

ATTACHMENT- 5

The Existing Data of Water Quality

The Existing Data of Water Quality (1/3)

NA	ID	DISTRICT	DIVISION	SAMPLE NO	LONGITUDE	LATITUDE	Type of aquifer	Depth of well (m)	Water level (level/m)	EC (us/cm)	PH	COOL TURBIDITY OR	CO ₂ (mg/l)	HCO ₃ (mg/l)	Mn (mg/l)	Mg (mg/l)	Fe (mg/l)	K (mg/l)	Na (mg/l)	Ca (mg/l)	TDS (mg/l)	P (mg/l)	NO ₃ (mg/l)	SO ₄ (mg/l)	Cl (mg/l)	CaCO ₃ (mg/l)	TOTAL ALKALINITY (mg/l)	O ₂ (mg/l)	PO ₄ (mg/l)	FREE CO ₂ (mg/l)	NO ₂ (mg/l)	SiO ₂ (mg/l)				
Q-1	C 616	Baringo	EMINING	02-JUL-92	35.867	0.263	Basement	90	46	770	8.4	5	0	0	170	42	0.15	17	97	39	482	0.8	0.25	12	272	524	1.6	0	0	0	0	80				
Q-2	C 626	Kisumu	ELDAMA RAVINE	29-MAY-93	35.783	0.083	Volcanics	152	121	70	7	0	0	0	170	21	3.3	158	21	466	0.2	300	2.1	0.01	0.3	15	45	170	0	0	0	0				
Q-3	C 3437	Baringo	TANGULBEI	13-JUN-92	35.283	0.800	Volcanics	183	93	760	8.7	5	1	2	15	21	5.1	273	3	576	2.5	24	32	14	510	0.8	0	0	0	0	0	0				
Q-4	C 3470	Baringo	NGANYANG	11-JUN-92	35.967	1.087	Volcanics	122	30	960	8.3	5	2	0	30	1.5	0.7	75	1	3.4	9	28	3.2	0.01	20	0	0	0	0	0	0	0	0			
Q-5	C 3506	Baringo	KABARNET	18-JUL-94	35.733	0.500	Volcanics	152	13	126	7.8	5	5.8	0	0.8708	0.05	0.4	0.2	6.9	7.4	5.6	75	1	3.4	9	28	3.2	0.01	20	0	0	0	0			
Q-6	C 3868	Baringo	NGANYANG	09-NOV-73	36.017	0.950	Volcanics	122	9	7000	7.6	5	0	0	0.8708	22	0.3	16	304	12	2500	18	4.53	0.76	122	3708	48	0.01	48	0.01	60	0	0			
Q-7	C 4722	Baringo	KABARNET	04-MAR-93	35.733	0.483	Volcanics	155	15	200	7.6	5	1	0	0.8708	1	7.6	23	12	120	1.4	2	6	34	102	0.04	0.01	24	0.01	44	0.01	0	0			
Q-8	C 4815	Baringo	KABARNET	25-SEP-86			Volcanics	214	181	480	7.2	5	0.9	0	0.8708	0.03	2.3	0.1	17	4.5	276	3	0.01	7	12	42	2.2	0.1	0.08	26	0	0	0			
Q-9	C 5072	Baringo	KABARNET	25-SEP-86			Volcanics	120	19	845	7.9	5	0.7	0	0.8708	0.02	7	0.1	11	19	507	6.87	0.38	13	67	108	338	0.1	0.05	12	0.01	0	0			
Q-10	C 5170	Baringo	KABARNET	07-SEP-82			Volcanics	120	19	170	7.7	100	40	0	0.8708	0.02	2	3.8	4	113	0.6	0.5	8	48	100	1.6	0.02	12	0.01	0	0	0	0			
Q-11	C 5340	Baringo	KABARNET	28-JUL-83			Volcanics	55	8	463	8.3	3	3.7	0	0.8708	0.01	4.6	12	291	2.8	4.7	3.9	46	190	0.8	0.04	0	0	0	0	0	0	0			
Q-12	C 5487	Baringo	KABARNET	08-JUN-92			Volcanics	55	8	520	7.7	5	3	0	0.8708	5	8	168	10	312	2.2	7	48	278	0.8	0.04	0	0	0	0	0	0	0			
Q-13	C 5754	Baringo	KABARNET	28-JUN-84			Volcanics	228	189	290	7.8	30	57	0	0.8708	0.5	1.89	1.6	124	1.7	12	6	48	278	0.8	0.04	0	0	0	0	0	0	0			
Q-14	C 5765	Baringo	KABARNET	08-JUN-92			Volcanics	228	189	330	7.6	5	4	0	0.8708	3.4	3.3	77	17	198	1.5	2.9	6	36	190	0.8	0	12	0.01	0	0	0	0			
Q-15	C 5883	Baringo	KABARNET	05-DEC-84			Volcanics	228	189	400	8.4	5	5	0	0.8708	0.1	0.4	0.6	13	110	3.5	240	4	8.5	13	28	246	1.6	0.04	0	0	0	0	0		
Q-16	C 6362	Baringo	MARRIAT	16-JUL-83	36.050	0.560	Sedimentary	60	12	15000	10	200	41	0	0.8708	0.2	2.3	8	2.6	3000	30	3280	2100	12	4338	46	0.3	0	0	0	0	0	0			
Q-17	C 6363	Baringo	NGANYANG	11-JUN-92	35.883	1.083	Volcanics	107	21	920	8.1	340	0	0	0.8708	0.1	1.7	8.8	1.9	1.8	8.6	15	9.6	108	0.7	0.3	32	66	2.8	0.01	4	0.01	0	0	0	
Q-18	C 6364	Baringo	TANGULBEI	11-JUN-92	36.083	0.600	Volcanics	120	92	450	8.1	500	100	0	0.8708	0.3	2.9	11.8	1.9	1.8	8.6	15	9.6	108	0.7	0.3	32	66	2.8	0.01	4	0.01	0	0	0	
