Table 2.--Selected water-quality data for surface-water sites in the Delta-Clearwater area. All analyses were for dissolved constituents and are reported in milligrams per liter except where noted.

Date	Streamflow, instantaneous (ft^3/s)	Temperature (°C)	pH (units)	Specific conductance (micromhos)	Dissolved solids, sum of constituents	Hardness as $CaCO_3$	Calcium	Magnesium	Sodium	Potassium	Bicarbonate	Sulfate	Chloride	Nitrite plus nitrate (as N)	Fluoride	Silica	Iron (µg/L)
Clearwater Creek near Delta Junction (at gaging station 0.4 mile downstream from campground) (Station No. 15477500)																	
77/09/05	753	3.5	7.4	300	179	150	46	8.7	3.8	2.1	140	34	1.1	0.16	0.2	14	40
78/02/27	--	2.0	8.0	290	188	150	45	9.4	3.6	2.0	160	31	1.2	.26	.2	15	50
78/08/16	742	5.0	7.5	306	183	150	45	8.6	3.8	2.1	150	33	1.2	.22	.1	14	10
78/10/16	--	1.5	8.2	312	179	140	43	8.2	3.7	2.0	150	31	1.3	.29	.2	14	<10
78/12/06	674	1.0	7.4	315	155	98	31	5.0	2.1	1.3	150	34	1.2	.27	.1	5.3	100
79/03/22	646	1.0	7.6	360	188	160	48	9.0	3.7	2.2	150	36	1.4	.26	.2	12	0
79/05/24	634	5.0	7.2	310	176	150	46	8.5	3.7	2.2	140	33	1.4	.17	.2	11	10
79/06/20	660	8.6	7.8	317	182	140	43	9.1	4.6	2.2	150	31	1.5	.18	.2	15	370
79/07/27	787	7.0	8.0	330	179	140	42	8.8	3.8	2.5	150	32	1.3	.18	.2	14	10
Clearwater Creek 0.1 mile above Sawmill Creek near Delta Junction (64°02'54"N 145°20'14"W)																	
77/08/25	135	3.5	7.7	360	208	180	55	9.5	4.2	2.1	170	37	1.3	.16	.2	14	20
Granite Creek 0.1 mile above Sawmill Creek near Delta Junction (64°01'22"N 145°18'07"W)																	
77/08/25	53	3.0	8.0	310	182	150	45	8.5	3.1	2.2	140	38	.9	.23	.2	14	40
Clearwater Lake near Big Delta (64°05'10"N 145°36'00"W)																	
78/10/16	--	2.0	7.8	289	163	130	38	9.1	2.5	2.5	120	41	1.2	.27	.1	8.5	<10
79/06/20	--	12.0	7.7	271	166	130	38	9.7	2.9	2.6	120	42	1.4	.25	.1	9.2	10
Clearwater Lake outlet near Delta Junction (64°06'23"N 145°36'00"W)																	
77/09/05	463	6.0	8.0	250	155	130	37	9.4	2.8	2.6	110	38	1.2	.13	.1	9.4	30
Sawmill Creek 0.2 mile above Granite Creek near Delta Junction (64°01'23"N 145°17'43"W)																	
77/08/25	209	3.0	7.7	325	--	--	--	--	--	--	150	--	--	--	--	--	--

Table 2.--Selected water-quality data for surface-water sites in the Delta-Clearwater area. All analyses were for dissolved constituents and are reported in milligrams per liter except where noted--Continued.

