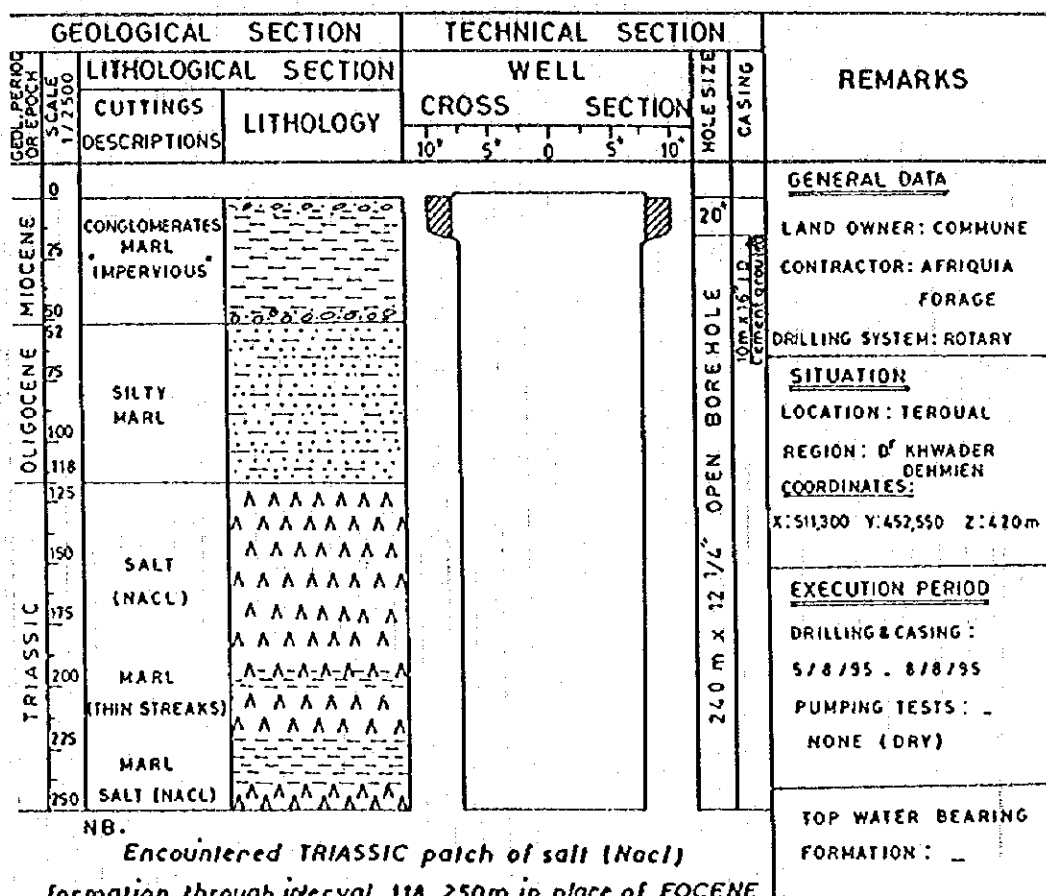
Figure 4.4.4
Geological and Technical Cross Sections of Exploratory Well (3/9)
- Ain Defall (ADF3)

DETAILED LOCATION SKETCH



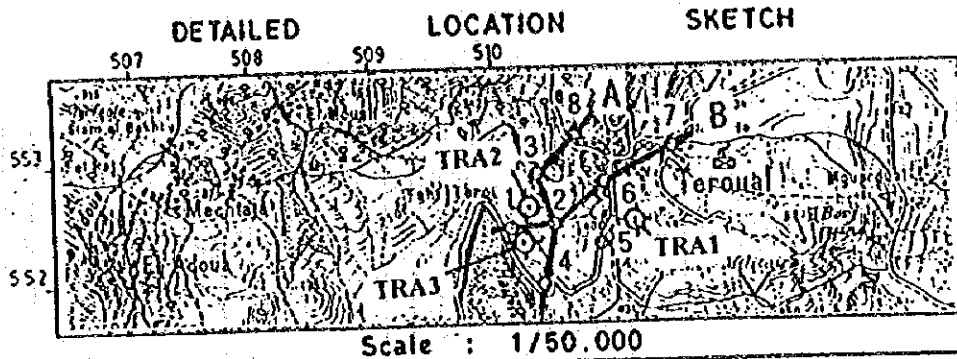
Scale : 1/50.000

GEOLOGICAL AND TECHNICAL WELL CROSS SECTION



NB.
 Encountered TRIASSIC patch of salt (NaCl) formation through interval 118-250m in place of EOCENE limestone in the synclinal structure.
 The TRIASSIC patch was unexpected due to its absence in the catchment area, and was unrecognized by the geophysical prospection survey, where 40 ohm, m resistivity was recorded.

Figure 4.4.4
Geological and Technical Cross Sections of Exploratory Well (4/9)
- Teroual (TRA1)



GEOLOGICAL AND TECHNICAL WELL CROSS SECTION

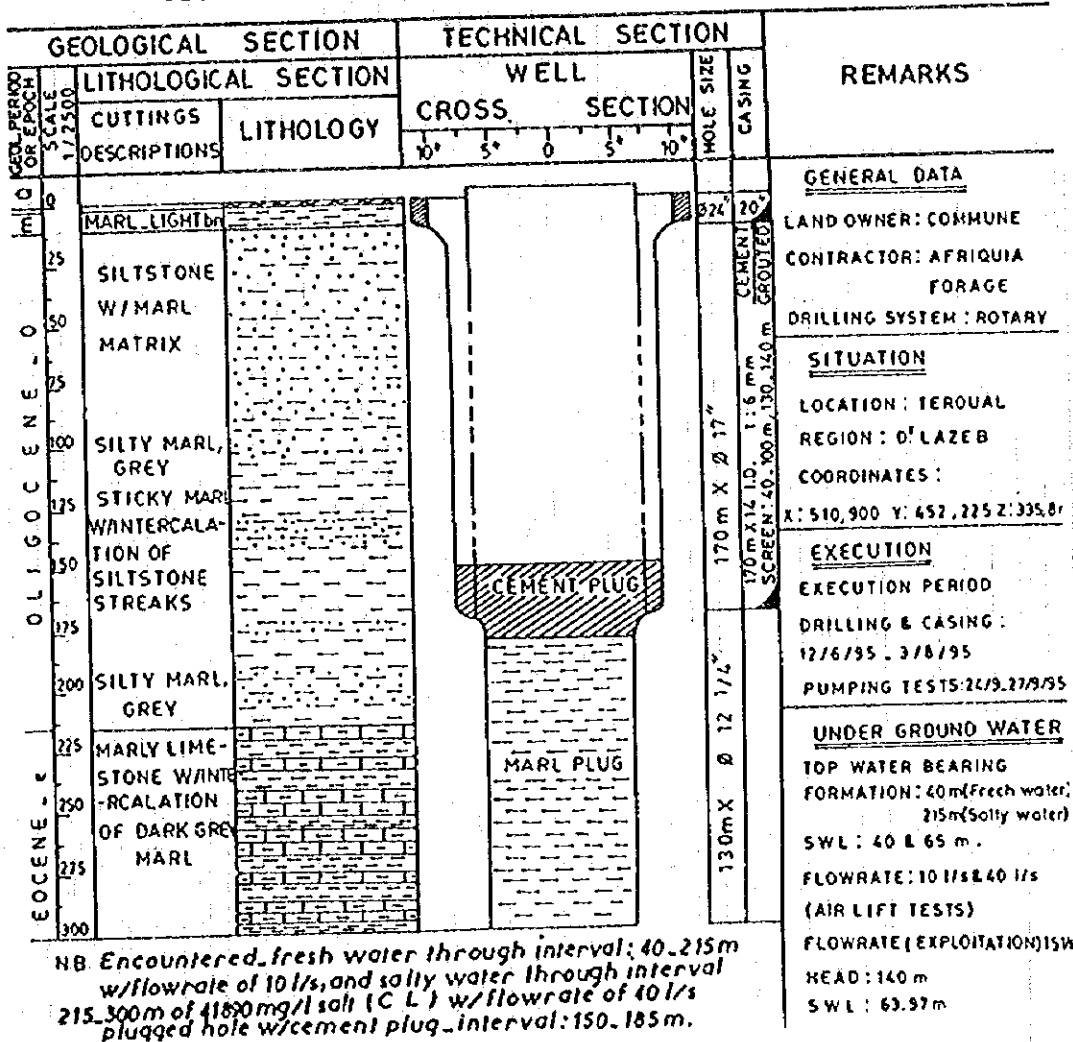
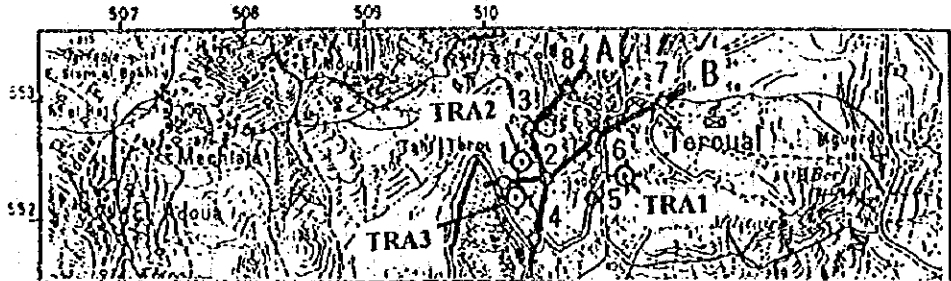


Figure 4.4.4
Geological and Technical Cross Sections of Exploratory Well (5/9)
- Teroual (TRA2)

DETAILED LOCATION SKETCH



Scale : 1/50,000

GEOLOGICAL AND TECHNICAL WELL CROSS SECTION

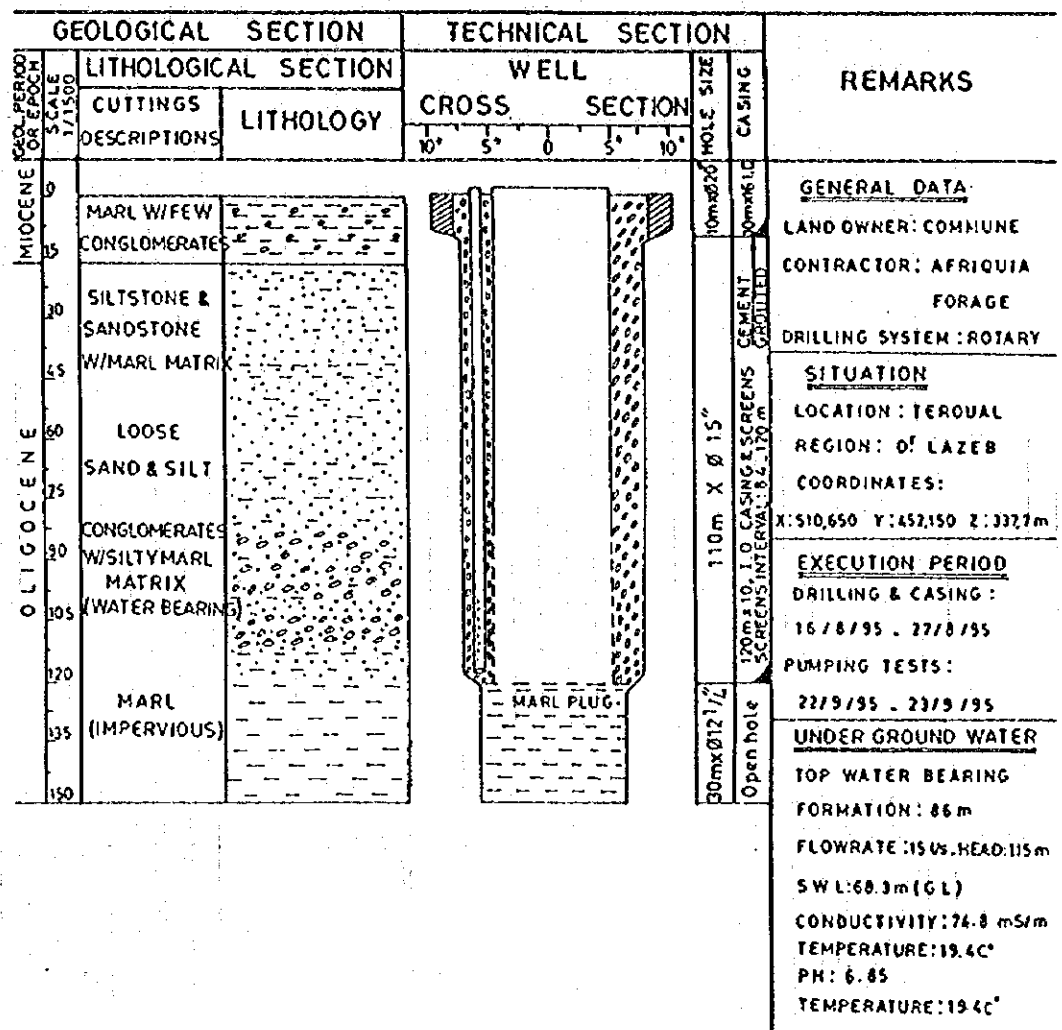


Figure 4.4.4
Geological and Technical Cross Sections of Exploratory Well (6/9)
- Teroual (TRA3)