Q-19	C 6365	Baringo	MARRIAT	16-JUL-83	36.083	0.480	Sedimentary	60	20	5000	8.6	200	28	0	0.8708	0.8	3.0	1.4	6.3	33	4.8	114	1	1.4	1	28	112	0.4	0.01	40	0.01	0	0	0	0	
Q-20	C 8870	Baringo	KABARNET	24-AUG-93	35.738	0.480	Volcanics	108	63	180	7.3	50	19	0	0.8708	0.2	5.3	0.1	27	137	14	450	1.7	20	20	58	362	1.2	0.01	60	0.01	0	0	0		
Q-21	C 9152	Baringo	KABARNET	04-DEC-90			Volcanics	124	190	750	7.3	5	14	0	0.8708	2	2	9.6	9.5	4	282	1.7	22	15	18	206	0.79	0.04	8	0.01	0	0	0	0		
Q-22	C 10846	Baringo	KABARNET	23-MAY-84			Volcanics	62	43	470	7.7	5	10	0	0.8708	0.12	0.9	5.9	10	1.2	77	0.48	1.3	1.3	12	18	40	1.1	0.05	8	0.01	0	0	0		
Q-23	P 84	Kisumu	EMINING	15-JUL-92			Volcanics	123	141	130	6.9	200	22	0	0.8708	0.140	0	0	0	0	0	258	0.1	0	0.3	6	70	140	0	0	0	0	0	0	0	
Q-24	C 576	Kisumu	EMINING	06-AUG-83	35.883	0.000	Volcanics	123	141	130	6.9	200	22	0	0.8708	0.140	0	0	0	0	0	258	0.1	0	0.3	6	70	140	0	0	0	0	0	0	0	0
Q-25	C 711	Kisumu	EMINING	25-SEP-83	35.917	0.033	Volcanics	141	27	130	6.9	200	22	0	0.8708	0.140	0	0	0	0	0	258	0.1	0	0.3	6	70	140	0	0	0	0	0	0	0	
Q-26	C 722	Kisumu	ELDAMA RAVINE	21-SEP-83	35.733	0.050	Volcanics	140	50	67	7	0	0	0	0.8708	0.140	0	0	0	0	0	258	0.1	0	0.3	6	70	140	0	0	0	0	0	0	0	
Q-27	C 784	Kisumu	KISANANA	16-MAY-83	36.083	0.017	Volcanics	122	102	310	7.1	5	10	0	0.8708	0.1	0.1	0.6	0.6	158	3.6	3.8	11.8	4.6	14.2	30	152	1.8	0.06	8	0	0	0	0		
Q-28	C 829	Kisumu	KISANANA	11-SEP-83	36.000	0.050	Volcanics	100	79	470	7.6	5	2	0	0.8708	0.01	4.9	0.5	3.8	4	147	1.3	2.5	8	30	152	1.8	0.06	8	0	0	0	0	0		
Q-29	C 8396	Kisumu	ELDAMA RAVINE	16-JUL-92	35.733	0.050	Volcanics	200	119	245	7.6	5	2	0	0.8708	0.01	5.1	0.7	4	57	15	262	1	1.51	12.5	8	30	152	1.8	0.06	8	0	0	0	0	
Q-30	C 8416	Kisumu	ELDAMA RAVINE	16-JUL-92	35.733	0.050	Volcanics	200	119	245	7.6	5	2	0	0.8708	0.01	5.1	0.7	4	57	15	262	1	1.51	12.5	8	30	152	1.8	0.06	8	0	0	0	0	0
Q-31	C 26	Laikeil	CENTRAL	13-MAR-83	37.150	0.107	Basement	37	470	8	8	5	2.4	0	0.8708	0.1	39	1.2	39	660	3.1	571	3	0.01	15	65	30	365	0.1	0.01	0	0	0	0		
Q-32	C 28	Laikeil	CENTRAL	16-NOV-83	37.133	0.183	Basement	69	1100	8.4	8	0	1	0	0.8708	0.1	39	1.2	39	660	3.1	571	3	0.01	15	65	30	365	0.1	0.01	0	0	0	0	0	
Q-33	C 37	Laikeil	RUMURUTI	20-NOV-83	36.467	0.317	Volcanics	153	46	1100	8.4	8	0	0	0.8708	0.2	2.7	0.4	3.8	0.1	3.8	0.1	0.1	0.1	4.6	37	27	34	0	0	0	0	0	0		
Q-34	C 149	Laikeil	CENTRAL	01-MAR-83	37.067	0.000	Volcanics	122	55	73	7.3	0	0	0	0.8708	0.234	0	0	0	0	0	330	3.3	21	13	40	234	0	0	0	0	0	0	0	0	
Q-35	C 290	Laikeil	LAMURIA	22-MAR-83	37.033	0.050	Volcanics	128	37	60	7.2	300	82	0	0.8708	0.2	2.7	0.4	3.8	0.1	3.8	0.1	0.1	0.1	4.6	37	27	34	0	0	0	0	0	0		
Q-36	C 291	Laikeil	CENTRAL	16-APR-83	37.067	0.033	Volcanics	109	24	60	7.2	300	82	0	0.8708	0.234	0	0	0	0	0	330	3.3	21	13	40	234	0	0	0	0	0	0	0	0	
Q-37	C 296	Laikeil	RUMURUTI	01-NOV-83	36.760	0.100	Volcanics	109	24	60	7.2	300	82	0	0.8708	0.234	0	0	0	0	0	330	3.3	21	13	40	234	0	0	0	0	0	0	0	0	
Q-38	C 297	Laikeil	RUMURUTI	01-NOV-83	36.717	0.200	Volcanics	308	50	700	8.3	5	2.3	0	0.8708	0.01	1.5	0.49	2.8	4.0	1.4	15.7	48	130	374	7.9	0.01	0	0	0	0	0	0	0	0	
Q-39	C 309	Laikeil	LAMURIA	22-OCT-83	36.817	0.000	Volcanics	40	17	1300	8.9	5	1																							