Date	Streamflow, instantaneous (ft^3/s)	Temperature (°C)	pH (units)	Specific conductance (micromhos)	Dissolved solids, sum of constituents	Hardness as $CaCO_3$	Calcium	Magnesium	Sodium	Potassium	Bicarbonate	Sulfate	Chloride	Nitrite plus nitrate (as N)	Fluoride	Silica	Iron (µg/L)
Sawmill Creek 3.0 miles above Granite Creek near Delta Junction (63°59'48"N 145°14'49"W)																	
77/08/25	49	2.5	7.3	270	196	160	49	8.4	3.7	2.2	160	37	1.4	0.15	0.2	14	20
Sawmill Creek near Big Delta at Alaska Highway Bridge (63°53'55"N 145°13'45"W)																	
49/07/21	--	13.5	6.2	33	--	12	--	--		1.6**	15	1.8	0.2	.13*	--	4.4	--
79/06/20	5.2	13.0	6.4	35	--	--	--	--	--	--	14	--	--	--	--	--	--
Delta River near Big Delta (64°07'05"N 145°50'00"W)																	
55/05/17	--	--	7.2	205	123	94	27	6.4	2.8	3.8	86	31	1.0	.20*	.0	7.4	--
55/09/20	--	--	7.5	261	153	119	32	9.6	3.9	3.2	102	44	1.8	.09*	.1	8.1	--
56/05/03	--	--	7.7	194	118	91	26	6.3	2.9	3.3	89	27	.2	.11*	.1	8.0	--
56/05/11	--	--	8.0	220	126	101	28	7.5	3.1	3.0	88	35	1.5	.09*	.0	4.7	--
56/09/01	--	9.5	7.9	215	126	98	30	5.6	3.2	2.8	87	33	1.0	.09*	.0	7.4	--
57/09/19	--	--	7.8	252	148	119	28	12	2.7	3.4	98	47	1.0	.02*	.1	5.6	--
58/01/05	--	.0	7.8	266	157	130	38	8.4	2.4	3.6	120	36	1.5	.38*	.0	6.8	--
58/02/14	--	.0	7.3	284	161	130	39	8.0	2.9	4.0	125	36	.5	.31*	.0	7.6	--
78/10/16	--	4.0	8.2	255	156	120	35	7.6	3.0	3.7	110	45	1.0	.28	.1	5.6	<10
79/06/20	--	13.0	7.0	186	103	81	22	6.4	2.4	2.0	76	27	1.2	.11	.1	4.3	40
Tanana River 18 miles above Gerstle River near Delta Junction (63°55'00"N 144°53'55"W)																	
78/10/15	--	--	8.0	290	186	140	43	9.1	5.5	1.4	160	32	2.2	.34	.1	12	10
79/06/20	--	12.0	7.8	218	122	93	27	6.3	5.7	1.4	92	25	3.3	.04	.1	7.8	30

*Value calculated from dissolved nitrate value which was reported as NO_3.
**Sodium and potassium values combined.

Table 2.--Selected water-quality data for surface-water sites in the Delta-Clearwater area. All analyses were for dissolved constituents and are reported in milligrams per liter except where noted--Continued.