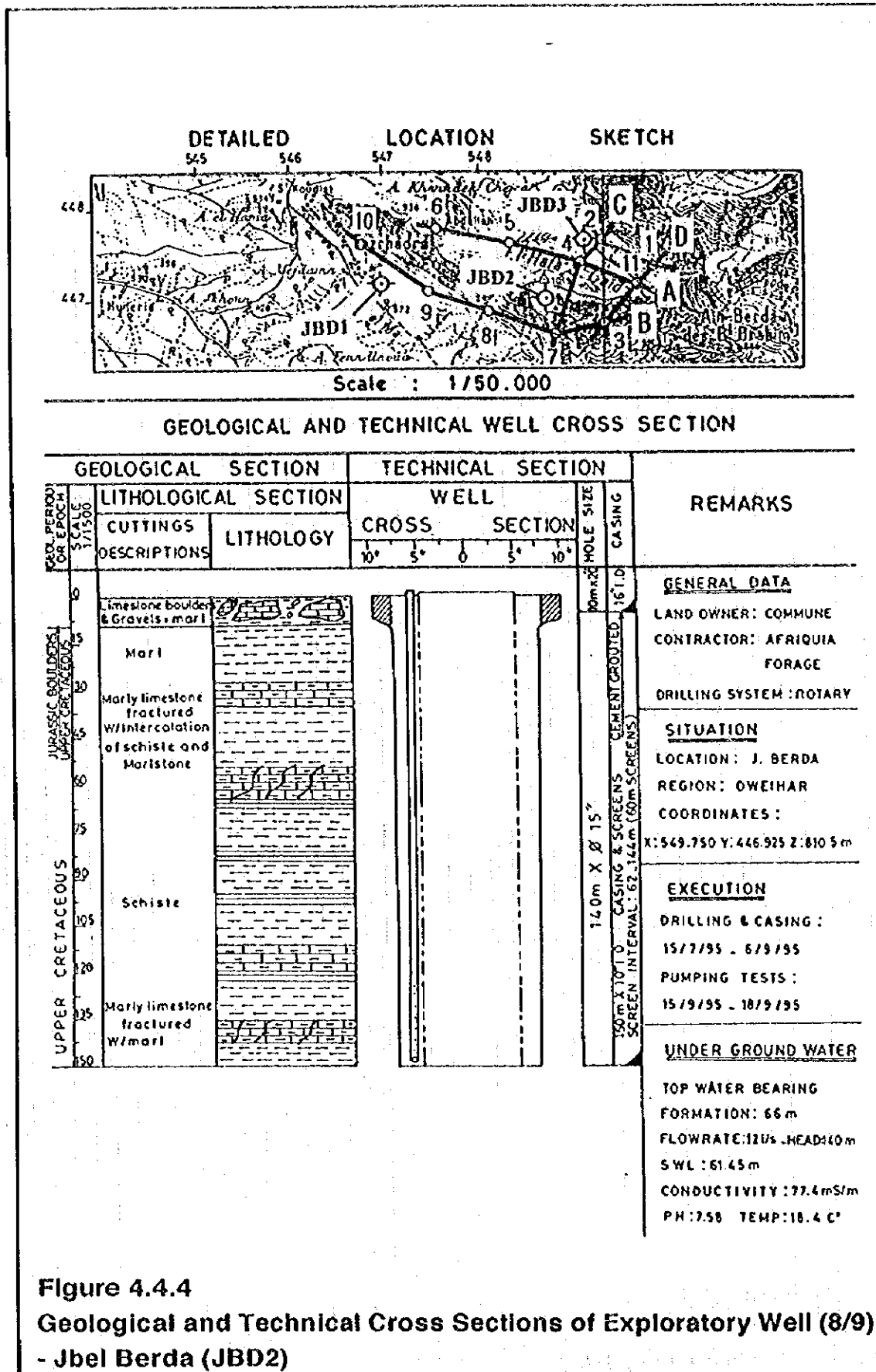
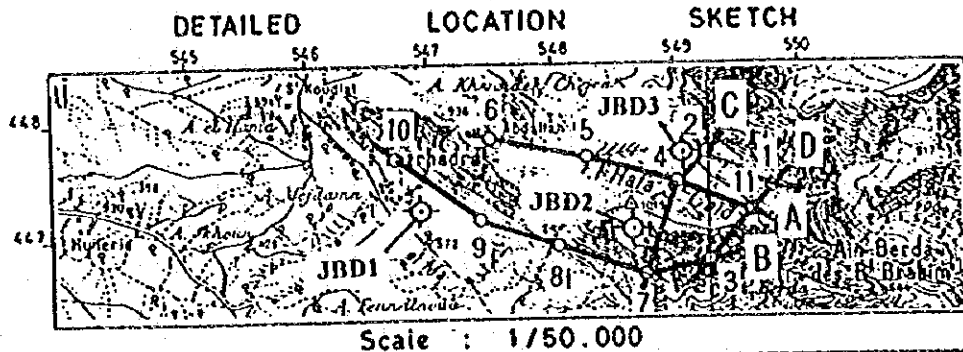


Figure 4.4.4
Geological and Technical Cross Sections of Exploratory Well (8/9) - Jbel Berda (JBD2)



GEOLOGICAL AND TECHNICAL WELL CROSS SECTION

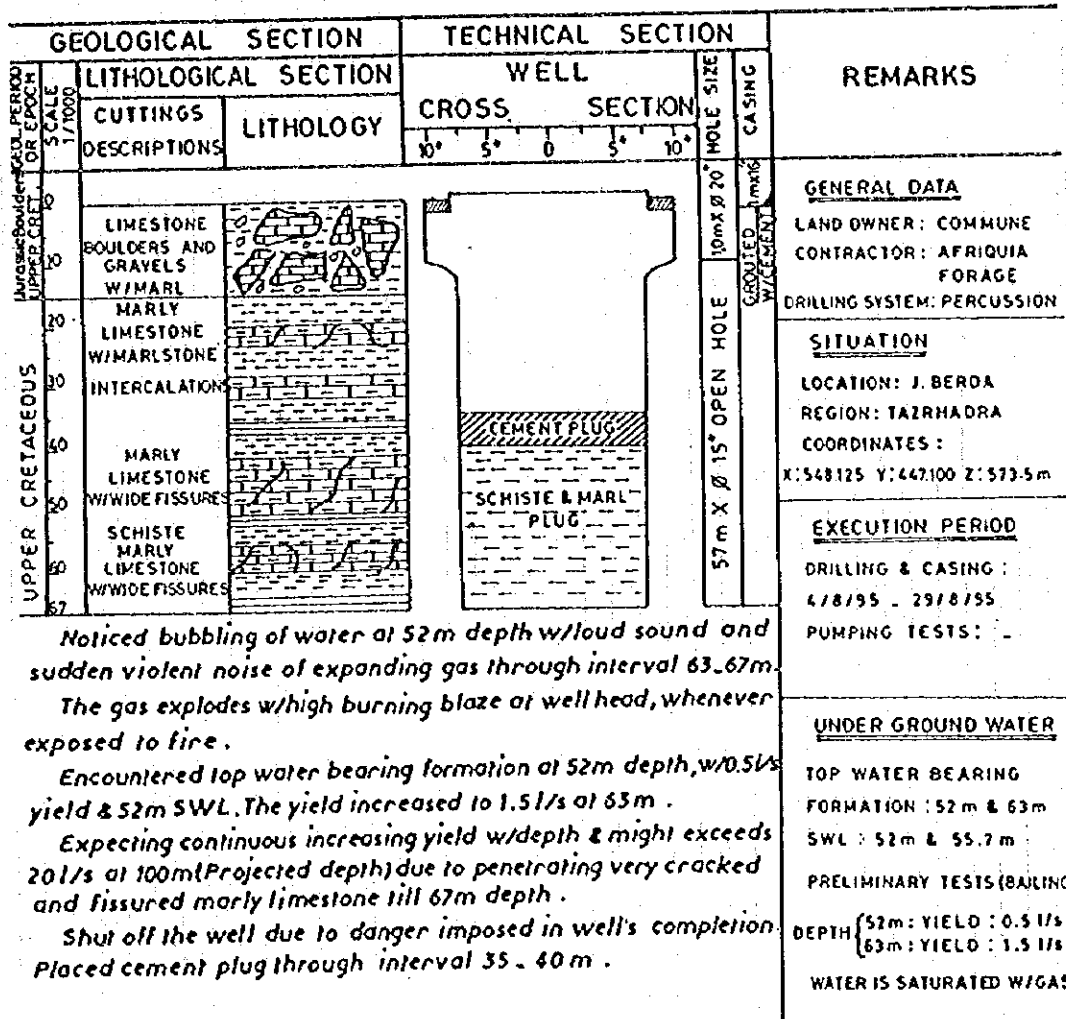
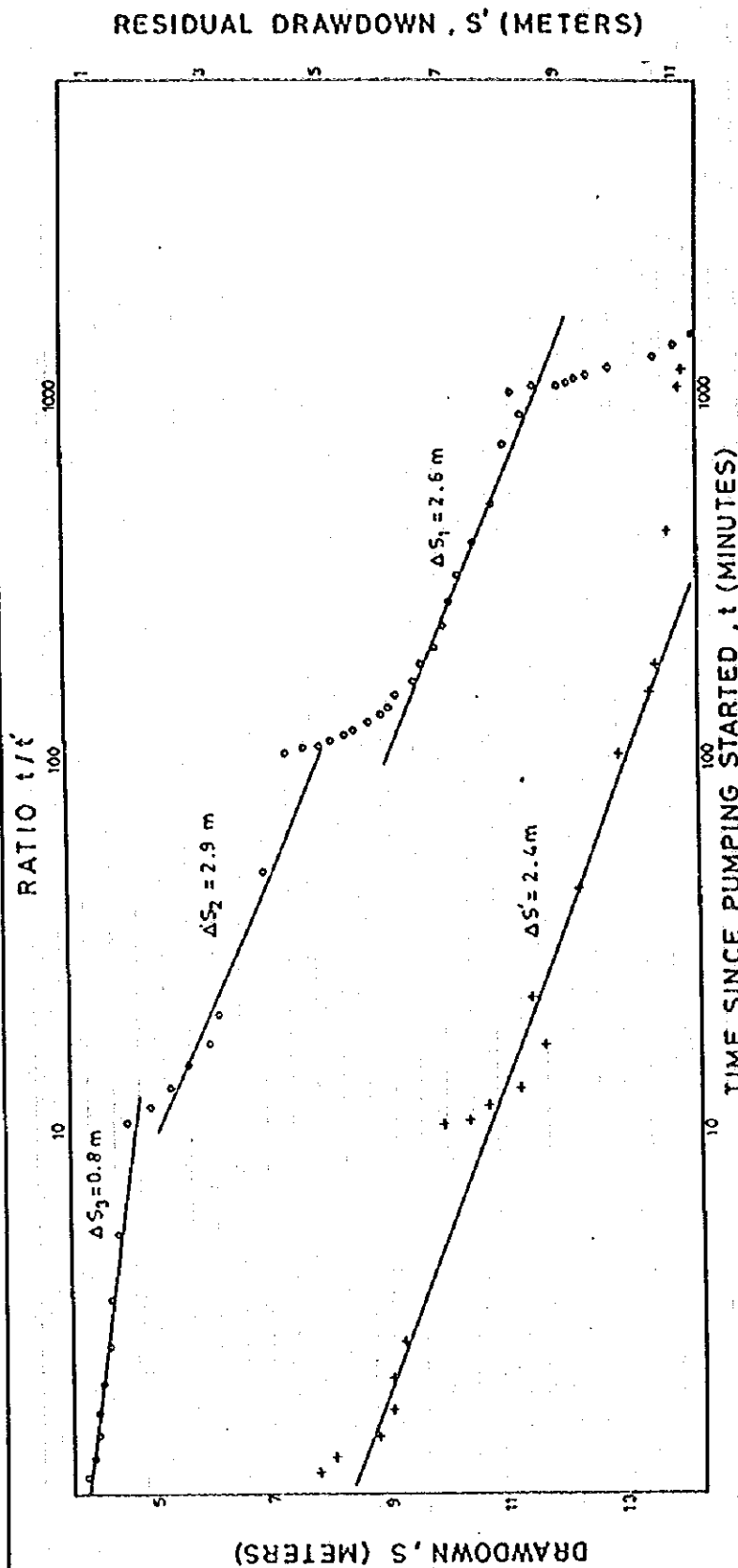


Figure 4.4.4
Geological and Technical Cross Sections of Exploratory Well (9/9)
- Jbel Berda (JBD3)