The Existing Data of Water Quality (2/3)

No.	ID	DISTRIC T	DIVISION	SAMPLING DATE	Longitude	Latitude	Type of aquifer	Depth of well(m)	Water near (m)	EC (µm)	pH	CO ₂ TURBID OR	CO ₂ (mg/l)	HCO ₃ (mg/l)	Mg (mg/l)	Fe (mg/l)	K (mg/l)	Na (mg/l)	Ca (mg/l)	TDS (mg/l)	F (mg/l)	NO ₃ (mg/l)	SO ₄ (mg/l)	Cl (mg/l)	GCCO ₃ (mg/l)	TOTAL ALKALI (mg/l)	O ₂ (mg/l)	PO ₄ (mg/l)	FREE CO ₂ (mg/l)	NO ₂ (mg/l)	SiO ₂ (mg/l)			
Q-48 C	571	Lalapa	CENTRAL	17-OCT-83	107.317	0.283	Volcanics	58	33	460	8.3	5	2.8	0.01	2.4	0.13	2.4	276	0.35	2.4	276	0.35	4.1	30	130	232	1.6							
Q-47 C	611	Lalapa	NGARUA	20-JAN-83	106.883	0.750	Volcanics	72	18	800	8.3	15	1.8	0.1	2.2	1.12	6	140	5.4	360	0.8	2.7	22	74	34	222	1.8	0.01						
Q-48 C	674	Lalapa	CENTRAL	18-OCT-83	107.167	0.133	Basement	60	20	640	7	5	3	0.01	2.1	0.24	42	324	0.41	51	54	190	178	10	160	344	0.63	0.01						
Q-49 C	690	Lalapa	CENTRAL	30-OCT-83	106.967	0.117	Volcanics	40	32	640	8.3	5	3	0.01	1.7	0.11	36	384	1.3	1.4	29	160	344	0.63	0.01									
Q-50 C	913	Lalapa	RUMURUTI	25-NOV-83	106.367	0.400	Sedimentary	72	46	650	8.1	0.3		0.1	1.1	0.1	4.8	397																
Q-51 C	832	Lalapa	RUMURUTI	22-OCT-83	106.717	0.033	Volcanics	183	46	870	8.9	5	7	0.01	1.4	0.18	21	402	1.3	20	33	114	304	2.5	0.01									
Q-52 C	951	Lalapa	RUMURUTI	04-DEC-77	106.400	0.483	Volcanics	285		650	8.7	4	38	366	4	0.2	6	158	10	356	0.9	0.6	20	13	42	404								
Q-53 C	1014	Lalapa	RUMURUTI	08-AUG-83	106.300	0.507	Volcanics	251	115	621	7.7	5	3	0.2	0.5	10	103																	
Q-54 C	1290	Lalapa	CENTRAL	13-OCT-83	107.333	0.200	Basement	122	49	600	7.8	5	1	0.01	2.7	0.1	71	360	0.41	40	55	286	280	0.47	0.01									
Q-55 C	1381	Lalapa	CENTRAL	24-OCT-83	106.500	0.133	Volcanics	213	36	640	8.3	2	1	0.01	1.2	0.12	22	344	0.7	21	46	102	316	0.79	0.01									
Q-56 C	1498	Lalapa	CENTRAL	18-OCT-83	107.083	0.250	Basement	92	40	860	8.4	5	2	0.01	3.1	0.04	66	516	0.55	324	53	290	82	1.3	0.01									
Q-57 C	1600	Lalapa	RUMURUTI	13-DEC-83	106.767	0.633	Volcanics	64	35		8.5		8	294	0.1	0.45																		
Q-58 C	1646	Lalapa	RUMURUTI	11-JAN-84	106.617	0.350	Volcanics	90	24	560	8	15	0.5	0.1	2.5	0.1	17	130	5.9	336	0.4	0.63	11	35	38	192	1	0.01						
Q-59 C	1787	Lalapa	RUMURUTI	01-NOV-83	106.893	0.150	Volcanics	127	24	880	9	5	0.9	0.01	1.6	0.1																		
Q-60 C	1785	Lalapa	RUMURUTI	04-NOV-83	106.550	0.717	Volcanics	179	69		8.8		0	244	0.01	0.01																		
Q-61 C	1813	Lalapa	MUKOGODO	01-SEP-83	107.167	0.400	Volcanics	53	19		7.4	0	0	403	49	0.01	116																	
Q-62 C	1819	Lalapa	RUMURUTI	25-MAR-83	106.617	0.450	Volcanics	160	76	1980	9	5	0.4	0.01	0.1	0.3	13	330	1.1	1176	3.8	0.07	166	324	5	200	2.1	0.04						
Q-63 C	1806	Lalapa	RUMURUTI	26-MAR-83	106.717	0.767	Volcanics	80	60	1295	8.4	5	1.4	0.02	0.3	0.3	7.4	266	0.9	777	3.4	0.06	118	118	10	210	2	0.07						
Q-64 C	2023	Lalapa	LAMURUA	30-OCT-83	106.850	0.067	Volcanics	55	45	300	8.4	5	7.5	0.01	1.8	0.3	23	180	0.6	1.5	14	134	190	0.79	0.01									
Q-65 C	2195	Lalapa	CENTRAL	18-OCT-83	107.083	0.350	Volcanics	71	26	980	7.9	5	10	0.01	3.7	0.39	120	568	0.54	20	568	0.54	319	65	454	302	0.15	0.01						
Q-66 C	2188	Lalapa	CENTRAL	03-MAY-83	107.017	0.400	Volcanics	150	49		7.5	0	378	8.8	5.76	15	140	1																
Q-67 C	2259	Lalapa	RUMURUTI	26-MAR-83	106.800	0.617	Volcanics	110	73	747	8.6	5	5.3	0.05	0.2	1	2.2	159	0.5	448	1.6	0.02	20	59	3	258	3	0.19						
Q-68 C	2318	Lalapa	NGARUA	27-MAR-83	106.433	0.517	Volcanics	152	70	482	8	5	2.4	0.01	1.9	0.5	11	89	2.5	277	0.85	0.03	7.2	24	30	222	1.2	0.05						
Q-69 C	2375	Lalapa	CENTRAL	20-FEB-83	106.850	0.150	Sedimentary	128	61		7.8	0	0	538	0.1	1.4	0.1	21	170	5	330	0.32	0.87	1	34	26	296	7	0.01					
Q-70 C	2400	Lalapa	NGARUA	13-JAN-84	106.883	0.650	Volcanics	165	50	550	7.6	5	1.5	0.1	1.4	0.1	21	170	5	330	0.32	0.87	1	34	26	296	7	0.01						
Q-71 C	2461	Lalapa	CENTRAL	26-JUL-83	106.767	0.167	Volcanics	92	37		7.1	0	0	380	0.06	1.8	0.6	710	2.2	0	62	86	80	939										
Q-72 C	2562	Lalapa	CENTRAL	20-MAR-83	106.800	0.183	Volcanics	219	62	1060	8.2	5	4.1	0.06	1.8	1.2	43	250	68	996	3.5	0.01	95	200	264	442	2.1	0.03						
Q-73 C	2576	Lalapa	CENTRAL	21-APR-73	107.033	0.033	Volcanics	146	40	650	8.3	5	36	403	3	0.3	13	150	8	380	3.5	1.8	32	22	32	439								
Q-74 C	2594	Lalapa	CENTRAL	02-NOV-83	106.850	0.100	Volcanics	84	41	690	9	10	5	0.01	1.1	0.04	30	414	1.2	12	62	1	74	360	5	0.01								
Q-75 C	2638	Lalapa	CENTRAL	13-FEB-83	107.050	0.067	Volcanics	69	14		7.7	0	0	452	0.04	0.04																		
Q-76 C	2676	Lalapa	RUMURUTI	26-MAR-83	106.867	0.667	Volcanics	125	23	1220	7.8	5	1	0.01	6.3	0.4	24	170	14	732	0.85	0	69	55	108	216	1.6	0.01						
Q-77 C	2727	Lalapa	RUMURUTI	11-JAN-84	106.517	0.350	Volcanics	179	60	650	9	10	5.4	0.4	0.1	1.3	6	180	1.5	390	1.1	0.01	19.6	48	2	348	2.5	0.01						
Q-78 C	2803	Lalapa	CENTRAL	03-UN-83	106.883	0.117	Sedimentary	92	39		7.8	0	0	329	24	0.7	17	108	40	553	1.3	0.01	32	39	199	329								
Q-79 C	2805	Lalapa	RUMURUTI	25-MAR-83	106.583	0.483	Volcanics	194	55	890	8.9	5	0.8	0.01	0.2	0.2	5	180	0.9	54	0.55	0.08	32	79	9	290	0.24	0.04						
Q-80 C	2858	Lalapa	MUKOGODO	16-AUG-83	106.400	0.133	Volcanics	107	12	235	7.9	5	1.1	0.01	1.4	0.5	8.4	59	2.8	200	0.27	0.03	1.7	12	2.6	154	0.1	0.02						
Q-81 C	2889	Lalapa	RUMURUTI	14-SEP-83	106.967	0.217	Volcanics	238	69		7.5		0	385	0.1	1.8																		
Q-82 C	2895	Lalapa	RUMURUTI	20-UN-83	106.800	0.400	Volcanics	122	48	1355	7.4	5	1.7	0.02	2.5	0.6	15	200	4.3	813	1.2	0.9	25	27	42	414	0.95	0.03						
Q-83 C	3022	Lalapa	CENTRAL	25-MAR-83	106.817	0.183	Volcanics	182	38	860	8.3	5	2.4	0.01	1.9	0.4	15.6	190	4.4	510	2.6	0.08	23	53	36	368	0.47	0.04						
Q-84 C	3022	Lalapa	CENTRAL	05-AUG-83	107.250	0.267	Sedimentary	98	75		7.3	0	0																					
Q-85 C	3119	Lalapa	NGARUA	09-AUG-83	106.483	0.267	Volcanics	235	54	747	8.8	5	3	0.2	0.2	0.2	8.4	165		625	0.58		2.9	17	28	352	0.8							
Q-86 C	3122	Lalapa	NGARUA	08-AUG-83	106.550	0.583	Volcanics	155	15	1085	8.6	10	7	0.01	0.2	0.4	7.6	195		788	0.4		40	129	94	302	0.8							
Q-87 C	3420	Lalapa	MUKOGODO	24-OCT-83	107.017	0.483	Volcanics	119	23	1000	8.8	5	2.5	0.01	5.9	0.08	69	636	0.75	171	108	452	250	0.										

