

APPENDIX A. DISTRIBUTIONS OF 17 CONSTITUENTS IN SAMPLES FROM 21 SITES

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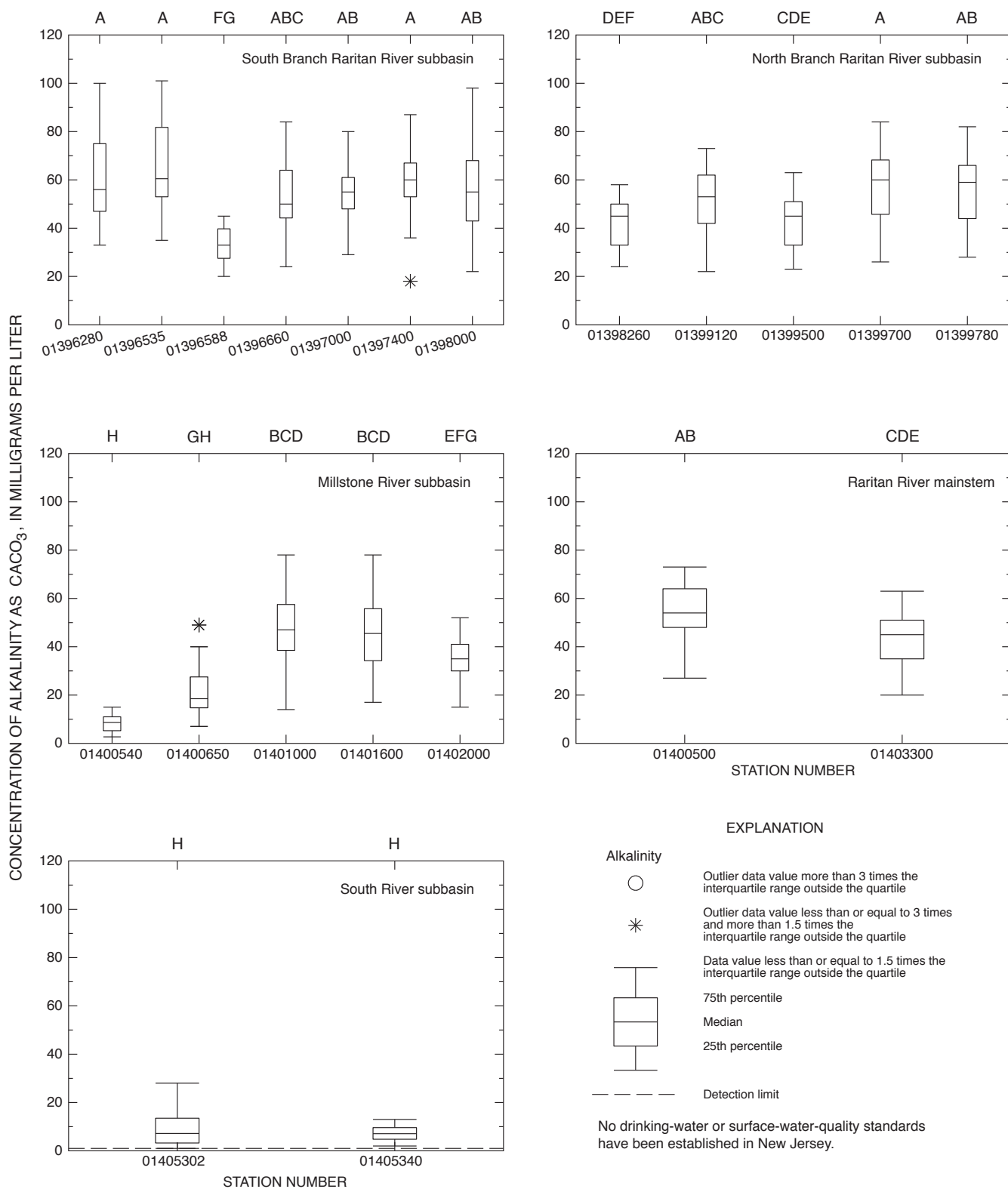


Figure A-1. Distribution of concentrations of alkalinity as CaCO_3 in samples collected at 21 surface-water sampling sites in the Raritan River Basin, N.J., 1991-97.