JACOB TIME - DRAWDOWN / RESIDUAL DRAWDOWN PLOTS



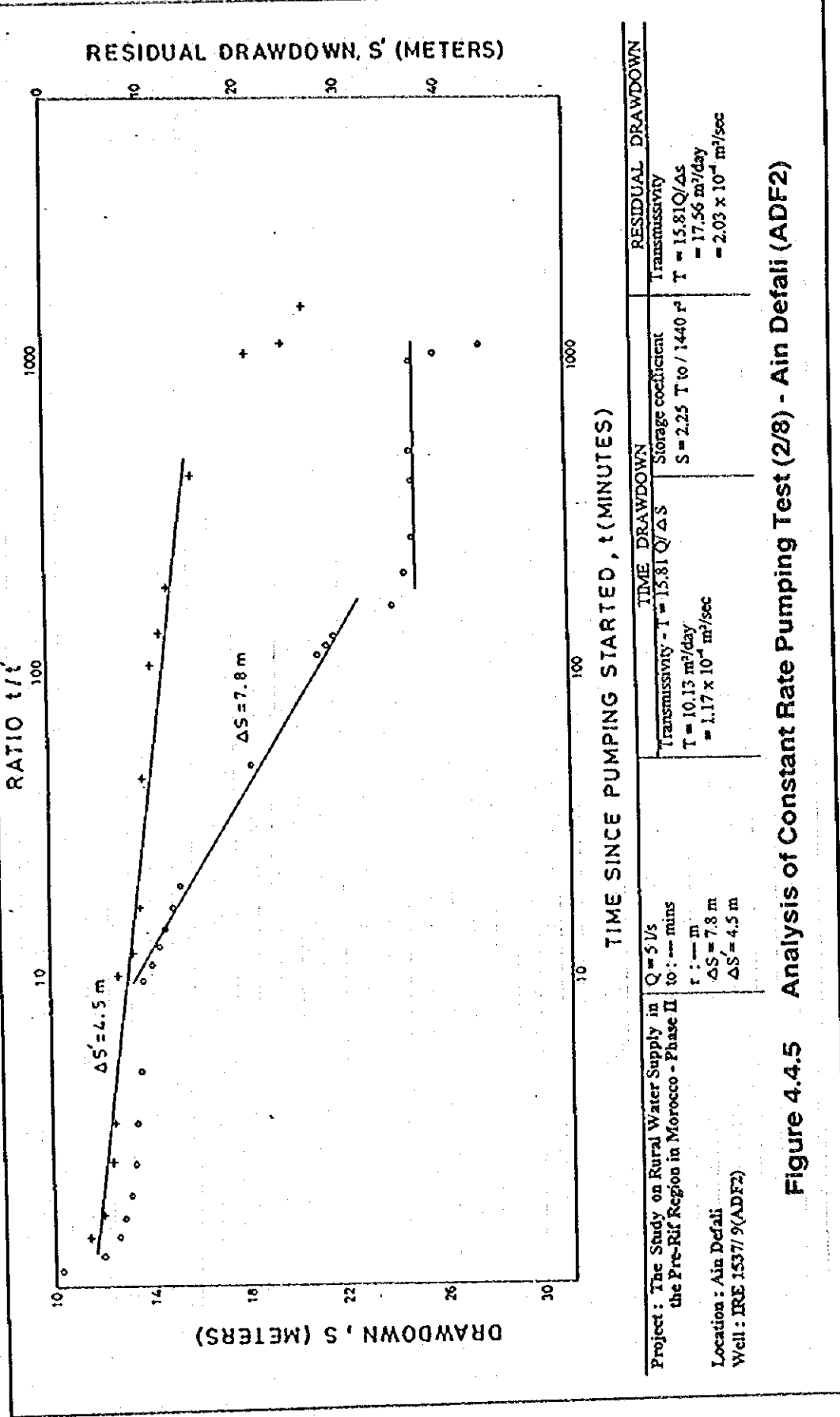
TIME SINCE PUMPING STARTED, t (MINUTES)		TIME DRAWDOWN	RESIDUAL DRAWDOWN
Q = 15 l/s		Transmissivity - T = 15.81 Q/Δs	Transmissivity
to : - mins	r : - m	T ₁ = 91.2 m ² /d = 1.05 x 10 ³ m ² /sec	T = 15.81Qav / Δs
ΔS ₁ = 2.6 m	ΔS ₂ = 2.9 m	T ₂ = 81.7 m ² /d = 0.94 x 10 ³ m ² /sec	T = 98.8 m ² /day
ΔS ₃ = 0.8 m	ΔS ₁ = 2.4 m	T ₃ = 296.4 m ² /d = 3.43 x 10 ³ m ² /sec	= 1.14 x 10 ³ m ² /sec
ΔS ₁ = 2.6 m	ΔS ₁ = 2.4 m	T _{av} = 156.4 m ² /d = 1.8 x 10 ³ m ² /sec	
Storage coefficient S = 2.25 T to / 1440 r ²			

Project : The Study on Rural Water Supply in the Pre-Rif Region in Morocco - Phase II

Location : Ain Defali
Well : IRE 3997/8(ADFF)

Figure 4.4.5 Analysis of Constant Rate Pumping Test (1/8) - Ain Defali (ADFF)

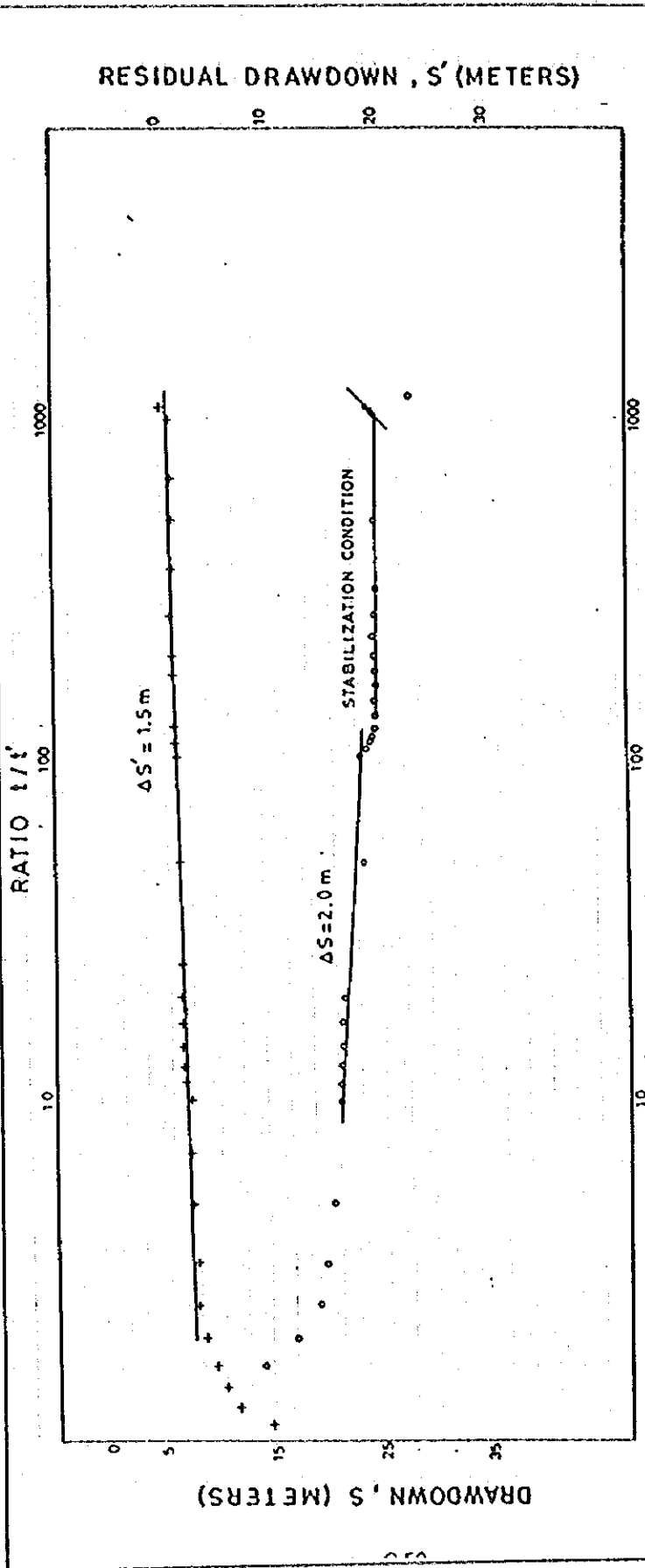
JACOB TIME-DRAWDOWN / RESIDUAL DRAWDOWN PLOTS



Project : The Study on Rural Water Supply in the Pre-Rif Region in Morocco - Phase II Location : Ain Defali Well : IRE 1537/9(ADF2)	Q = 5 l/s to : --- mins	TIME DRAWDOWN Transmissivity - T = 15.81 Q / ΔS T = 10.13 m ² /day = 1.17 x 10 ⁻⁴ m ² /sec	RESIDUAL DRAWDOWN Transmissivity T = 15.81 Q / ΔS = 17.56 m ² /day = 2.03 x 10 ⁻⁴ m ² /sec
	r : --- m ΔS = 7.8 m ΔS' = 4.5 m	Storage coefficient S = 2.25 T to / 1440 r ²	

Figure 4.4.5 Analysis of Constant Rate Pumping Test (2/8) - Ain Defali (ADF2)

JACOB TIME - DRAWDOWN / RESIDUAL DRAWDOWN PLOTS

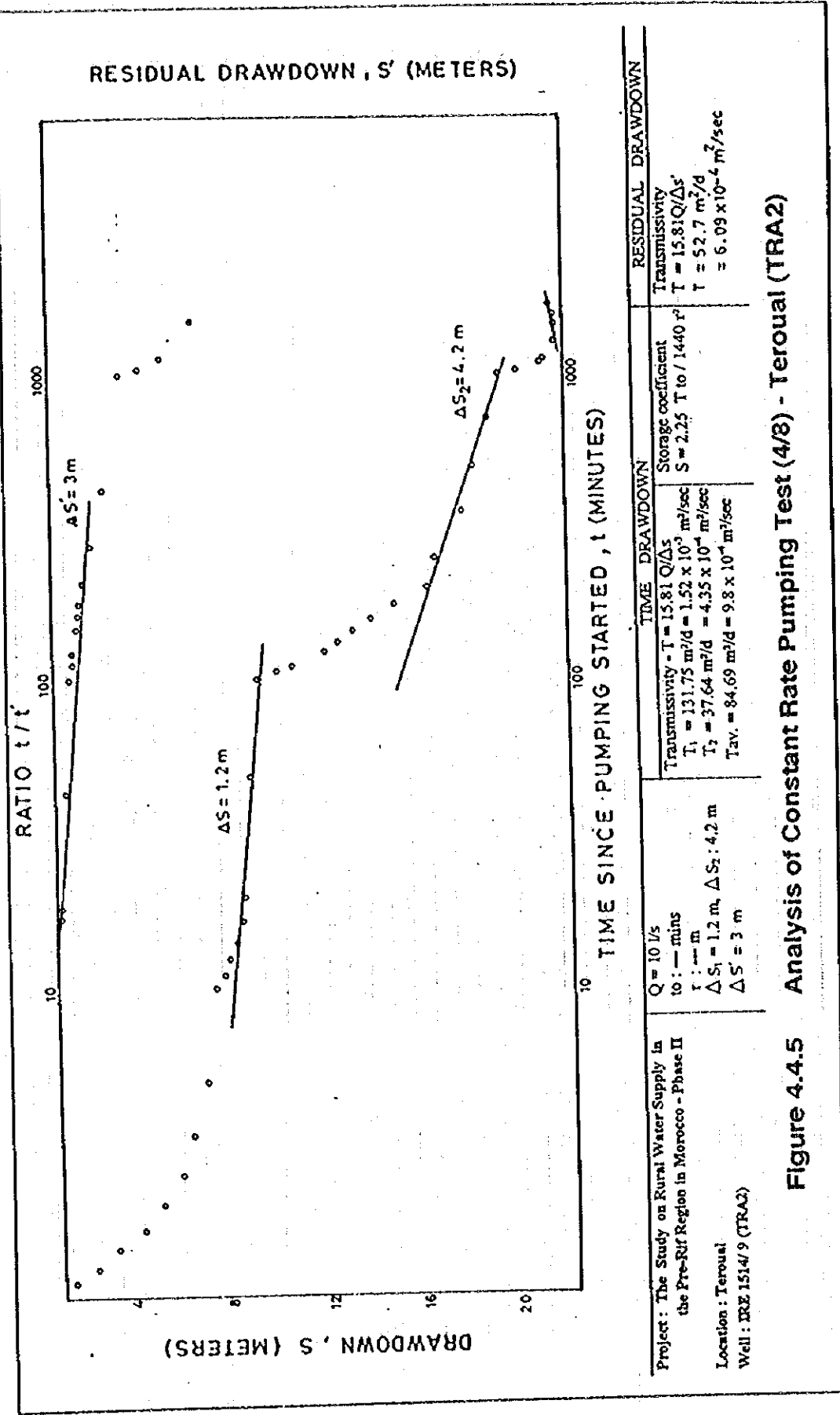


TIME SINCE PUMPING STARTED, t (MINUTES)

Project: The Study on Rural Water Supply in the Pre-Rif Region in Morocco - Phase II Location: Ain Defali Well: IRE 1538/9(ADF3)	Q = 10 l/s & 12 l/s, Q _{av} = 11.08 l/s Q _{av} = 11.08 l/s to : — mins	TIME DRAWDOWN Transmissivity - T = 15.81 Q / ΔS = 79 m ² /d = 9.14 x 10 ⁻⁴ m ² /sec	RESIDUAL DRAWDOWN Transmissivity T = 15.81 Q _{av} / ΔS T = 116.8 m ² /d = 1.35 x 10 ⁻³ m ² /sec
		Storage coefficient S = 2.25 T to / 1440 r ²	

Figure 4.4.5 Analysis of Constant Rate Pumping Test (3/8) - Ain Defali (ADF3)

JACOB TIME - DRAWDOWN / RESIDUAL DRAWDOWN PLOTS



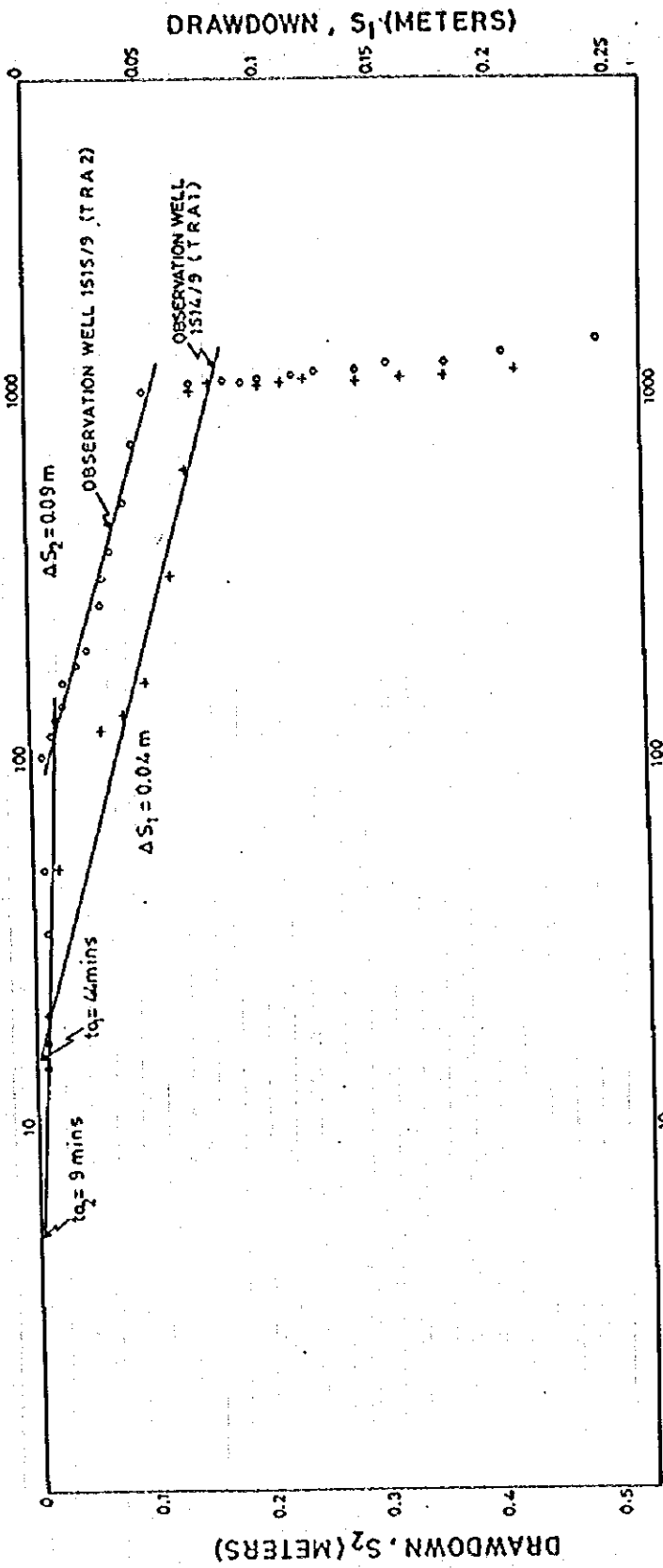
TIME SINCE PUMPING STARTED, t (MINUTES)