Date	Streamflow, instantaneous (ft^3/s)	Temperature (°C)	pH (units)	Specific conductance (micromhos)	Dissolved solids, sum of constituents	Hardness as $CaCO_3$	Calcium	Magnesium	Sodium	Potassium	Bicarbonate	Sulfate	Chloride	Nitrite plus nitrate (as N)	Fluoride	Silica	Iron (µg/L)
Tanana River at Big Delta (Station No. 15478000)																	
49/07/01-10	29,310[1]	--	7.3	209	124	97	28	6.7	4.6	1.8	95	23	2.6	0.18*	0.3	9.1	--
49/08/01-10	50,890[1]	--	7.5	251	148	118	37	6.2	4.0	1.6	118	29	2.1	.13*	.2	9.7	--
49/09/01-10	32,170[1]	--	7.5	251	147	119	36	7.0	4.2	1.4	118	29	1.8	.07*	.2	9.1	--
49/10/01-10	13,720[1]	--	7.6	273	163	130	38	8.6	5.0	2.1	131	31	2.4	.11*	.2	11	--
49/11/01-10	6,680[1]	--	7.6	278	167	134	39	9.0	4.5	2.1	134	30	1.7	.22*	.1	14	--
49/12/01-10	4,670[1]	--	7.5	278	167	132	38	9.0	4.2	2.1	134	32	1.8	.18*	.2	13	--
51/01/01-10	5,910[1]	--	7.4	304	181	146	43	9.5	4.7**		153	31	1.6	.16	.0	15	--
51/02/01-10	4,630[1]	--	7.5	296	174	141	43	8.3	5.8**		148	28	2.2	.04*	.1	14	--
51/03/01-10	4,350[1]	--	7.5	270	155	126	39	7.0	5.0**		122	33	1.1	.29*	--	8.4	--
51/04/01-10	4,882[1]	--	7.9	286	163	133	41	7.5	4.9**		139	26	1.6	.16*	--	13	--
51/05/01-10	12,380[1]	--	6.8	244	145	112	33	7.2	6.4**		116	27	1.4	.22*	--	12	--
51/06/01-10	19,130[1]	--	7.5	249	144	113	33	7.5	5.7**		113	28	2.2	.20*	--	11	--
78/10/16	--	--	7.9	277	160	130	37	8.1	4.1	2.3	130	32	1.4	.21	.1	10	<10
79/06/20	--	13.0	7.4	218	131	97	28	6.5	5.1	1.7	98	29	2.7	.15	.1	8.8	170
Jarvis Creek near Delta Junction at Richardson Highway Bridge (64°01'25"N 145°43'25"W)																	
49/07/07	748	14.0	6.7	170	95	84	22	7.0	0.7**		69	27	.5	.16*	--	3.5	--
49/07/17	--	--	7.0	232	134	118	32	9.4	2.1**		107	32	1.2	.09*	--	4.3	--
51/07/03	--	--	7.5	247	138	119	32	9.5	2.1**		104	33	2.2	.13*	0.1	7.3	--

*Value calculated from dissolved nitrate value which was reported as NO_3.
**Sodium and potassium values combined.

[1] Streamflow, mean (ft^3/s)

Table 2.--Selected water-quality data for surface-water sites in the Delta-Clearwater area. All analyses were for dissolved constituents and are reported in milligrams per liter except where noted--Continued.

Date	Streamflow, instantaneous (ft^3/s)	Temperature (°C)	pH (units)	Specific conductance (micromhos)	Dissolved solids, sum of constituents	Hardness as $CaCO_3$	Calcium	Magnesium	Sodium	Potassium	Bicarbonate	Sulfate	Chloride	Nitrite plus nitrate (as N)	Fluoride	Silica	Iron (µg/L)
Jarvis Creek near Delta Junction at Richardson Highway Bridge (64°01'25"N 145°43'25"W)--Continued																	
53/07/29	--	15.5	7.4	228	131	111	29	9.3	1.3	1.8	87	43	0.2	0.09*	0.1	3.2	--
54/09/27	--	.0	7.4	318	182	155	39	14	2.3	.5	112	66	.4	.11*	.0	3.9	--
55/09/20	--	--	7.7	312	172	151	39	13	2.4	1.2	114	55	.2	.07*	.0	5.2	--
56/08/02	--	--	7.5	227	135	113	29	10	3.1	2.2	96	39	.0	.09*	.3	3.4	--
75/06/25	551	8.0	8.2	204	109	95	26	7.2	2.6	1.1	83	27	1.0	.07	.1	2.7	30
78/10/16	--	--	8.2	362	217	180	46	17	3.5	1.5	150	69	.6	.23	.1	4.9	<10
79/06/20	--	11.0	7.8	182	101	84	21	7.6	1.5	.9	70	30	1.5	.09	.1	3.3	100
Gerstle River near Big Delta at Alaska Highway Bridge (Station No. 15476700)																	
49/07/21	--	11.5	7.1	272	160	138	41	8.5	2.5**		115	45	1.0	.20*	--	4.1	--
51/06/21	--	--	7.7	280	157	125	36	8.5	5.1**		92	54	2.2	.18*	.2	5.3	--
52/08/26	--	5.5	7.5	248	151	125	34	9.8	1.9	1.7	85	57	1.0	.11*	.2	3.6	--
53/05/13	--	2.0	7.2	244	147	119	36	7.0	2.4	1.7	82	55	1.0	.11*	.2	3.1	--
53/07/29	--	10.5	7.4	214	119	97	28	6.5	1.3	3.0	78	37	.0	.04*	.9	3.8	--
54/09/18	--	--	7.4	304	179	148	41	11	2.9	2.2	93	70	.5	.11*	.3	4.7	--
55/05/17	--	--	6.8	199	113	92	27	5.9	1.4	1.7	66	38	.8	.11*	.4	4.7	--
55/09/20	--	--	7.6	340	205	167	47	12	3.7	2.7	117	74	1.2	.11*	.4	5.6	--
56/05/11	--	--	7.5	171	103	83	25	5.0	1.3	2.0	59	38	.5	.00	--	2.4	--
56/06/15	--	--	7.8	196	114	90	26	6.1	3.1	1.8	71	34	2.8	.22*	.4	3.7	--