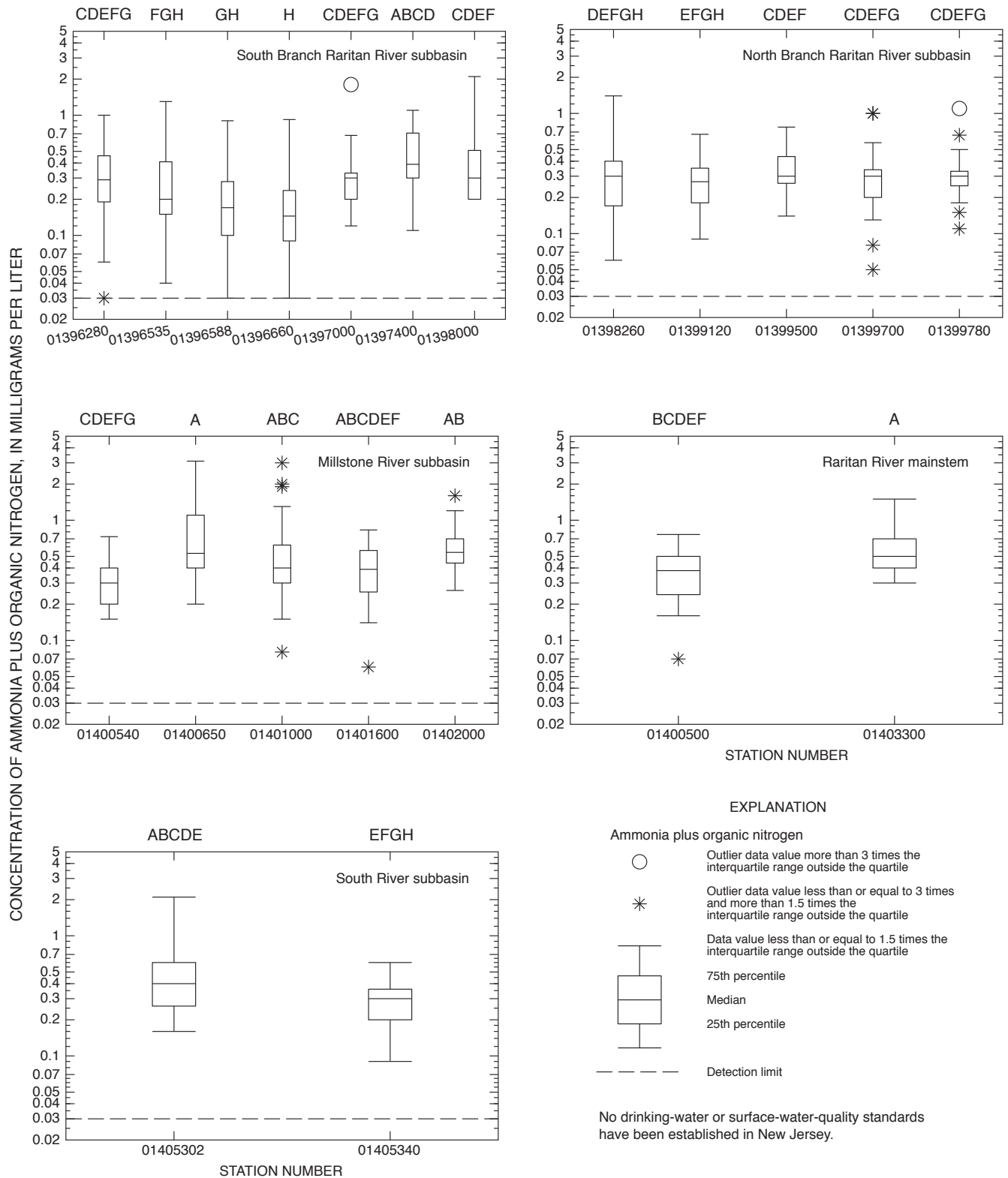


Figure A-2. Distribution of concentrations of ammonia plus organic nitrogen in samples collected at 21 surface-water sampling sites in the Raritan River Basin, N.J.