TIME SINCE PUMPING STARTED, t (MINUTES)		TIME DRAWDOWN	RESIDUAL DRAWDOWN
Q = 10 l/s		Transmissivity - T = 15.81 Q/Δs	Transmissivity
t ₀ = - mins	Δs ₁ = 1.2 m, Δs ₂ = 4.2 m	T ₁ = 131.75 m ² /d = 1.52 x 10 ³ m ² /sec	T = 15.81 Q/Δs
t = - m	Δs = 3 m	T ₂ = 37.64 m ² /d = 4.35 x 10 ⁴ m ² /sec	T = 52.7 m ² /d
		T _{av} = 84.69 m ² /d = 9.8 x 10 ⁴ m ² /sec	= 6.09 x 10 ⁻⁶ m ² /sec
			Storage coefficient
			S = 2.25 T to / 1440 r ²

Project : The Study on Rural Water Supply in the Pre-Rif Region in Morocco - Phase II
 Location : Teroual
 Well : IRE 1514/9 (TRA2)

Figure 4.4.5 Analysis of Constant Rate Pumping Test (4/8) - Teroual (TRA2)

JACOB TIME - DRAWDOWN PLOT

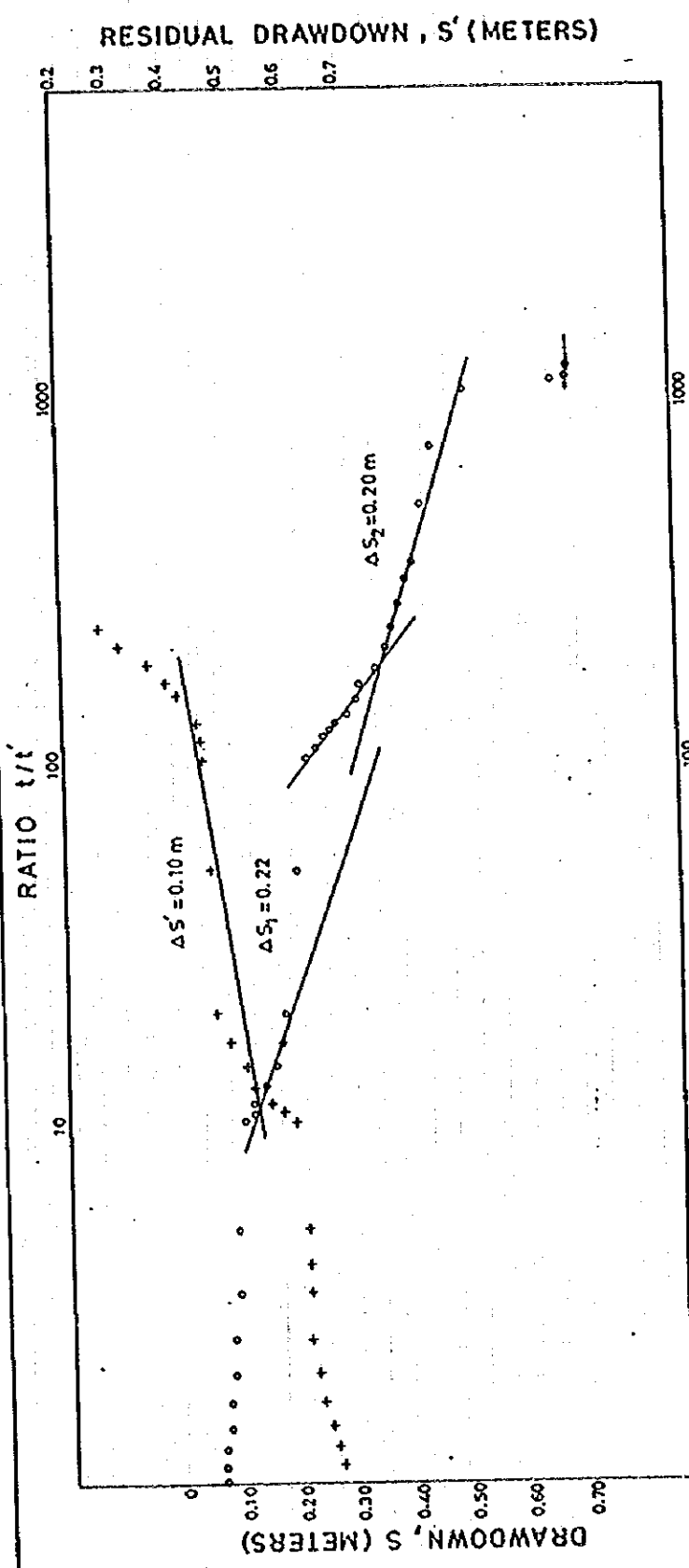


TIME SINCE PUMPING STARTED, t (MINUTES)

<p>Project: The Study on Rural Water Supply in the Pre-Rif Region in Morocco - Phase II</p> <p>Location: Teroual Piezometric Well: 1514- TRA2 (1) to test well TRA3 1515- TRA3 (2) to test well TRA2</p>	<p>TIME DRAWDOWN</p> <p>Transmissivity - $T = 15.81 Q / \Delta S$ $T_1 = 3952.5 \text{ m}^2/\text{d} = 4.57 \times 10^{-2} \text{ m}^2/\text{sec}$ $T_2 = 1756.6 \text{ m}^2/\text{d} = 2.03 \times 10^{-2} \text{ m}^2/\text{sec}$</p> <p>Storage coefficient: 2.25 T to / 1440 F $S_1 = 4.3 \times 10^{-3}$ $S_2 = 4.36 \times 10^{-4}$</p>
<p>$Q_1 = 10 \text{ l/s}$, $Q_2 = 10 \text{ l/s}$ $t_{01} = 44 \text{ min}$, $t_{02} = 9 \text{ min}$ $r = 238 \text{ m}$ $\Delta S_1 = 0.04 \text{ m}$ $\Delta S_2 = 0.09 \text{ m}$</p>	

Figure 4.4.5 Analysis of Constant Rate Pumping Test (5/8) - Teroual (TRA2 and TRA3)

JACOB TIME - DRAWDOWN / RESIDUAL DRAWDOWN PLOTS

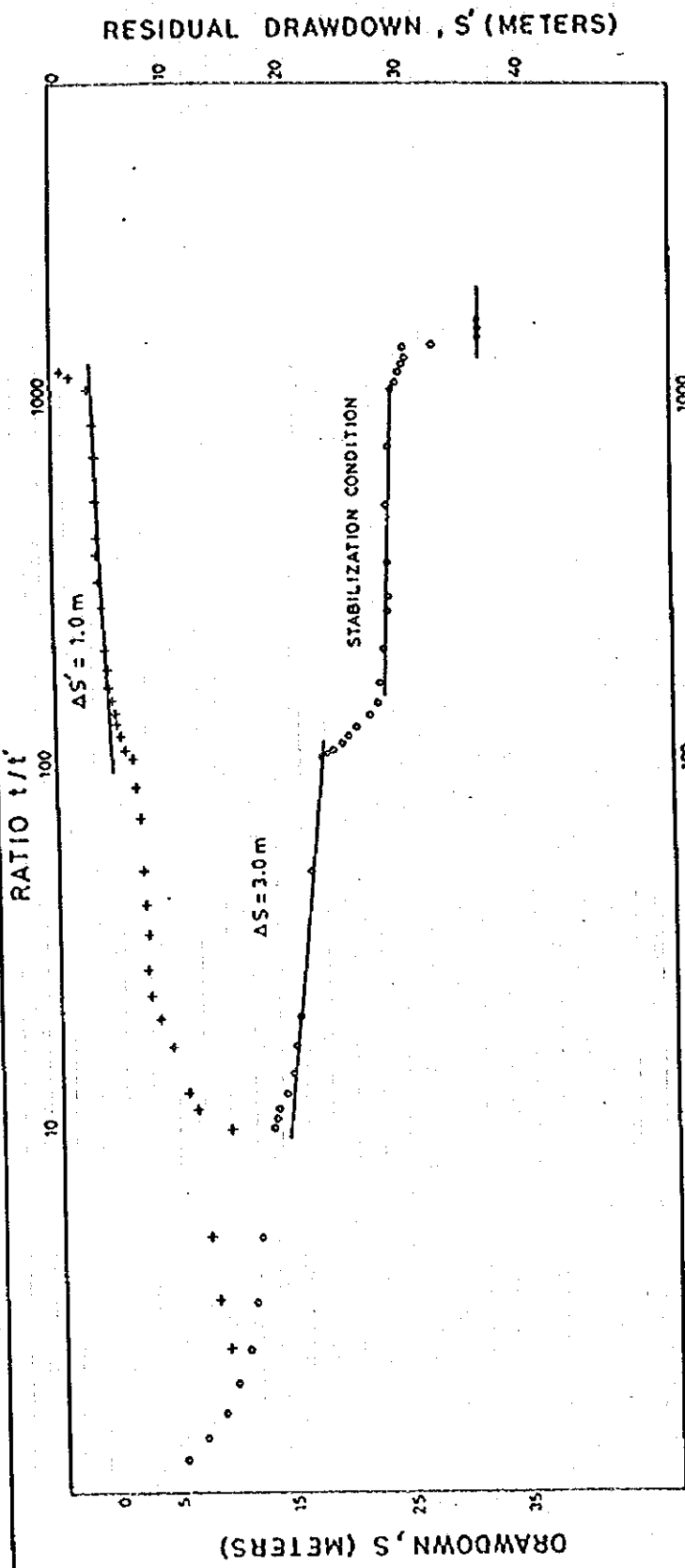


TIME SINCE PUMPING STARTED, t (MINUTES)

TIME SINCE PUMPING STARTED, t (MINUTES)		TIME DRAWDOWN	RESIDUAL DRAWDOWN
Project : The Study on Rural Water Supply in the Pre-Rif Region in Morocco - Phase II		Transmissivity : $T = 15.81 Q / \Delta s$	Transmissivity
Location : Teroual		$T_1 = 718.6 \text{ m}^2/\text{d} = 8.31 \times 10^{-3} \text{ m}^2/\text{s}$	$T = 15.81 Q / \Delta s$
Well : IRE 1515/9 (TRA3)		$T_2 = 790.5 \text{ m}^2/\text{d} = 9.15 \times 10^{-3} \text{ m}^2/\text{s}$	$= 1581 \text{ m}^2/\text{day}$
		$T_{av} = 9.14 \times 10^{-4} \text{ m}^2/\text{sec}$	$= 1.81 \times 10^{-2} \text{ m}^2/\text{sec}$
		$T_{av} = 754.5 \text{ m}^2/\text{d} = 8.73 \times 10^{-3} \text{ m}^2/\text{sec}$	
		Storage coefficient	
		$S = 2.25$	
		T to / 1440 T^2	

Figure 4.4.5 Analysis of Constant Rate Pumping Test (6/8) - Teroual (TRA3)