ATTACHMENT- 6

Water Quality Analysis

Final Report

FINAL REPORT

The Study on Project for Groundwater development in
Laikipia and the Surrounding Areas of Samburu, Koibatek
and Baringo Districts In The Republic of Kenya

WATER QUALITY ANALYSIS

August 1998

**JOMO KENYATTA UNIVERSITY OF
AGRICULTURE AND TECHNOLOGY
(JKUAT)**

Civil Engineering Department

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EXECUTIVE SUMMARY

The study of water quality for boreholes from Baringo, Koibatek, Laikipia, and Samburu districts was carried out from 10/8/98 to 20/8/98. Analysis was done at the JKUAT laboratories. Sampling was done within this period with samples from Baringo and Samburu districts being received on 11/8/98 and from Koibatek and Laikipia districts on 18/8/98.

The maximum Temperature recorded was for sample from Molo river in Koibatek district. The temperature varied between 20° C and 20.4° C for all the samples.

The maximum pH recorded was 9.2 from Samburu district. The range in pH was between 9.2 and 6.8.

The turbidity varied between 17 NTU and 1 NTU units. The highest recorded turbidity in Baringo district was 14 NTU, 2NTU from Laikipia district, 17 NTU from Samburu district and 5 NTU from Koibatek district.

The fluoride levels were generally low, with a range of 0.2 to 3.5mg/l. The highest recorded fluoride content was from Baringo and Samburu districts. The minimum recorded fluoride content was obtained from Koibatek district.

The colour levels were varying between 4 and over 30. The highest recorded colour level content was from Koibatek district.

The carbonate levels were varying between 11 and 239 mg/l. The highest recorded carbonate content was from Baringo district.

The highest recorded hydrogencarbonate content was 465mg/l from Baringo district. The minimum recorded hydrogencarbonate content was obtained from Koibatek district. The range in hydrogencarbonate was between 48 and 465mg/l.

The Hardness levels were generally high, with a range of 47 to 503 mg/l. The highest recorded Hardness content was from Samburu district. The minimum recorded Hardness content was obtained from Laikipia district.

Calcium levels varied between 0.8 to 307.5 mg/l. The highest recorded Calcium content was from Samburu district. The minimum recorded Calcium content was obtained from Koibatek district.

Magnesium levels were varying between 2.3 to 325mg/l. The highest recorded Magnesium content was from Samburu district. The minimum recorded Magnesium content was obtained from Baringo district.

Manganese levels were generally low , with a range of 0 to 4.1mg/l. The highest recorded Manganese content was from Samburu district. The minimum recorded Manganese content was obtained from Baringo district.

The Chloride levels were generally low , with a range of 17.5 to 750 mg/l. The highest recorded Chloride content was from Samburu district. The minimum recorded Chloride content was obtained from Koibatek district.

Conductivity levels were generally high , with a range of 98 to 3760 μ s. The highest recorded Conductivity levels was from Samburu district. The minimum recorded Conductivity level was obtained from Koibatek district.

The Total Dissolved Solid levels varied between 10 to 1445 mg/l. The highest recorded Total Dissolved Solid levels was from Samburu district. The minimum recorded Total Dissolved Solid levels was obtained from Laikipia district.

The Iron levels were generally low , with a range of 0.1 to 8.8 mg/l. The highest recorded Iron content was from Baringo district. The minimum recorded Iron content was obtained from Laikipia district.

Potassium levels were generally low , with a range of 3.65 to 25 mg/l. The highest recorded Potassium content was from Laikipia district. The minimum recorded Potassium content was obtained from Samburu district.

The Sodium levels varied between 12.5 to 430mg/l. The highest recorded Sodium content was from Baringo district. The minimum recorded Sodium content was obtained from Koibatek district.

The Nitrates level varied between 0.1 to 19.36 mg/l. The highest recorded Nitrate content was from Samburu district. The minimum recorded Nitrite content was obtained from Samburu.

The Sulphate levels varied between 62 to 782 mg/l. The highest recorded Sulphate content was from Samburu district. The minimum recorded Sulphate content was obtained from Laikipia district.

The water from the four districts is expected to be hard. This is due to the presence of ions of magnesium , calcium carbonates, and hydrogencarbonates.

CHAPTER ONE

INTRODUCTION

1.1 GENERAL INTRODUCTION

The main objective of this monitoring exercise was to evaluate the quality of borehole water from the four districts so as to assess its general quality. The executive summary gives an overview of the accomplished consultancy work and the recommendations. This is followed in chapter one (1) with a general introduction of the scope and nature of the exercise, the outcome of the monitoring work and finally the contents of the report.

Chapter 2 gives details of both laboratory method and on-site measurements which were taken to determine the quality of the wastewater and the clean water.

The results and discussion are then presented in chapter 4.

Tables of the sampling points and their results and a list of the participants who concluded the study, and compiled the report are given in an Appendix A and B.

1.2 Terms of Reference

The department of Civil Engineering at Jomo Kenyatta of Agriculture and Technology (JKUAT) was sub-contracted by JICA Study Team to analyze ground water from Koibatek, Samburu, Baringo and Laikipia districts. The terms and conditions are contained in the main contract for consultancy provided by the JICA Study Team. The terms of reference are briefly reproduced below:-

The items to be analysed and monitored are water temperatures, pH, electrical conductivity, turbidity, hardness, colour, Sulphate, Nitrates, Total dissolved solids, Sodium, Potassium, Iron, Manganese, Hardness, Hydrogencarbonate, Carbonate, Calcium, Magnesium and fluoride.

CHAPTER TWO

METHODOLOGY

2.1 Sampling and Handling of the Samples

Sampling was done by the Engineer in-charge of the JICA study team water section.

2.2 Laboratory Tests

Laboratory analysis of the various parameters was carried out as explained .

Temperature:

This was measured in the laboratory using Celsius thermometer.

pH:

pH was determined on site using microcomputer pH meter, Palintest instruments.

Color:

This was determined in the Laboratory with Colimeter cylinders with plane -parallel base and sample observed in diffused light against a white background.

Turbidity:

Turbidity was determined by nephelometric turbidity meter in NTU

Electrical Conductivity:

Electrical conductivity was determined and measured by means of a conductivity meter, model, PT115 Palintest instruments.