*Value calculated from dissolved nitrate value which was reported as NO_3.
**Sodium and potassium values combined.

Table 2.--Selected water-quality data for surface-water sites in the Delta-Clearwater area. All analyses were for dissolved constituents and are reported in milligrams per liter except where noted--Continued.

Date	Streamflow, instantaneous (ft^3/s)	Temperature (°C)	pH (units)	Specific conductance (micromhos)	Dissolved solids, sum of constituents	Hardness as $CaCO_3$	Calcium	Magnesium	Sodium	Potassium	Bicarbonate	Sulfate	Chloride	Nitrite plus nitrate (as N)	Fluoride	Silica	Iron (µg/L)
Gerstle River near Big Delta at Alaska Highway Bridge (Station No. 15476700)--Continued																	
56/08/03	--	13.0	7.6	235	141	109	30	8.4	2.1	2.0	86	49	0.8	0.07*	0.3	6.2	--
56/09/01	--	8.0	6.8	247	148	122	35	8.5	2.3	2.1	81	54	.8	.09*	.2	5.1	--
57/09/18	--	--	7.7	291	173	141	35	13	2.1	2.0	92	71	1.5	.07*	.1	3.0	--
58/05/06	--	.0	7.7	243	167	140	38	11	2.4	2.0	98	60	.5	.13*	.6	3.6	--
58/06/04	--	11.0	7.3	213	122	101	30	6.3	1.8	2.2	80	36	1.5	.07*	.6	3.9	--
58/06/24	--	8.5	7.5	226	132	108	30	8.2	2.0	2.2	79	45	1.5	.02*	.6	3.1	--
58/08/27	--	9.0	7.7	265	154	128	33	11	2.1	1.8	82	62	1.0	.02*	.4	2.7	--
78/10/15	--	--	8.0	335	214	180	52	11	3.7	2.3	120	78	1.8	.54	.6	3.5	<10
79/06/20	--	10.0	7.8	205	114	93	26	6.8	1.7	1.5	72	39	.9	.04	.3	2.2	30

*Value calculated from dissolved nitrate value which was reported as NO_3.

sites during this study are shown on a trilinear diagram (fig. 12). Samples from the Gerstle River, Delta River, Jarvis Creek, and Clearwater Lake had higher percentages of sulfate than the Clearwater Creek and Tanana River samples. Plotted values for Clearwater Lake, Jarvis Creek, and the Delta River are in close proximity, indicating similar water quality. The plots for Clearwater Creek, the Tanana River at Big Delta, and the Tanana River 18 mi above the Gerstle River also lie proximate.

The similarities of surface-water quality in the discharge and recharge areas of the alluvial aquifer seem compatible with the hypothesized hydrologic flow system. For example, the similarity of water quality in Clearwater Lake, the Delta River, and Jarvis Creek supports the hypothesis that the section of the aquifer discharging at Clearwater Lake is recharged by channel losses from the Delta River and Jarvis Creek. However, this apparent compatibility may also be a result of the influence on water quality by the sediment with which the water comes in contact. Thus, the chemical quality of water in Clearwater Lake, Jarvis Creek, and the Delta River may be similar because the materials near the lake were derived from the Delta River-Jarvis Creek drainage areas.