JACOB TIME - DRAWDOWN / RESIDUAL DRAWDOWN PLOTS

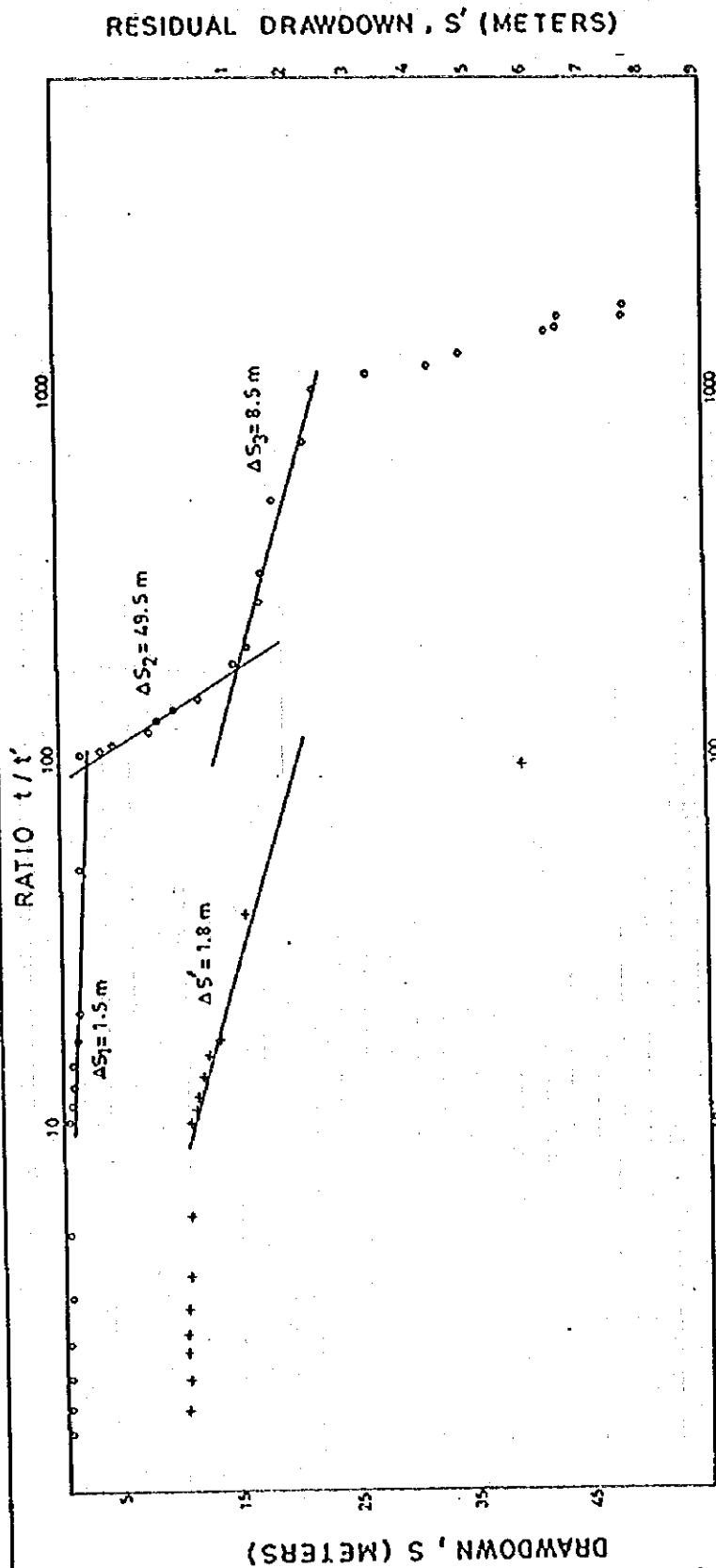


TIME SINCE PUMPING STARTED, t (MINUTES)

Project : The Study on Rural Water Supply in the Pre-Rif Region in Morocco - Phase II Location : J. Berda Well : IRE 1527/9 (JBD2)	Q = 8 l/s and 11 l/s, Q _{av} : 8.56 l/s Q _{av} = 8.56 l/s t ₀ : --- mins t : --- m ΔS = 3 m ΔS' = 1.0 m	TIME DRAWDOWN Transmissivity - T = 15.81 Q / ΔS = 42.16 m ² /sec = 4.88 x 10 ⁻⁴ m ² /sec	RESIDUAL DRAWDOWN Transmissivity T = 15.81 Q _{av} / ΔS' = 135.33 m ² /d = 1.56 x 10 ⁻³ m ² /sec
	Storage coefficient S = 2.25 T to / 1440 f ²		

Figure 4.4.5 Analysis of Constant Rate Pumping Test (7/8) - J. Berda (JBD2)

JACOB TIME - DRAWDOWN/RESIDUAL DRAWDOWN PLOTS



TIME SINCE PUMPING STARTED, t (MINUTES)		TIME DRAWDOWN	RESIDUAL DRAWDOWN
Q = 2 l/s and 2.5 l/s		Transmissivity - $T = 15.81 Q / \Delta S$	Transmissivity
to : -- mins		$T_1 = 21.08 \text{ m}^2/\text{d} = 2.44 \times 10^{-4} \text{ m}^2/\text{sec}$	$T = 2.25 T \text{ to } / 1440 \text{ r}^2$
r : -- m		$T_2 = 0.64 \text{ m}^2/\text{d} = 0.07 \times 10^{-4} \text{ m}^2/\text{sec}$	$T = 15.81 Q_{av} / \Delta S'$
$\Delta S_1 = 1.5 \text{ m}$		$T_3 = 3.72 \text{ m}^2/\text{d} = 0.43 \times 10^{-4} \text{ m}^2/\text{sec}$	$T = 18.05 \text{ m}^2/\text{d}$
$\Delta S_2 = 49.5 \text{ m}$		$T_{av} = 8.48 \text{ m}^2/\text{d} = 9.8 \times 10^{-5} \text{ m}^2/\text{sec}$	$= 2.08 \times 10^{-4} \text{ m}^2/\text{sec}$
$\Delta S_3 = 8.5 \text{ m}$			
$\Delta S' = 1.8 \text{ m}$			
Q _{av} = 2.06 l/s			

Project : The Study on Rural Water Supply in the Pre-Rif Region in Morocco - Phase II
 Location : J. Berda
 Well : IRE 1526/9 (JBD3)

Figure 4.4.5 Analysis of Constant Rate Pumping Test (8/8) - J. Berda (JBD3)

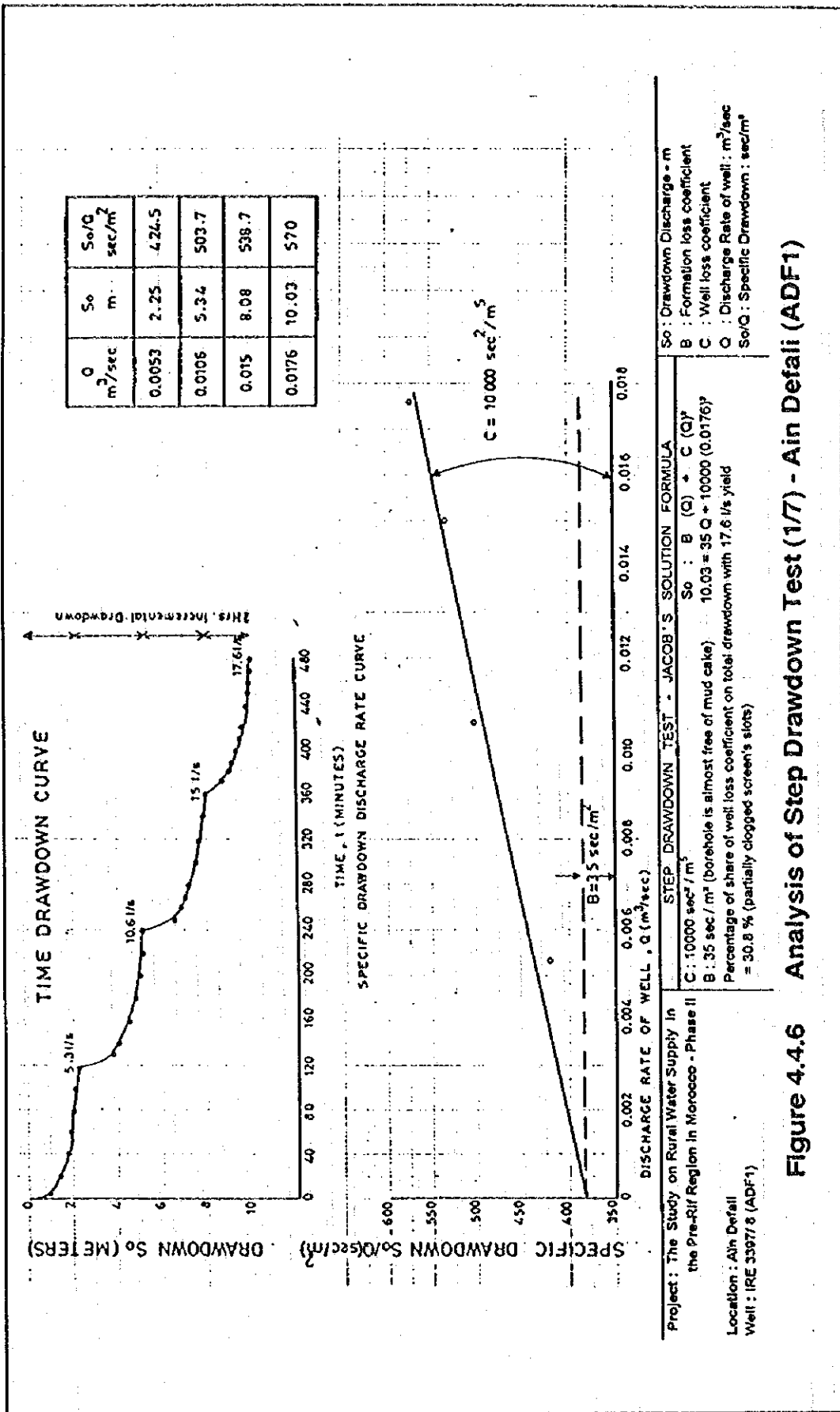


Figure 4.4.6 Analysis of Step Drawdown Test (1/7) - Ain Defali (ADF1)

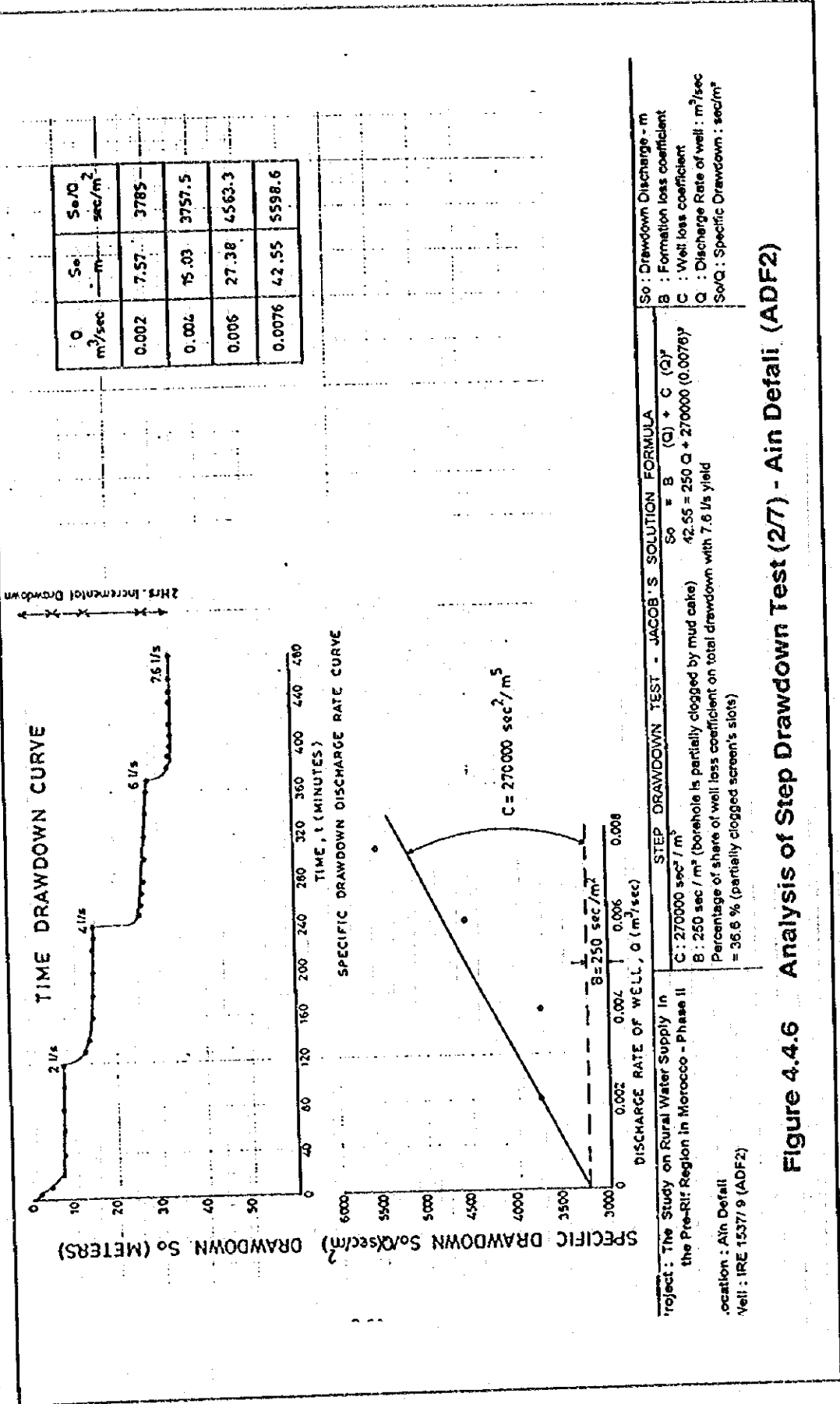


Figure 4.4.6 Analysis of Step Drawdown Test (2/7) - Ain Defali (ADF2)