Hardness:

Hardness was determined using titrametric method by EDTA titrant, prepared and standardized based on standard methods manual.

Total Dissolved Solids(TDS):

This was determined by filtration and oven-drying of the filtrate at $180^{\circ}\text{C}\pm 2$ to a constant weight.

Metals:

All the metals were analysed by means of atomic absorption spectrophotometer

Flouride:

Fluoride concentration was determined using the palintest with a direct- reading photometer at 570nm wavelength and a calibration chart.

Nitrates:

Nitrates concentration was determined using the palintest with a direct-reading photometer at 570nm wavelength and a calibration chart

Chloride:

Chloride analysis was based on Argentometric method described in the Standard Methods Manual, 1989.

Sulphate:

Sulphate ions were determined by Gravimetric method as outlined in the Standard Methods Manual, 1989.

Carbonate ions and Hydrogen carbonate ions:

These were determined by titrimetric methods as per standard methods manual, 1989.

CHAPTER THREE

RESULTS AND DISCUSSION

3.1 Result and Analysis

The tabulated results of the analysis are presented in appendix A in the following order

- 1) Samburu - Page 12 - 16
- 2) Baringo - Page 17 - 21
- 3) Koibatek - Page 22
- 4) Laikipia - Page 23 - 27

3.2 Discussion of Results.

i) Samburu District

pH

pH range was between 7.7 to 9.2. The pH of 9.2 was recorded at Kisima, Lorroki, while the pH of 7.7 was obtained from an existing well at Kiroriti, Baawa.

Conductivity

Conductivity range was from 1419 to 3760 μs . The conductivity of 1419 μs was recorded at Tomiyoi, Maralal, while the one of 3760 μs was recorded from an existing well at Wanba location.

Total Hardness

Total Hardness range was between 0 and 503 mg/l, CaCO_3 . The value of 503 mg/l, CaCO_3 was recorded at Kiroriti, Baawa.

Chlorides

Chlorides range was between 750 to 130mg/l. The value of 750 was obtained from an existing well at Wanba location, while the value of 130 was obtained from an existing well (AIC) at Wanba location.

Total Dissolved solids

Total Dissolved solids range was between 1445 and 590mg/l. The value of 1445 was obtained from Wanba location. While the value of 590 was from an existing well at Kiroriti location.

Sulphates

Sulphates range was between 0 and 782mg/l. The value of 782mg/l was obtained from Wanba location. While an existing well at Kiroriti location had no sulphate content.

Carbonates

Carbonates range was between 34.5 and 11 mg/l. The value of 34.5mg/l was obtained from an existing well at Kiroriti location. While the 11mg/l was obtained from Existing well at Tomiyoi village, Maralal location.

Hydrogencarbonate

Hydrogencarbonate range was between 238 and 144mg/l. The value of 238mg/l was recorded from a well at Wanba location. While the value of 144mg/l was obtained from an existing well at Wanba location.

Turbidity and colour

The highest colour level was sampling point No. 4, Wanba location and that was 8 and turbidity was 17NTU. The lowest was sampling point No. 1 at an existing well, Kiloriti location.

Fluorides

The highest value was 3.5mg/l and was recorded from an existing well at Kisima location. While the lowest value was 0.7mg/l at an existing well at Wanba location sampling point 4.

Nitrates

Generally was of high range between 0.07 and 19.36 mg/l, NO₃.

Metals

Sodium and magnesium were the most dominant ion in most of the well waters ranging from 370mg/l to 45.5mg/l for sodium and 325 to 6.375mg/l for magnesium. Manganese and iron were the least dominant metal ions. The highest recorded iron content was 2.0mg/l at Wanba sampling point 4. While for manganese the highest was 4.05mg/l recorded from the same point as that of iron.

ii) Baringo

pH

pH range was between 7.4 to 9.1. The pH of 9.1 was recorded at Makutano river while the pH of 7.4 was obtained from an existing well at Chepturu village, Koloa location.

Conductivity

Conductivity range was from 1517 to 525 μ s. The conductivity of 1517 was recorded at Mukutani river, Mukutani location, while the one of 525 μ s was recorded from an existing well at Chepturu village, Koloa location.

Total Hardness

Total Hardness range was between 301 and 41mg/l. The value of 301 was recorded at Chemoligot village, Kositet location, while the one of 41 was recorded at Makutani location.

Chlorides

Chlorides range was between 140 to 40mg/l. The value of 140 was obtained from an existing well (CDN) at Tangelubei location, while the value of 40 was obtained from an existing well (AIC) at Chepturu, Koloa location.

Total Dissolved solids

Total Dissolved solids range was between 1060 and 340mg/l. The value of 1060 was obtained from Makutani seasonal river, Makutani location. While the value of 340 was from an existing well (AIC) Chepturu village, Koloa location.

Sulphates

Sulphates range was between 350 and 137 mg/l. The value of 350mg/l was obtained from Makutani seasonal river, Makutani village. While the value of 137mg/l was obtained from an existing well(AIC) Chepturu village, Koloa location.

Carbonates

Carbonates range was between 62 and 6 mg/l. The value of 62mg/l was obtained from Makutani river. While the 6mg/l was obtained from Existing well(AIC), Chepturu village, Koloa location.

Hydrogencarbonate

Hydrogencarbonate range was between 465 and 99mg/l. The value of 465mg/l was recorded at Makutani river. While the value of 99mg/l was obtained from a dug well (CDN) at Sibiro location.

Turbidity and colour

The highest colour level was sampling point No. 6 Makutani river and that was 11 and turbidity was 14NTU. The lowest was 1 at Chemolingot village, Kositei location.

Fluorides

The highest value was 2.40mg/l and was recorded at Chemolingot village, Kositei location. While the lowest value was 1.20mg/l at a dug well in Sibilo village, Sibilo location.

Nitrites

Generally was of low range between 1.1 and 0.05mg/lN

Metals

Sodium and magnesium were the most dominant ion in most of the well waters ranging from 430mg/l to 20mg/l for sodium and 14.875 to 2.265mg/l for magnesium. Manganese and iron were the least dominant metal ions. The highest recorded iron content was 3.25mg/l at Makutani. While for manganese was 0.35mg/l and recorded at Chepturu village, Koloa.

iii) Koibatek District

Compared with water from the other three districts the values obtained were relatively low.

iv) Laikipia District

pH

pH range was between 7.7 to 8.2. The pH of 8.2 was recorded from an existing well at Kinamba location. While the pH of 7.7 was obtained from an existing well at Ilindigiri location.

Conductivity

Conductivity range was from 1048 to 486 μ s. The conductivity of 1048 was recorded from an existing well at Ilindigiri location, while the one of 486 μ s was recorded from an existing well at Kinamba location.

Total Hardness

Total Hardness range was between 0 and 434mg/l, CaCO₃. The value of 434mg/l, CaCO₃ was recorded from an existing well at Ilindigiri location.

Chlorides

Chlorides range was between 75 to 17.5mg/l. The value of 75 was obtained from an existing well at Ilindigiri location, while the value of 17.5 was obtained from an existing well at Kinamba location.