Ground Water

Ground-water quality was not intensively analyzed during this study, largely because of a lack of wells near the agricultural development area. Some water-quality data are available for wells along the Richardson Highway, at Fort Greely, and for the well at the Gerstle River Army Test Site. Predominant ions in the ground water are calcium and bicarbonate, and all samples plot within a small area on a trilinear diagram (fig. 13). Concentrations of constituents were similar in all wells tested with the exception of the well at the Gerstle River Army Test Site in which the concentrations were higher (table 3). However, the variation in percentages of milliequivalents per liter among all the ground-water samples is even less than the variation in the surface-water samples. Analyses of water from the well at the Gerstle River Army Test Site and from three other wells in the vicinity of Delta Junction and Fort Greely are shown in table 3. Temperatures of the ground water in the area are generally between 2° and 5°C. The higher temperatures shown for two of the samples (7.2° and 9.0°C) indicate that those samples may not be representative of the fresh ground water and, therefore, that other chemical constituents in the analyses may not accurately portray the ground-water quality. However, the analyses shown are representative of the historical data that exist for the wells in the Delta-Clearwater area.

CONCLUSIONS

Hydrologic observations and data analysis indicate that the sections of the aquifer that discharge at Clearwater Lake and near Big Delta are recharged largely by seepage losses from the Delta River and Jarvis Creek. Similarly, it appears that the sections of the aquifer that discharge at the Clearwater Creek network receive recharge from the Tanana River along the eastern boundary of the study area, the Gerstle River, and several small creeks draining the north face of the Alaska Range. Additional data are needed to improve confidence that this conceptual hydrologic flow model is correct. Specifically, ground-water level data are needed, especially in the eastern and central parts of the study area. Additional measurements of aquifer recharge and discharge are also needed.