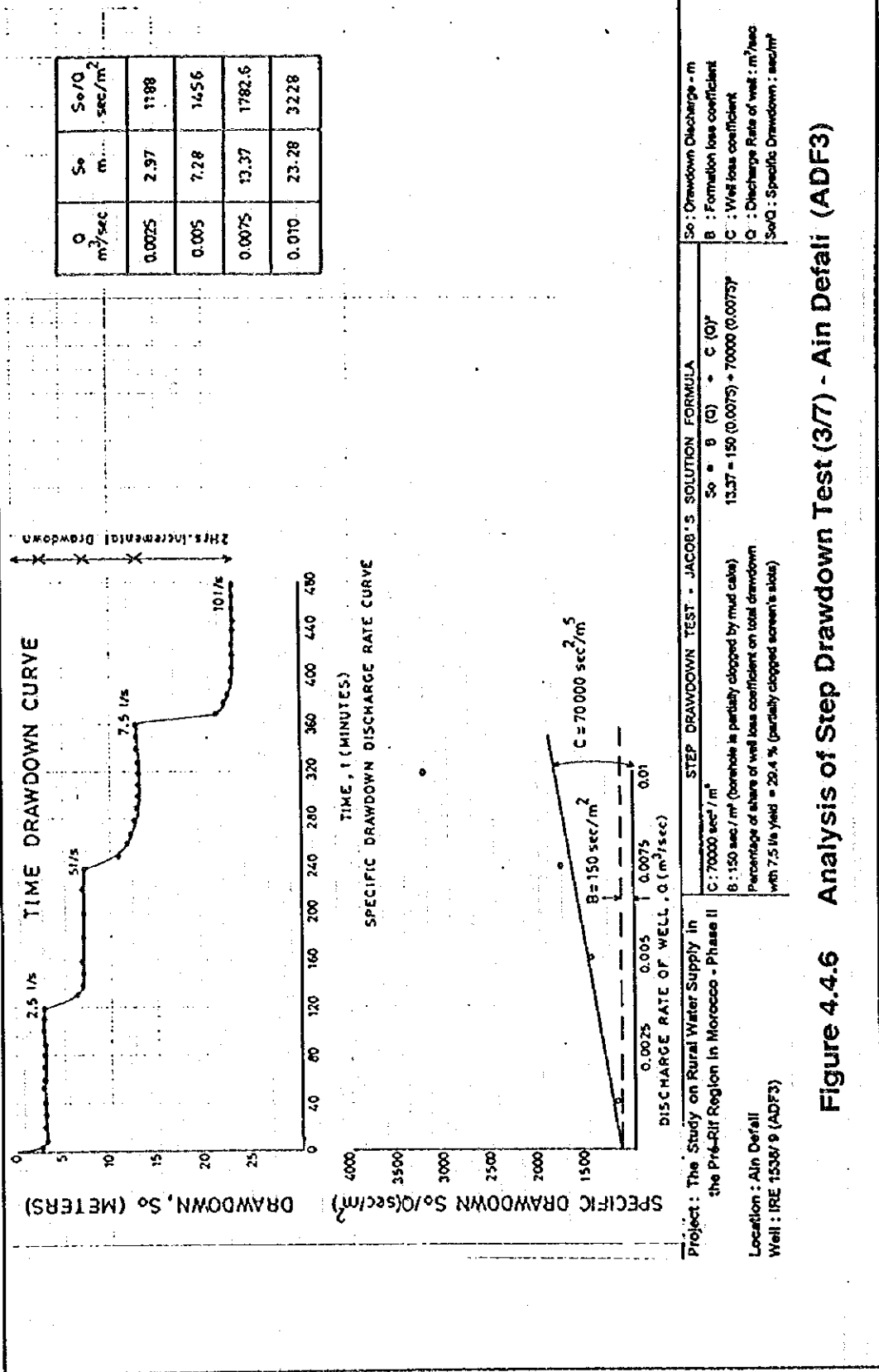
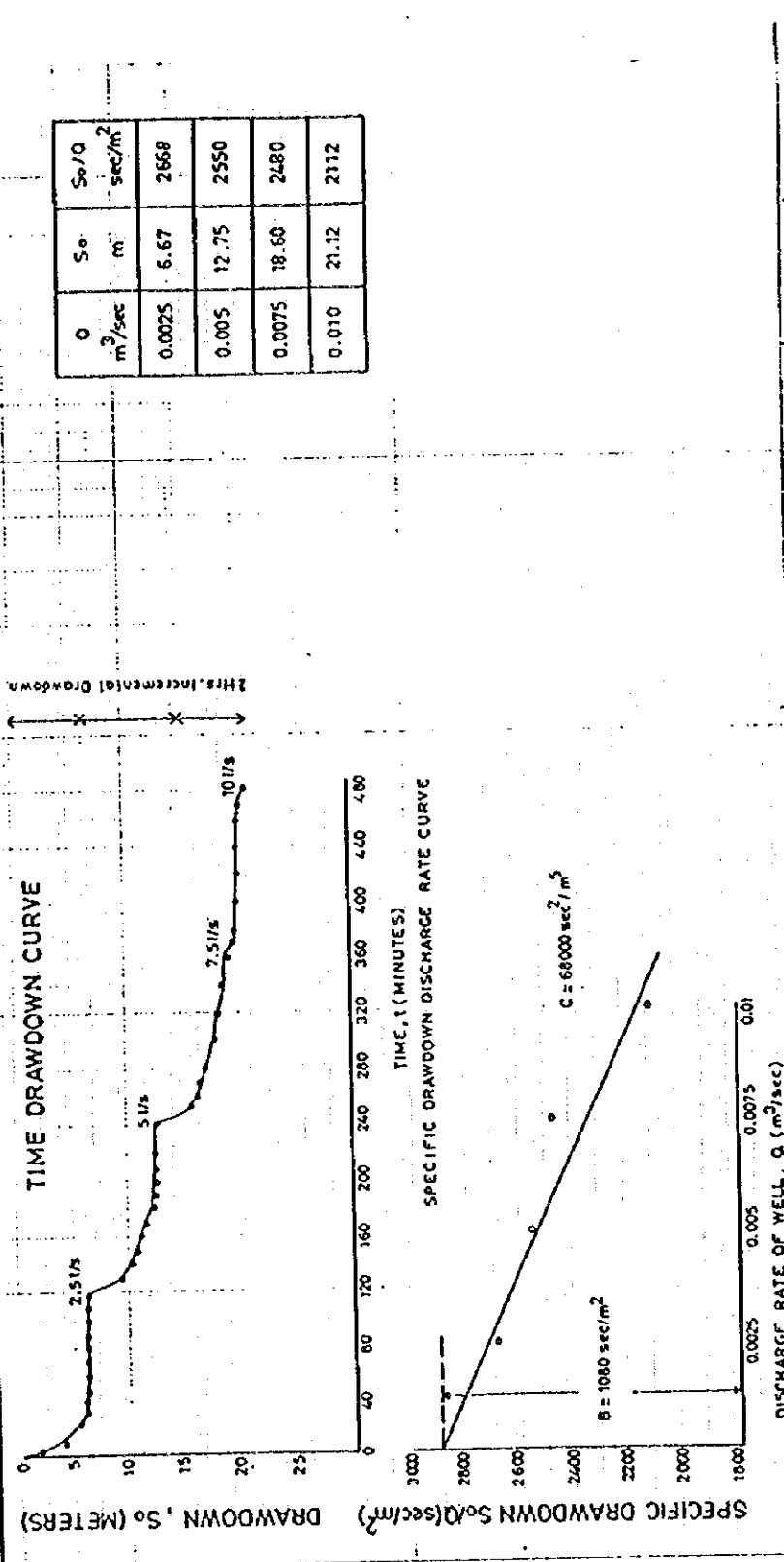


Figure 4.4.6 Analysis of Step Drawdown Test (3/7) - Ain Defali (ADF3)



Q	S ₀	S ₀ /Q
m ² /sec	m	sec/m ²
0.0025	6.67	2668
0.005	12.75	2550
0.0075	18.60	2480
0.010	21.12	2112

Project: The Study on Rural Water Supply in the Pro-Rif Region in Morocco - Phase II

Location: Teroual
Well: IRE 1514/9 (TRA2)

DISCHARGE RATE OF WELL, Q (m²/sec)

STEP DRAWDOWN TEST - JACOB'S SOLUTION FORMULA

So : Drawdown Discharge - m
B : Formation loss coefficient
C : Well loss coefficient
Q : Discharge Rate of well : m²/sec
So/Q : Specific Drawdown : sec/m²

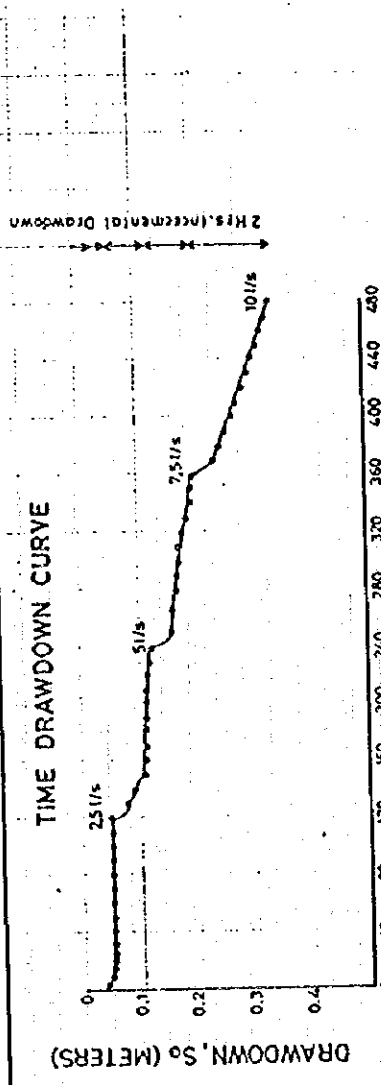
So : B (Q) + C (Q)²
So : 21.12 = 108 (0.01) + 66000 (0.01)²

C : 66000 sec²/m²
B : 1080 sec/m² (borehole is 51% clogged by mud cake)

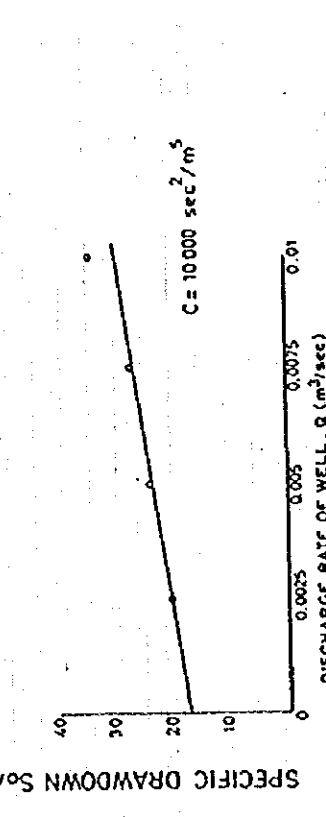
Percentage of share of well loss coef. on total drawdown with 10 l/s yield = 32.2% (partially clogged screen's slots)

Figure 4.4.6 Analysis of Step Drawdown Test (4/7) - Teroual (TRA2)

Q	S _o	S _o /Q
m ³ /sec	m	sec/m ³
0.0025	0.05	20
0.005	0.12	24
0.0075	0.2	26.6
0.010	0.34	34



SPECIFIC DRAWDOWN DISCHARGE RATE CURVE



Project : The Study on Rural Water Supply in the Pre-Rif Region in Morocco - Phase II
 Location : Teroual
 Well : IRE 1515/0 (TRA3)

STEP DRAWDOWN TEST - JACOB'S SOLUTION FORMULA
 $S_o = B (Q) + C (Q)^2$
 $S_o = 17 (0.01) + 500 (0.01)^2$
 $0.34 = 17 (0.01) + 500 (0.01)^2$
 B : 17 sec / m³ (borehole is free of mud cake)
 C : 500 sec² / m³
 Percentage of share of well loss coefficient on total drawdown with 0.01 l/s yield = 14.7 % (partially clogged screen's slots)

So : Drawdown Discharge - m
 B : Formation loss coefficient
 C : Well loss coefficient
 Q : Discharge Rate of well : m³/sec
 So/Q : Specific Drawdown : sec/m³

Figure 4.4.6 Analysis of Step Drawdown Test (5/7) - Teroual (TRA3)

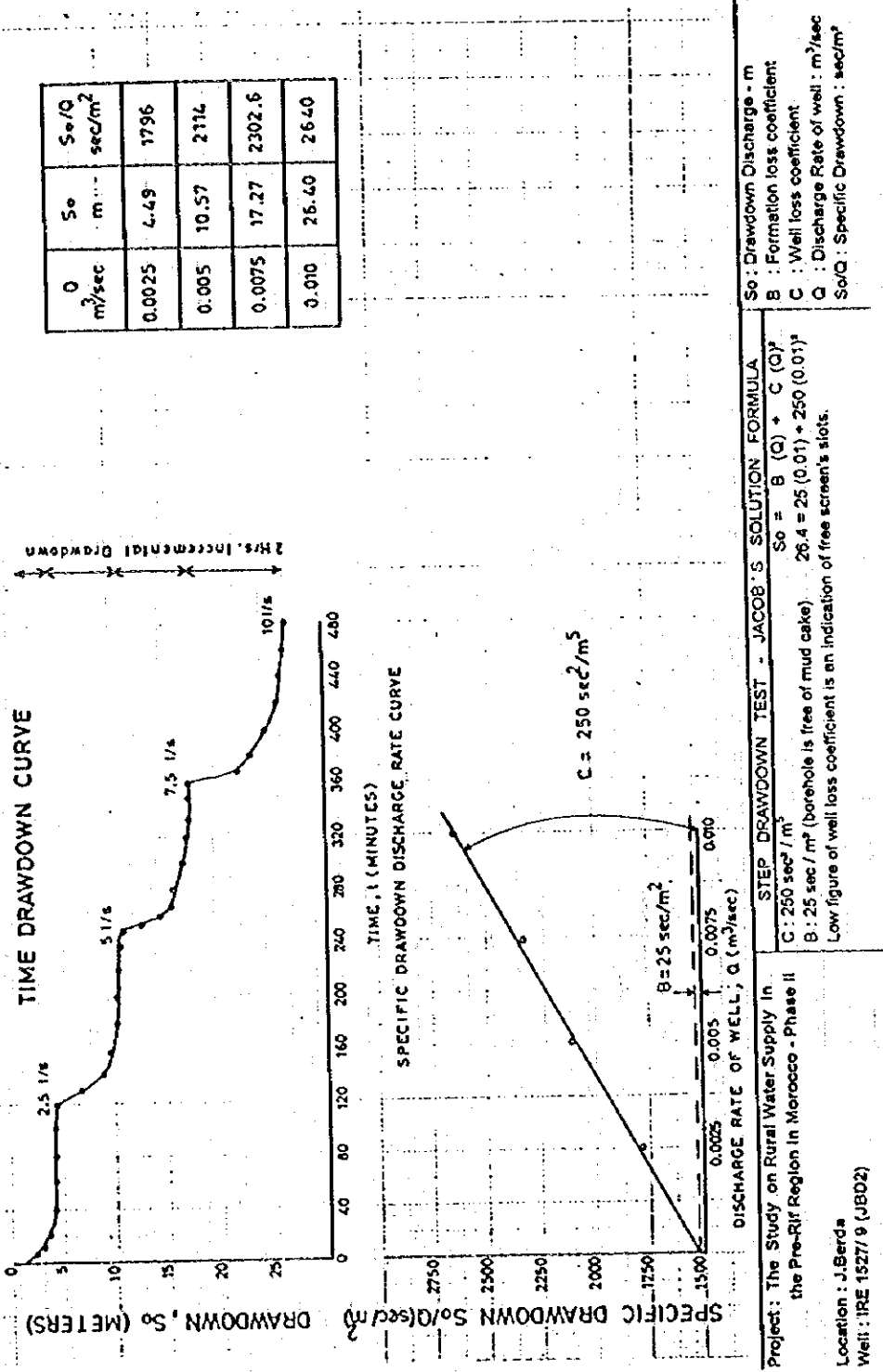


Figure 4.4.6 Analysis of Step Drawdown Test (6/7) - J. Berda (JBD2)