Total Dissolved solids

Total Dissolved solids range was between 700 and 10mg/l. The value of 700 was obtained from an existing well at Ilindigiri location. While the value of 10 was from a spring at Segera, Sirima location.

Sulphates

Sulphates range was between 308.7 and 61.74 mg/l. The value of 308.7mg/l was obtained from an existing well at Ilindigiri location, while the value of 61.74mg/l was obtained from an existing well at Kinamba location.

Carbonates

Carbonates range was between 171 and 26 mg/l. The value 171mg/l was obtained from a spring at Segera, Sirima location, while 26mg/l was obtained from Existing well at Kinamba location.

Hydrogencarbonate

Hydrogencarbonate range was between 208 and 170mg/l. The value of 208mg/l was recorded from a spring at Segera, Sirima location. While the value of 170mg/l was obtained from an existing well at Kinamba location.

Fluorides

The highest value was 1.50mg/l recorded from a spring at Segera, Sirima location. While the lowest value was 0.3mg/l at an existing well at Rugutu Sirima location.

Nitrates

Generally was of low range between 1.19 and 0.09mg/lN

Metals

Sodium and magnesium were the most dominant ion in most of the well waters ranging from 62.5mg/l to 55mg/l for sodium and 115 to 30mg/l for magnesium. Manganese and iron were the least dominant metal ions. The highest recorded iron content was 0.30mg/l from a spring at Segera, Sirima location. While for manganese it was not traced.

APPENDIX A : RESULTS

Date samples were received 11/8/98

Date of Analysis 11-14/8/98

Name of Testing Technician: R. Matono & F. Munyi

Name of Supervisor: Dr. G. Thumbi

Name of sampling site: Kiroriti, Baawa, Samburu District Sample No. 1

S/No	Parameter tested	Results obtained
1	Temperature(°C)	20.1
2	Conductivity(µs)	848
3	PH	7.7
4	Color	>30
5	Turbidity(NTU)	1
6	Carbonate (mg/l, CO ₃)	34.5
7	Hydrogen carbonate (mg/l, HCO ₃)	189
8	Manganese(mg/l, Mn)	No trace
9	Magnesium(mg/l, Mg)	110
10	Iron (mg/l, Fe)	0.8
11	Potassium (mg/l, K)	9.5
12	Sodium (mg/l, Na)	45.5
13	Calcium (mg/l, Ca)	39.8
14	Total Dissolved solids (mg/l, TDS)	590
15	Fluorides(mg/l, F)	1.1
16	Nitrates(mg/l, NO ₃)	19.4
17	Sulphates(mg/l, SO ₄)	No trace
18	Chlorides(mg/l, Cl)	180
19	Total Hardness(mg/l, CaCO ₃)	503

Date samples were received: 11/8/98 Date of Analysis: 11-14/8/98

Name of Testing Technician: R. Matano & F. Munyi

Name of Supervisor Dr. G. M. Thumbi

Name of sampling site: Kisima, Lorroki, Samburu District Sample No. 2

S/No	Parameter tested	Results obtained
1	Temperature(°C)	20.1
2	Conductivity(μ s)	919
3	pH	9.2
4	Color	>30
5	Turbidity(NTU)	2
6	Carbonate (mg/l, CO ₃)	24
7	Hydrogen carbonate (mg/l, HCO ₃)	147
8	Manganese(mg/l, Mn)	No Trace
9	Magnesium(mg/l, Mg)	0.5
10	Iron (mg/l, Fe)	No Trace
11	Potassium (mg/l, K)	3.7
12	Sodium (mg/l, Na)	141
13	Calcium (mg/l, Ca)	1.3
14	Total Dissolved solids (mg/l,TDS)	645
15	Fluorides(mg/l, F)	3.5
16	Nitrates(mg/l, NO ₃)	0.2
17	Sulphates(mg/l, SO ₄)	262
18	Chlorides(mg/l, Cl)	175
19	Total Hardness(mg/l, CaCO ₃)	No trace

Date samples were received: 11/8/98

Date of Analysis: 11-14/98

Name of Testing Technician: R. Matano & F. Munyi

Name of Supervisor : Dr. G. M. Thumbi

Name of sampling site: Wanba, Wanba, Samburu District Sample No. 3

S/No	Parameter tested	Results obtained
1	Temperature(°C)	20
2	Conductivity(μ s)	778
3	pH	7.5
4	Color	>30
5	Turbidity(NTU)	2
6	Carbonate (mg/l, CO_3)	18
7	Hydrogen carbonate (mg/l, HCO_3)	238
8	Manganese(mg/l, Mn)	1.2
9	Magnesium(mg/l, Mg)	145
10	Iron (mg/l, Fe)	No trace
11	Potassium (mg/l, K)	6.25
12	Sodium (mg/l, Na)	42.5
13	Calcium (mg/l, Ca)	50
14	Total Dissolved solids (mg/l, TDS)	1380
15	Fluorides(mg/l, F)	1.3
16	Nitrates(mg/l, NO_3)	0.2
17	Sulphates(mg/l, SO_4)	556
18	Chlorides(mg/l, Cl)	130
19	Total Hardness(mg/l, CaCO_3)	376

Date samples were received: 11/8/98 Date of Analysis: 11-11/8/98

Name of Testing Technician: R. Matano & J. Munyi

Name of Supervisor: Dr. G. M. Thumbi

Name of sampling site: Wamba, Wamba, Samburu District Sample No. 4

S/No	Parameter tested	Results obtained
1	Temperature(°C)	20
2	Conductivity(μ s)	3760
3	pH	6.9
4	Color	8
5	Turbidity(NTU)	17
6	Carbonate (mg/l, CO_3)	32
7	Hydrogen carbonate (mg/l, HCO_3)	144
8	Manganese(mg/l, Mn)	4.1
9	Magnesium(mg/l, Mg)	325
10	Iron (mg/l, Fe)	2
11	Potassium (mg/l, K)	10.8
12	Sodium (mg/l, Na)	370
13	Calcium (mg/l, Ca)	307.5
14	Total Dissolved solids (mg/l, TDS)	1445
15	Fluorides(mg/l, F)	0.7
16	Nitrates(mg/l, NO_3)	0.1
17	Sulphates(mg/l, SO_4)	782
18	Chlorides(mg/l, Cl)	750
19	Total Hardness(mg/l, CaCO_3)	434

Date samples were received: 11/8/98 Date of Analysis: 11--14/8/98

Name of Testing Technician: R. Matano & F. Munyi

Name of Supervisor: Dr. G. M. Thumbi

Name of sampling site: Tomiyoi, Mararal, Kirista, Samburu District Sample No. 5

S/No	Parameter tested	Results obtained
1	Temperature(°C)	20.1
2	Conductivity(μ s)	1419
3	PH	6.8
4	Color	16
5	Turbidity(NTU)	12
6	Carbonate (mg/l, CO_3)	11
7	Hydrogen carbonate (mg/l, HCO_3)	162
8	Manganese(mg/l, Mn)	0.5
9	Magnesium(mg/l, Mg)	140
10	Iron (mg/l, Fe)	1.8
11	Potassium (mg/l, K)	10.5
12	Sodium (mg/l, Na)	135
13	Calcium (mg/l, Ca)	122.5
14	Total Dissolved solids (mg/l,TDS)	1130
15	Fluorides(mg/l, F)	0.9
16	Nitrates(mg/l, NO_3)	0.1
17	Sulphates(mg/l, SO_4)	247
18	Chlorides(mg/l, Cl)	160
19	Total Hardness(mg/l, CaCO_3)	214