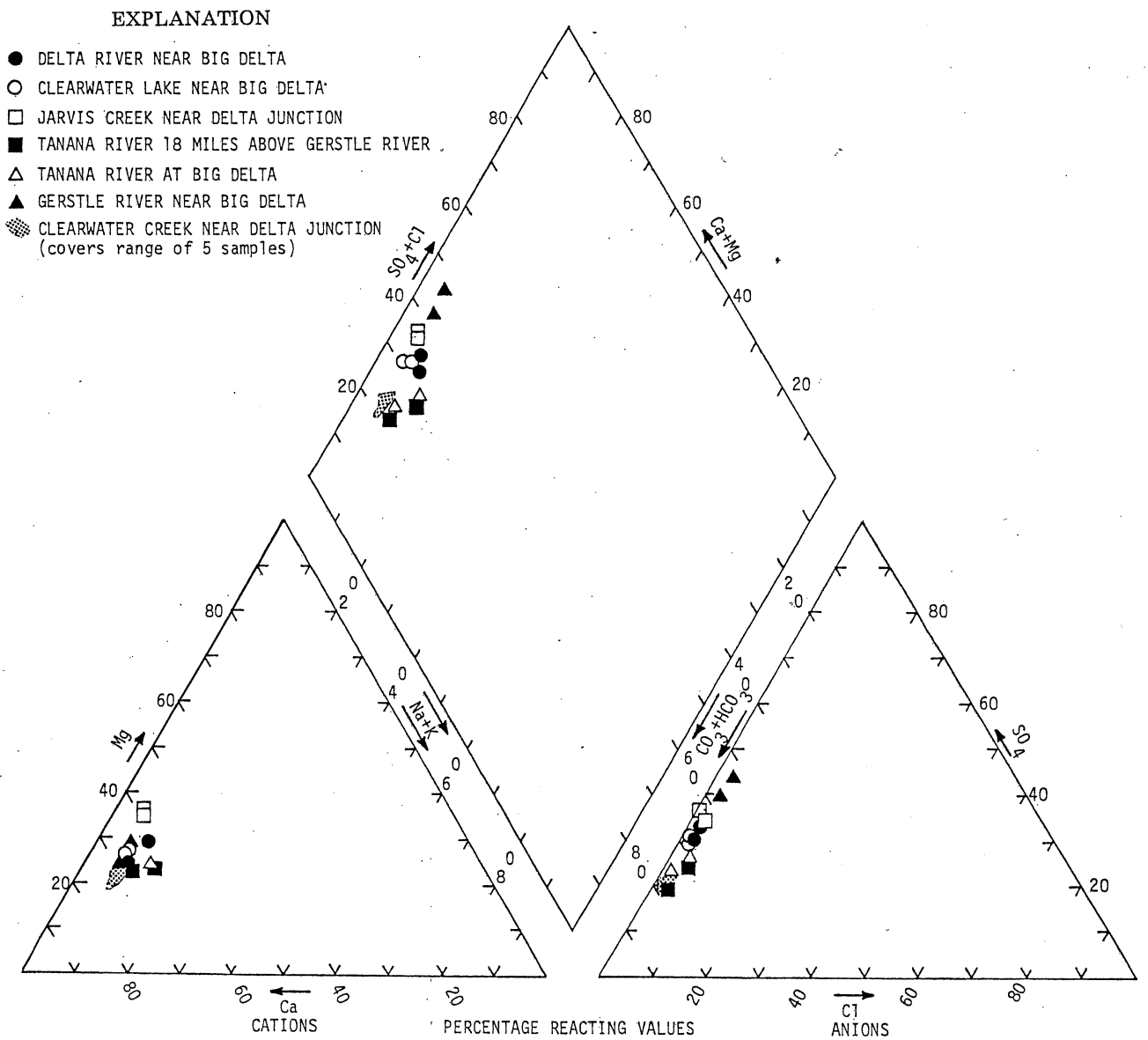

Figure 12.--Trilinear diagram of surface-water quality analyses in the Delta-Clearwater area.