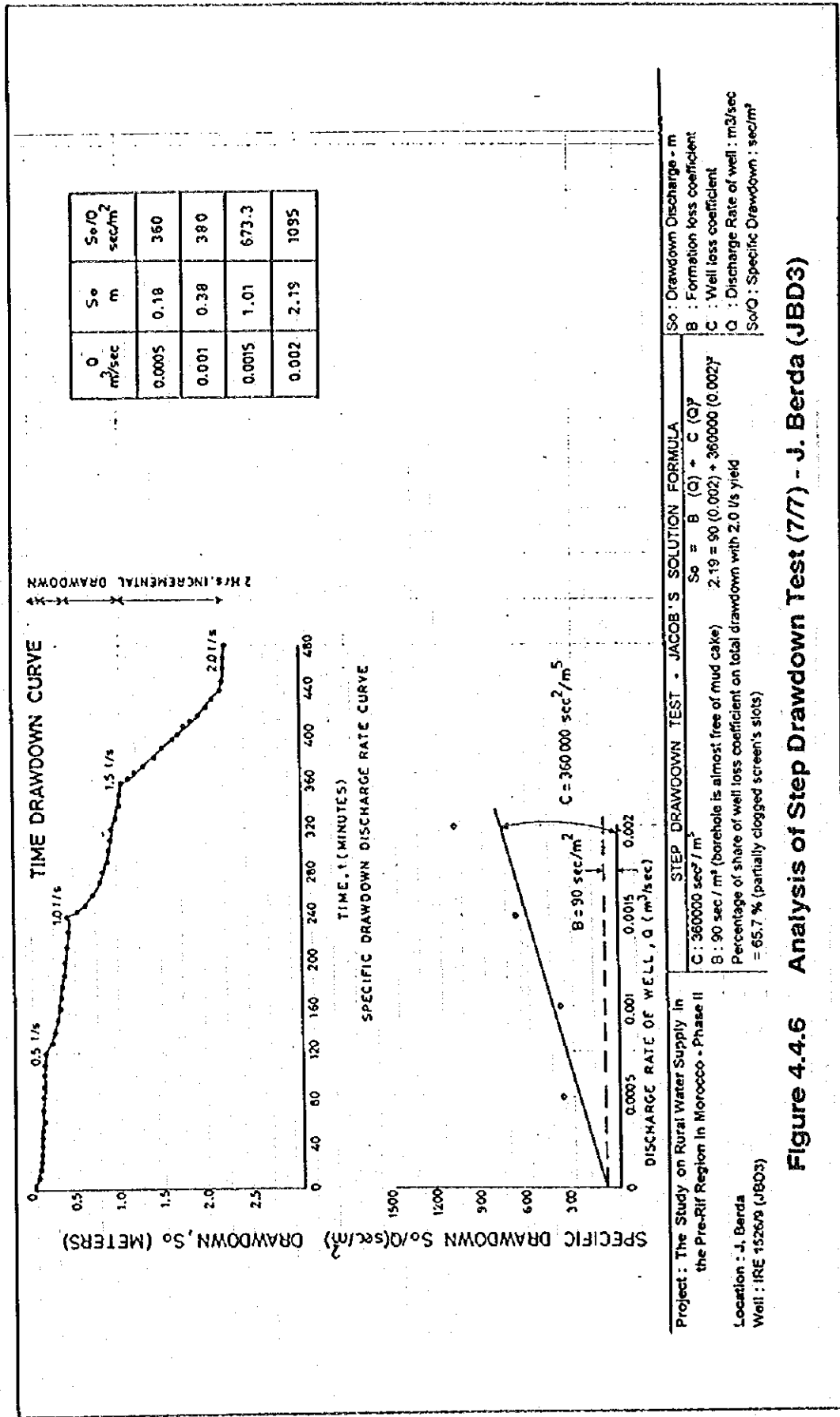
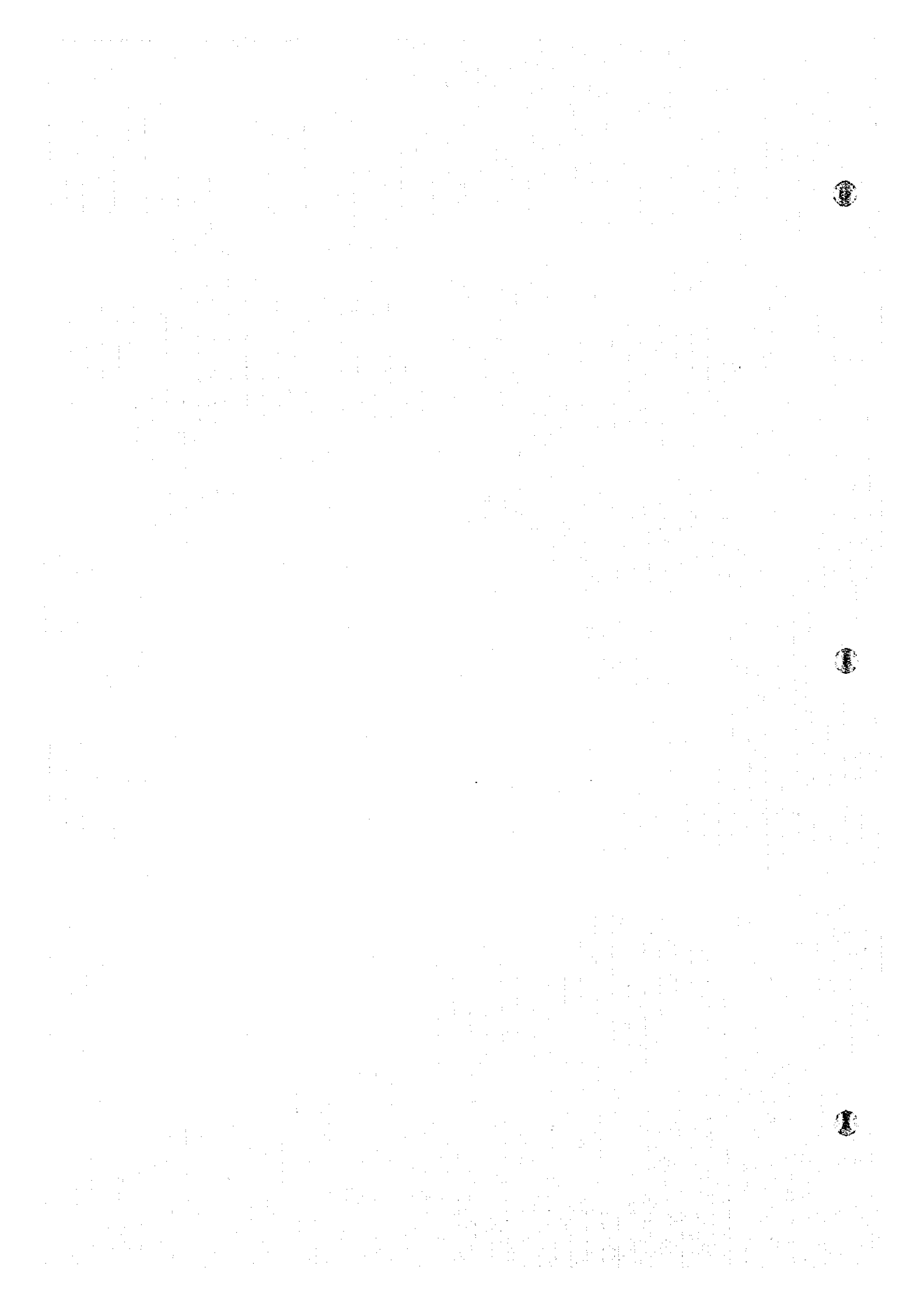


Figure 4.4.6 Analysis of Step Drawdown Test (77) - J. Berda (JBD3)

4.5 Groundwater Simulation



4.5 Groundwater Simulation

4.5.1 Objective Area

The objective areas for groundwater simulation cover the areas of the groundwater potential structures at Ain Defali, Teroual and J. Berda, respectively. Location, topography and mesh diagram of each area are shown in Figures 4.5.1 to 4.5.9.

(1) Ain Defali

The Ain Defali synclinal structure is similar to a close basin, stretching 4 km from east to west and 3 km from north to south. The area of the structure is some 12 km² with the ground surface elevation ranging from 250 m in the north to 90 m in the south/east along the Rdat river. The base formation of the structure is the Miocene series dipping towards the center axis. The basin is filled up by the Quaternary ancient (Villafranchian) conglomerates with light brown marl matrix.

(2) Teroual

The Teroual structure is roughly a close synclinal basin oriented north-east to south-west. The ground surface elevation ranges from 500 m in the north to 400 m in the south. The area of the structure is around 6 km². According to the hydrogeological investigation, presence of two aquifer was confirmed. The surface aquifer is presented around the eastern part of structure. It composes of the Miocene conglomerates with marl intercalation, overlaying the silt stone of the upper Oligocene formation. The lower aquifer, which was recognized by the exploratory drilling, belongs to the Oligocene epoch. It composes of silt stone with marl matrix. the average thickness of this aquifer is estimated around 60 m existing at the depth between 40 m to 150 m below ground surface.

(3) J. Berda

The monoclinical structure of J. Berda is an oval from stretching over 5 km from east to west and about 2 km from north to south. It belongs to the Jurassic system having a limestone deposition on its summit and cracked cavernous boulders of limestone underneath. the area of the structure is around 6 km². There are two steep mountains with the elevations of 900 m and 1,000 m at their summits, and the elevations are around 500 m to 600 m in the south east to west along the foot the mountains. The hydrogeological investigations confirmed the presence

of groundwater in the conglomerates, the consolidated marl stone and schist formation with fissure and crack. Such formations exist in the base of the monoclinial structure and in areas close to the southern faulted like in the upper Cretaceous formation. These formations present around 40 m below ground surface with the estimated average thickness of 60 m.

4.5.2 Estimation of Groundwater Recharge

As discussed in the Section 3.3 of this Report, the groundwater recharge for each objective area was estimated by applying the tank model. It should be noted that the estimation of groundwater recharge was carried out under the limitation explained below.

In general, estimation of groundwater recharge by tank model is conducted based on calibration of surface water balance in the rainfall-runoff process as well as seasonal variation of groundwater level which is indicated by a tank representing groundwater aquifer. However, available groundwater level data at the exploratory wells only cover a few month in the dry season in 1995 when rainfall was scarcely observed. In this regards, the recharge study by tank model could not take the seasonal variation of groundwater level into account. The study was able to obtain the recharge on annual basis estimated from the surface water balance.

This estimation also includes the assumption that the runoff and recharge characteristics in the groundwater potential structure might be similar to those of the river basin although the extent of the groundwater potential structure is quite smaller than the river basin. Since runoff and recharge characteristics in the groundwater potential structure may be similar but not exactly correspond to that in the whole river basin, it is necessary to verify the estimated recharge with reference to groundwater.

Regarding the limitation above, the estimated recharge by tank model was verified in the process of groundwater flow modeling. The modeling was elaborating to examine hydraulic parameters and boundary conditions as well as recharge. Necessary modification was provided until the groundwater simulation model indicates an acceptable water balance and groundwater level/flow condition. Consequently the recharge was finally determined when the simulation model was calibrated.

4.5.3 Modeling

The groundwater flow system modeling was carried out based on the data obtained during the field investigation including the geophysical prospecting. The exploratory drilling and the

pumping test. For preparation of numerical model, the objective area was divided into mesh blocks as shown in Figure 4.5.3, 4.5.6 and 4.5.9. The necessary data for modeling were given by mesh block.

The modeling is generally carried out in consideration of the followings.

- 1) Objective of Simulation Study
- 2) Availability of Data
- 3) Data Processing on Computer (processing time, computer capacity)

Necessary outputs of simulation study are water balance and distribution of groundwater level in the objective area for evaluating the quantity of groundwater resources. While the modeling includes the constraints on data availability and computer processing in terms of a volume of mesh data and computation time. In this regards, it was necessary to provide the approximations in a practical way to obtain the simulation results acceptable under the said constraints.

The actual hydrogeological structure is complicated while the field data were available on spot basis only. In order to prepare the model data covering the whole objective area, the structures were simplified as one or two layer system and the data extrapolation was provided with reference to the field data.

(1) Ain Defali

The surface layer includes the conglomerates with a thickness of a few meters. The water bearing formation found by the exploratory drilling distributes in a depth of 30 to 150 m. These two may independent, but a depth of groundwater in the surface conglomerates layer is so small that it could not be expressed by numerical model as water table in an individual layer.

Thus, the Ain Defali structure is considered as the one-layer system in the model. For the practical solution, the following assumptions are provided.