Date samples were received: 11/8/98

Date of Analysis: 11-14/8/98

Name of Testing Technician: R. Matano & F. Mumyi

Name of Supervisor :Dr. G. M. Thumbi

Name of sampling site: Mukutan, Mukutan, Baringo District

Sample No. 6

S/No	Parameter tested	Results obtained
1	Temperature(°C)	20.1
2	Conductivity(µs)	1517
3	pH	9.1
4	Color	11
5	Turbidity(NTU)	14
6	Carbonate (mg/l, CO ₃)	62
7	Hydrogen carbonate (mg/l, HCO ₃)	466
8	Manganese(mg/l, Mn)	0.1
9	Magnesium(mg/l, Mg)	6.4
10	Iron (mg/l, Fe)	3.3
11	Potassium (mg/l, K)	20
12	Sodium (mg/l, Na)	430
13	Calcium (mg/l, Ca)	7.5
14	Total Dissolved solids (mg/l, TDS)	1060
15	Fluorides(mg/l, F)	1.5
16	Nitrates(mg/l, NO ₃)	0.1
17	Sulphates(mg/l, SO ₄)	350
18	Chlorides(mg/l, Cl)	100
19	Total Hardness(mg/l, CaCO ₃)	No trace

Date samples were received: 11/8/98 Date of Analysis: 11-11/8/98

Name of Testing Technician: R. Matano & F. Muniyi

Name of Supervisor : Dr. G. M. Thumbi

Name of sampling site: Chemolingot, Kositei, Nginyang, Baringo District Sample No. 7

S/No	Parameter tested	Results obtained
1	Temperature(°C)	20.3
2	Conductivity(µs)	1032
3	pH	8.1
4	Color	>30
5	Turbidity(NTU)	1
6	Carbonate (mg/l, CO ₃)	33
7	Hydrogen carbonate (mg/l, HCO ₃)	278
8	Manganese(mg/l, Mn)	No trace
9	Magnesium(mg/l, Mg)	2.3
10	Iron (mg/l, Fe)	No trace
11	Potassium (mg/l, K)	9.3
12	Sodium (mg/l, Na)	95
13	Calcium (mg/l, Ca)	6.5
14	Total Dissolved solids (mg/l, TDS)	835
15	Fluorides(mg/l, F)	2.4
16	Nitrates(mg/l, NO ₃)	1.1
17	Sulphates(mg/l, SO ₄)	165
18	Chlorides(mg/l, Cl)	90
19	Total Hardness(mg/l, CaCO ₃)	No trace

Date samples were received: 11/8/98 Date of Analysis: 11-14/8/98

Name of Testing Technician: R. Matano & F. Munyi

Name of Supervisor: Dr. G. M. Thumbi

Name of sampling site: Chepturu, Koloa, Koloa, Baringo District Sample No. 8

S/No	Parameter tested	Results obtained
1	Temperature(°C)	20.2
2	Conductivity(us)	525
3	pH	7.4
4	Color	27
5	Turbidity(NTU)	5
6	Carbonate (mg/l , CO ₃)	15
7	Hydrogen carbonate (mg/l, HCO ₃)	161
8	Manganese(mg/l, Mn)	0.4
9	Magnesium(mg/l, Mg)	No trace
10	Iron (mg/l, Fe)	1.8
11	Potassium (mg/l, K)	8.7
12	Sodium (mg/l, Na)	27.5
13	Calcium (mg/l, Ca)	31.8
14	Total Dissolved solids (mg/l,TDS)	340
15	Fluorides(mg/l, F)	1.5
16	Nitrates(mg/l, NO ₃)	0.1
17	Sulphates(mg/l, SO ₄)	1379
18	Chlorides(mg/l,Cl)	40
19	Total Hardness(mg/l ,CaCO ₃)	209

Date samples were received: 11/8/98 Date of Analysis: 11-14/8/98

Name of Testing Technician: R. Matano & F. Munyi

Name of Supervisor: Dr. G. M. Thumbi

Name of sampling site: Sibilo, Sibilo, Kipsaraman, Baringo District Sample No. 9

S/No	Parameter tested	Results obtained
1	Temperature(°C)	20.3
2	Conductivity(μ s)	573
3	pH	8.7
4	Color	>30
5	Turbidity(NTU)	3
6	Carbonate (mg/l, CO_3)	15
7	Hydrogen carbonate (mg/l, HCO_3)	99
8	Manganese(mg/l, Mn)	No trace
9	Magnesium(mg/l, Mg)	14.9
10	Iron (mg/l, Fe)	0.8
11	Potassium (mg/l, K)	4.1
12	Sodium (mg/l, Na)	27.5
13	Calcium (mg/l, Ca)	29.5
14	Total Dissolved solids (mg/l, TDS)	420
15	Fluorides(mg/l, F)	1.2
16	Nitrates(mg/l, NO_3)	0.8
17	Sulphates(mg/l, SO_4)	144
18	Chlorides(mg/l, Cl)	60
19	Total Hardness(mg/l, CaCO_3)	156

Date samples were received: 11/8/98 Date of Analysis : 11-14/8/98

Name of Testing Technician: R. Matomo & F. Munyi

Name of Supervisor : Dr. G. M. Thumbi

Name of sampling site: Tangulubei, Tangulubei, Tangulubei, Baringo District

Sample No. 10

S/No	Parameter tested	Results obtained
1	Temperature(°C)	20
2	Conductivity(μ s)	839
3	pH	7.9
4	Color	>30
5	Turbidity(NTU)	1
6	Carbonate (mg/l, CO ₃)	24
7	Hydrogen carbonate (mg/l, HCO ₃)	191
8	Manganese(mg/l, Mn)	No trace
9	Magnesium(mg/l, Mg)	13.4
10	Iron (mg/l, Fe)	No trace
11	Potassium (mg/l, K)	8.5
12	Sodium (mg/l, Na)	31
13	Calcium (mg/l, Ca)	24.5
14	Total Dissolved solids (mg/l, TDS)	400
15	Fluorides(mg/l, F)	1.4
16	Nitrite(mg/l, NO ₃)	0.4
17	Sulphates (mg/l, SO ₄)	62
18	Chlorides(mg/l, Cl)	140
19	Total Hardness(mg/l, CaCO ₃)	491

Date samples were received: 18/8/98 Date of Analysis: 18-20/98

Name of Testing Technician: R. Matano & F. Munyi

Name of Supervisor: Dr. G. M. Thumbi

Name of sampling site: Gubereti, Mogotio, Mogotio, Koibatek District Sample No. 11