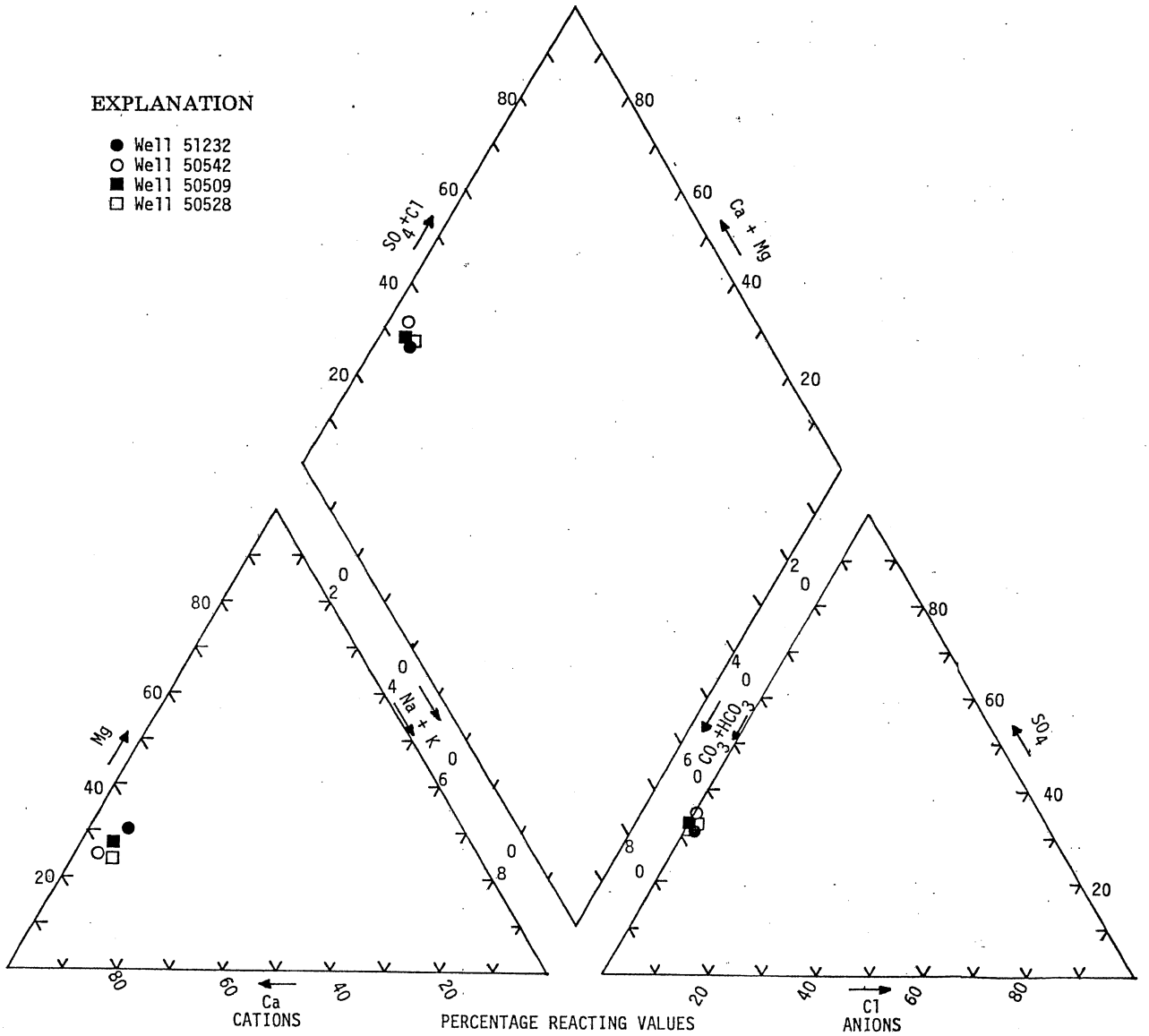

Figure 13.--Trilinear diagram of ground-water quality analyses in the Delta-Clearwater area.

Table 3.--Water-quality data from ground-water sites in the Delta-Clearwater area. All analyses were for dissolved constituents and are reported in milligrams per liter, except where noted.

	Well 51232 Gerstle River Army Test Site	Well 50542 Delta Junction School	Well 50509 Bay Hotel	Well 50528 Fort Greely No. 1
	April 3, 1969	June 18, 1968	June 18, 1968	September 16, 1970
Specific conductance (micromhos per centimeter at 25°C)	559	231	236	260
pH (units)	8.3	7.8	7.9	8.2
Water temperature (°C)	7.2	Missing	9.0	4.0
Hardness (total)	290	110	110	130
Hardness (noncarbonate)	88	25	31	38
Calcium	78	32	32	38
Magnesium	23	7.1	8.0	8.2
Sodium	8.3	1.8	2.7	2.6
Potassium	3.0	2.7	2.5	3.6
Bicarbonate	246	102	100	110
Sulfate	92	36	38	42
Chloride	3.5	0.4	0.8	1.5
Fluoride	0.8	0.0	0.2	0.2
Silica	6.7	7.9	8.2	6.1
Residue (calculated)	340	138	142	156
Nitrate as N	3.9	0.1	0.6	0.1
Iron	0.0	0.18	0.20	0.02

Without the benefits of several aquifer tests that are needed within the study area, the potential drawdown that will be caused by ground-water withdrawal for irrigation is largely unknown. Thus the potential effect of irrigation on the Clearwater Creek network cannot be assessed.

Water quality in the aquifer and in Clearwater Creek may be affected by agricultural development. Ground water passing beneath the agricultural area flows toward the Clearwater Creek network. Agricultural chemicals that infiltrate to the aquifer may be transported through the aquifer to springs feeding the creeks. Additionally, overland flow from cultivated areas may cause changes in the physical and chemical quality of the spring-fed creeks. Sediment, dissolved solids, nutrients, biota, and temperature may be affected.

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Table A.--U.S. Geological Survey downstream order numbers for sites in the Delta-Clearwater area

Station name	Station number	Latitude and Longitude	
Gerstle River near Big Delta	15476700	63°49'00"	144°55'00"
Clearwater Creek near Delta Junction	15477500	64°03'22"	145°26'16"
Tanana River at Big Delta	15478000	64°09'20"	145°51'00"