- 1) The model indicates the piezometric surface of the lower water bearing layer.
- 2) The present water extraction from the existing dughole is negligible small compared with the water balance in the system.
- 3) The most of recharge contributes to the groundwater in the lower layer and the rest of recharge into the surface conglomerate layer is equivalent to the spring discharge.

(2) Teroual

The surface layer is the Miocene formation with a thickness around 30 m. The Teroual spring belongs to this formation. The subsequent layer is the Oligocene formation with a thickness around 150m. Since the upper part of the Oligocene formation is less permeable, the Teroual structure is considered as the two-layer system. The recharge for the respective layer are estimated around 60 % of the total recharge for the surface layer and 40 % for the lower layer, respectively.

(3) J. Berda

The steep mountains of Jbel Berda belong to the Jurassic system with the limestone deposition. The water bearing formation exists around the contact between the Jurassic and the upper Cretaceous formations. This formation distribute around a depth of 50 to 150 m along the survey lines of the geophysical prospecting. The actual geological structure of Jbel Berda is composed of the complicated fault system with the various geological layers.

While the geological data are not sufficient for preparing a simulation model reflecting such complicated geological conditions precisely. The approximate solution was therefore provided for modeling. The model was simplified as the one-layer system composed of the objective water bearing formation, mainly aiming at evaluating water balance of the groundwater potential structure and groundwater flow condition around the exploratory wells.

(4) Steady State Simulation

The present groundwater flow condition was estimated by steady state simulation. As described in the previous section, since long term observation of groundwater level was not available, the seasonal variation of groundwater level could not be calibrated by transition state. Thus, the simulation model reproduced the groundwater flow condition of the dry season in 1995 in order to determine all the constituents of groundwater flow, including recharge, discharge boundary conditions and hydraulic parameters. The estimated contour maps of groundwater level are shown in Figure 4.5.10 to 4.5.12.

1) Recharge and Water Balance

The recharge estimated by tank model was initially applied, and then necessary correction was provided for model calibration. The water balance finally obtained by steady state simulation is

shown in Figure 4.5.13.

2) Boundary Condition

For boundary condition, no flow boundary and general head boundary were used. The general head boundary, which is a unique function of MODFLOW, was mainly applied for boundary of groundwater outflow. Flow into or out of a cell from an external source is provided in proportion to the difference between the head in the cell and the head assigned to the external source. Thus, a linear relationship between flow into cell and head in the cell is established as follows.

$$Q_b = C_b (H_b - H)$$

where,

Q_b : Flow into the objective cell

C_b : Hydraulic conductance between the external source and the objective cell

H_b : Head assigned to the external source

H : Head in the objective cell

3) Hydraulic Parameter

Figure 4.5.14 to 4.5.19 show the distribution of hydraulic parameters such as permeability coefficient (K) and transmissivity (T). For storage coefficient (S), practical values were applied in the order of 10^{-1} for unconfined aquifer and of 10^{-3} for confined aquifer, respectively.

4.5.4 Simulation for Groundwater Extraction

The simulation for groundwater extraction was carried out under the following conditions.

(1) Initial Condition

The groundwater flow simulated by steady state simulation was given as the initial condition.

(2) Output of Simulation

The initial condition was assumed as the groundwater flow condition in 1995 dry season. Groundwater flow condition with new extraction was simulated on annual basis by transient

simulation. Thus, groundwater flow condition in every dry season was predicted year by year.

(3) Lowering of Groundwater Level

Based on comparison between the initial condition and the predicted condition, the lowering of groundwater level was indicated as the contour map.

(4) Drawdown at Exploratory Well

Groundwater level is obtained for each mesh block by simulation. A mesh block has some extent, 250 m square for Ain Defali and 125 m square for Teroual and Ain Berda. On the other hand, pumping causes drawdown around well. The groundwater level around the exploratory well becomes locally lower than the simulated value in mesh block. Such drawdown is generally obtained based on an analysis of well hydraulics.

For the exploratory wells, the relationship between pumping yield and drawdown was given by the analysis of the step drawdown test. A value of drawdown at each exploratory well can be obtained with reference to this relationship.

(5) Evaluation of Groundwater Level at Exploratory well

The groundwater level at the exploratory well is evaluated as follows.

$$H = h - D$$

$$\Delta H = H_i - H$$

Where,

H : Groundwater Level with Pumping

h : Simulated Groundwater Level for Mesh Block

D : Drawdown at Exploratory Well

ΔH : Total Lowering of Groundwater Level

H_i : Groundwater Level at Initial Condition

(6) Allowable Yield

The allowable yield of groundwater extraction at the exploratory well was evaluated using a limit of the total lowering of groundwater level often 20 years pumping. The alternative limits of 10 m, 15 m, and 20 m were given.

For the groundwater recharge, the following two alternatives were provided.

- 1) Average recharge, and
- 2) Annual recharge for the recent 20 years (1975 /76 - 1994 /95)

The contour maps of the lowering of groundwater level are shown in Figure 4.5.20 to 4.5.22. For these cases, the average recharge was applied.

Figure 4.5.23 to 4.5.25 gives the variation of groundwater level at the exploratory wells in the case of the recharge for the recent 20 years. Results of groundwater simulation for all the cases are tabulated below.

Ain Defali

Recharge	Allowable Limit GWL Lowering	Yield of Exploratory Well (m ³ /day)			
		ADF1	ADF2	ADF3	Total
Average	10 m	241	60	155	456
	15 m	354	86	233	673
	20 m	475	120	311	906
Recent 20 Years	10 m	224	43	120	387
	15 m	336	77	120	533
	20 m	457	120	285	862

Teroual

Recharge	Allowable Limit GWL Lowering	Yield of Exploratory Well (m ³ /day)		
		TRA2	TRA3	Total
Average	10 m	111	106	217
	15 m	166	157	323
	20 m	224	207	431
Recent 20 Years	10 m	108	103	211
	15 m	164	155	319
	20 m	220	207	427

J. Berda

Recharge	Allowable Limit GWL Lowering	Yield of Exploratory Well (m ³ /day)		
		JBD2	JBD3	Total
Average	10 m	43	64	107
	15 m	64	99	163
	20 m	90	133	223
Recent 20 Years	10 m	34	47	81
	15 m	56	82	138
	20 m	82	116	198

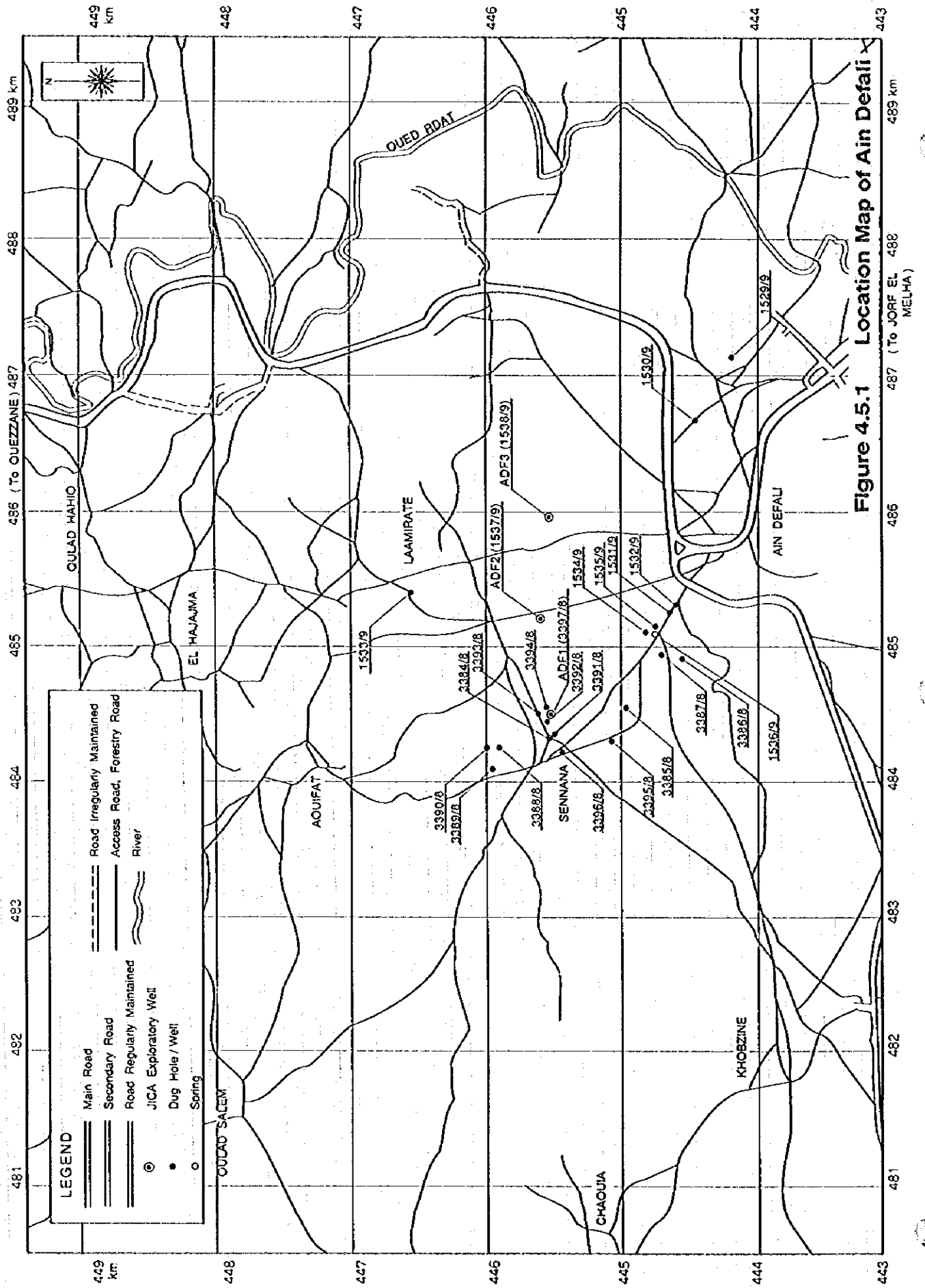


Figure 4.5.1 Location Map of Ain Defali

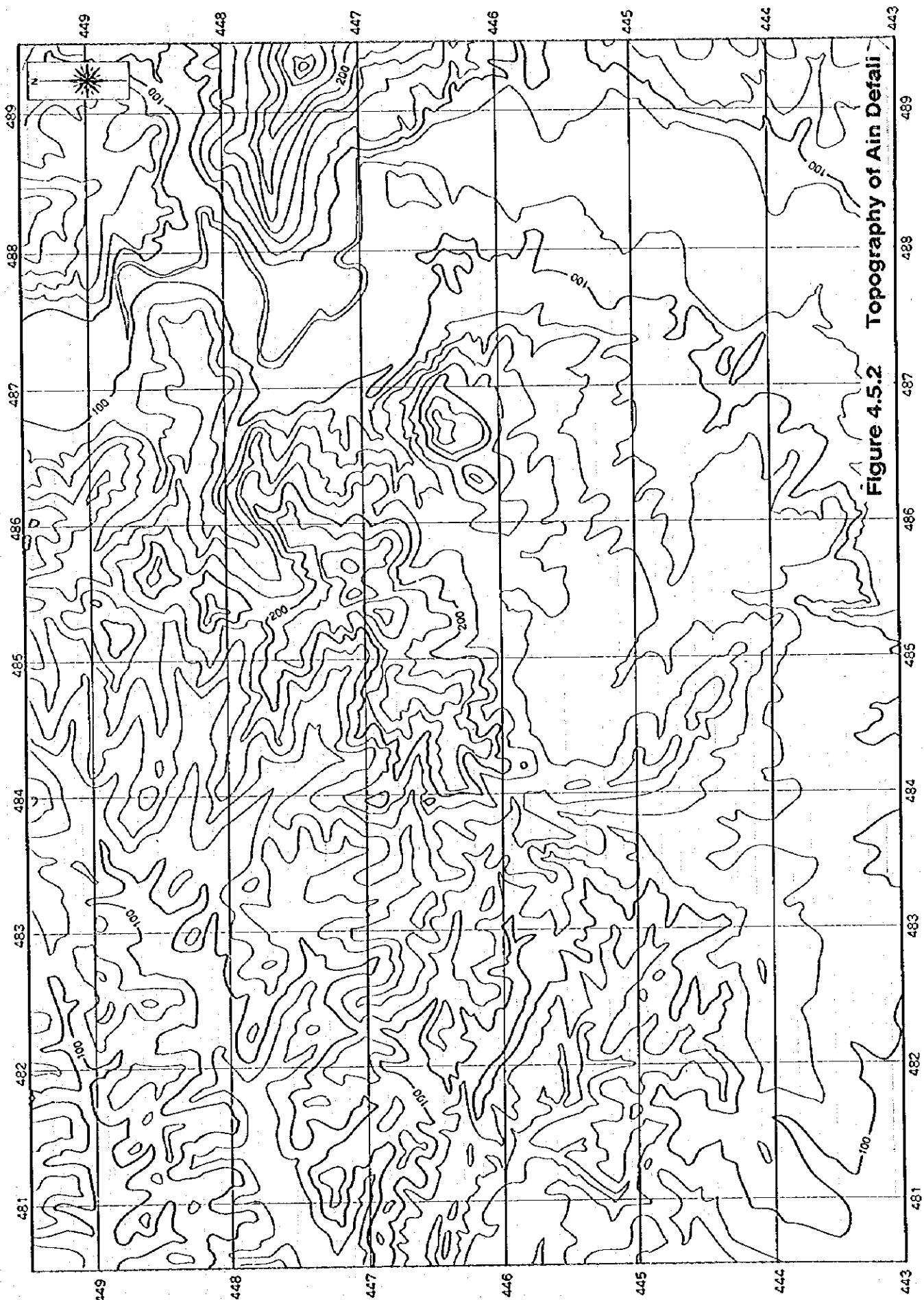


Figure 4.5.2 Topography of Ain Defali