S/No	Parameter tested	Results obtained
1	Temperature(°C)	20.4
2	Conductivity(μ s)	98
3	pH	7.9
4	Color	4
5	Turbidity(NTU)	5
6	Carbonate (mg/l, CO_3)	128
7	Hydrogen carbonate (mg/l, HCO_3)	48
8	Manganese(mg/l, Mn)	0.1
9	Magnesium(mg/l, Mg)	5
10	Iron (mg/l, Fe)	8.8
11	Potassium (mg/l, K)	7.5
12	Sodium (mg/l, Na)	12.5
13	Calcium (mg/l, Ca)	0.8
14	Total Dissolved solids (mg/l, TDS)	285
15	Fluorides(mg/l, F)	0.20
16	Nitrite(mg/l, NO_3)	No trace
17	Sulphates(mg/l, SO_4)	No trace
18	Chlorides(mg/l, Cl)	22.5
19	Total Hardness(mg/l, CaCO_3)	No trace

Date samples were received: 18/8/98 Date of Analysis: 18-20/8/98

Name of Testing Technician: R. Matano & F. Munyi

Name of Supervisor: Dr. G. M. Thumbi

Name of sampling site: Iloigiri, Mukogodo, Laikipia District Sample No. 12

S/No	Parameter tested	Results obtained
1	Temperature(°C)	20
2	Conductivity(μ s)	1048
3	pH	7.7
4	Color	>30
5	Turbidity(NTU)	2
6	Carbonate (mg/l, CO_3)	107
7	Hydrogen carbonate (mg/l, HCO_3)	194
8	Manganese(mg/l, Mn)	No trace
9	Magnesium(mg/l, Mg)	115
10	Iron (mg/l, Fe)	0.4
11	Potassium (mg/l, K)	15
12	Sodium (mg/l, Na)	62.5
13	Calcium (mg/l, Ca)	37.6
14	Total Dissolved solids (mg/l, TDS)	700
15	Fluorides(mg/l, F)	1.30
16	Nitrite(mg/l, NO_2)	1.2
17	Sulphates(mg/l, SO_4)	308.7
18	Chlorides(mg/l, Cl)	75
19	Total Hardness(mg/l, CaCO_3)	434

Date samples were received: 18/8/98

Date of Analysis: 18--20/8/98

Name of Testing Technician: R. Matano & F. Munyi

Name of Supervisor: Dr. G. M. Thumbi

Name of sampling site: Segeza, Mohoria, Sirima, Lamuria, Laikipia District

Sample No. 13

S/No	Parameter tested	Results obtained
1	Temperature(°C)	20.3
2	Conductivity(μs)	730
3	pH	7.7
4	Color	>30
5	Turbidity(NTU)	1
6	Carbonate (mg/l, CO ₃)	171
7	Hydrogen carbonate (mg/l, HCO ₃)	208
8	Manganese(mg/l, Mn)	No trace
9	Magnesium(mg/l, Mg)	45
10	Iron (mg/l, Fe)	0.3
11	Potassium (mg/l, K)	12.5
12	Sodium (mg/l, Na)	62.5
13	Calcium (mg/l, Ca)	17
14	Total Dissolved solids (mg/l, TDS)	10
15	Fluorides(mg/l, F)	1.5
16	Nitrite(mg/l, NO ₂)	0.6
17	Sulphates(mg/l, SO ₄)	144.1
18	Chlorides(mg/l, Cl)	35
19	Total Hardness(mg/l, CaCO ₃)	197

Date samples were received: 18/8/98

Date of Analysis: 18 -20/8/98

Name of Testing Technician: R. Matano & F. Munyi

Name of Supervisor :Dr. G. M. Thumbi

Name of sampling site: Rugutu, Segera, Central, Laikipia District Sample No. 14

S/No	Parameter tested	Results obtained
1	Temperature(°C)	20.1
2	Conductivity(µs)	696
3	pH	7.8
4	Color	>30
5	Turbidity(NTU)	2
6	Carbonate (mg/l, CO ₃)	33
7	Hydrogen carbonate (mg/l, HCO ₃)	187
8	Manganese(mg/l, Mn)	No trace
9	Magnesium(mg/l, Mg)	45
10	Iron (mg/l, Fe)	0.3
11	Potassium (mg/l, K)	25
12	Sodium (mg/l, Na)	60
13	Calcium (mg/l, Ca)	19.2
14	Total Dissolved solids (mg/l,TDS)	515
15	Fluorides(mg/l, F)	0.3
16	Nitrates(mg/l, NO ₃)	0.2
17	Sulphates(mg/l, SO ₄)	82.3
18	Chlorides(mg/l, Cl)	37.5
19	Total Hardness(mg/l, CaCO ₃)	47

Date samples were received: 18/8/98 Date of Analysis: 18-20/8/98

Name of Testing Technician: R. Matano & F. Munyi

Name of Supervisor : Dr. G. M. Thumbi

Name of sampling site: Kinamba, Ngarua, Laikipia District Sample No. 15

S/No	Parameter tested	Results obtained
1	Temperature(°C)	20.2
2	Conductivity(μ s)	486
3	pH	8.2
4	Color	>30
5	Turbidity(NTU)	1
6	Carbonate (mg/l, CO_3)	26
7	Hydrogen carbonate (mg/l, HCO_3)	170
8	Manganese(mg/l, Mn)	No trace
9	Magnesium(mg/l, Mg)	30
10	Iron (mg/l, Fe)	0.1
11	Potassium (mg/l, K)	25
12	Sodium (mg/l, Na)	55
13	Calcium (mg/l, Ca)	10.2
14	Total Dissolved solids (mg/l, TDS)	175
15	Fluorides(mg/l, F)	1.4
16	Nitrates(mg/l, NO_3)	0.1
17	Sulphates(mg/l, SO_4)	61.7
18	Chlorides(mg/l, Cl)	17.5
19	Total Hardness(mg/l, CaCO_3)	No trace

Date samples were received: 18/8/98 Date of Analysis: 18-20/8/98

Name of Testing Technician: R. Matano & F. Munyi

Name of Supervisor: Dr. G. M. Thumbi

Name of sampling site: Lake Baringo Lodge, Baringo District Sample No. 16

S/No	Parameter tested	Results obtained
1	Temperature(°C)	20.3
2	Conductivity(μ s)	645
3	pH	7.8
4	Color	7
5	Turbidity(NTU)	4
6	Carbonate (mg/l, CO ₃)	239
7	Hydrogen carbonate (mg/l, HCO ₃)	161
8	Manganese(mg/l, Mn)	0.1
9	Magnesium(mg/l, Mg)	15
10	Iron (mg/l, Fe)	8.8
11	Potassium (mg/l, K)	15
12	Sodium (mg/l, Na)	6.5
13	Calcium (mg/l, Ca)	5.2
14	Total Dissolved solids (mg/l, TDS)	410
15	Fluorides(mg/l, F)	3.5
16	Nitrates(mg/l, NO ₃)	4.18
17	Sulphates(mg/l, SO ₄)	102.9
18	Chlorides(mg/l, Cl)	50
19	Total Hardness(mg/l, CaCO ₃)	No trace

APPENDIX B: LIST OF PARTICIPANTS

Dr. E. Asano

Dr. G. M. Thumbi

Mr. A. O. Mayabi

Mr. F. Munyi

Mr. R. Matano

All from Department of Civil Engineering

ATTACHMENT- 7

**The Graph of Electric Soundings Analysis
(VES Curve)**

