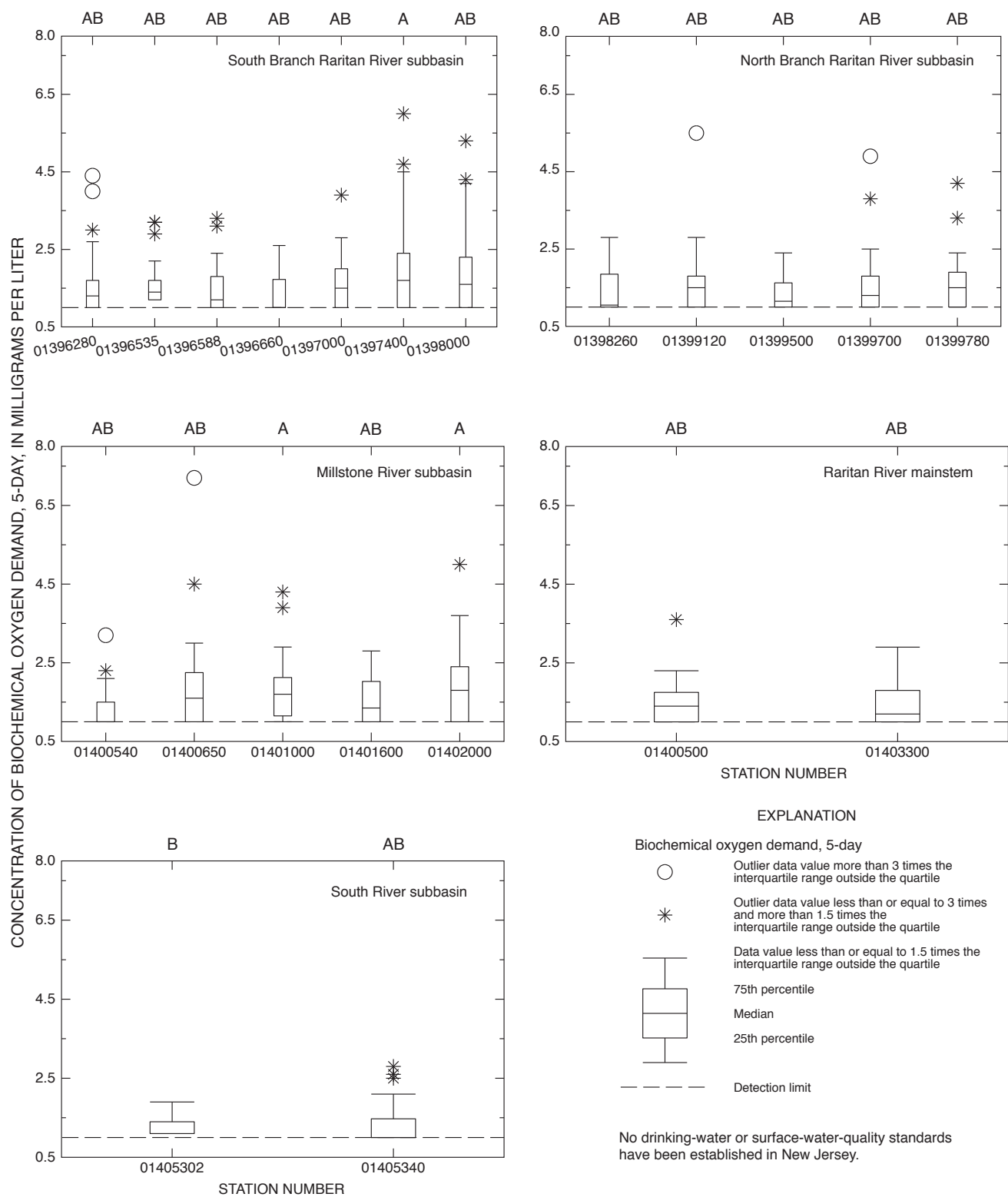


Figure A-3. Distribution of concentrations of biochemical-oxygen demand in samples collected at 21 surface-water sampling sites in the Raritan River Basin, N.J., 1991-97.

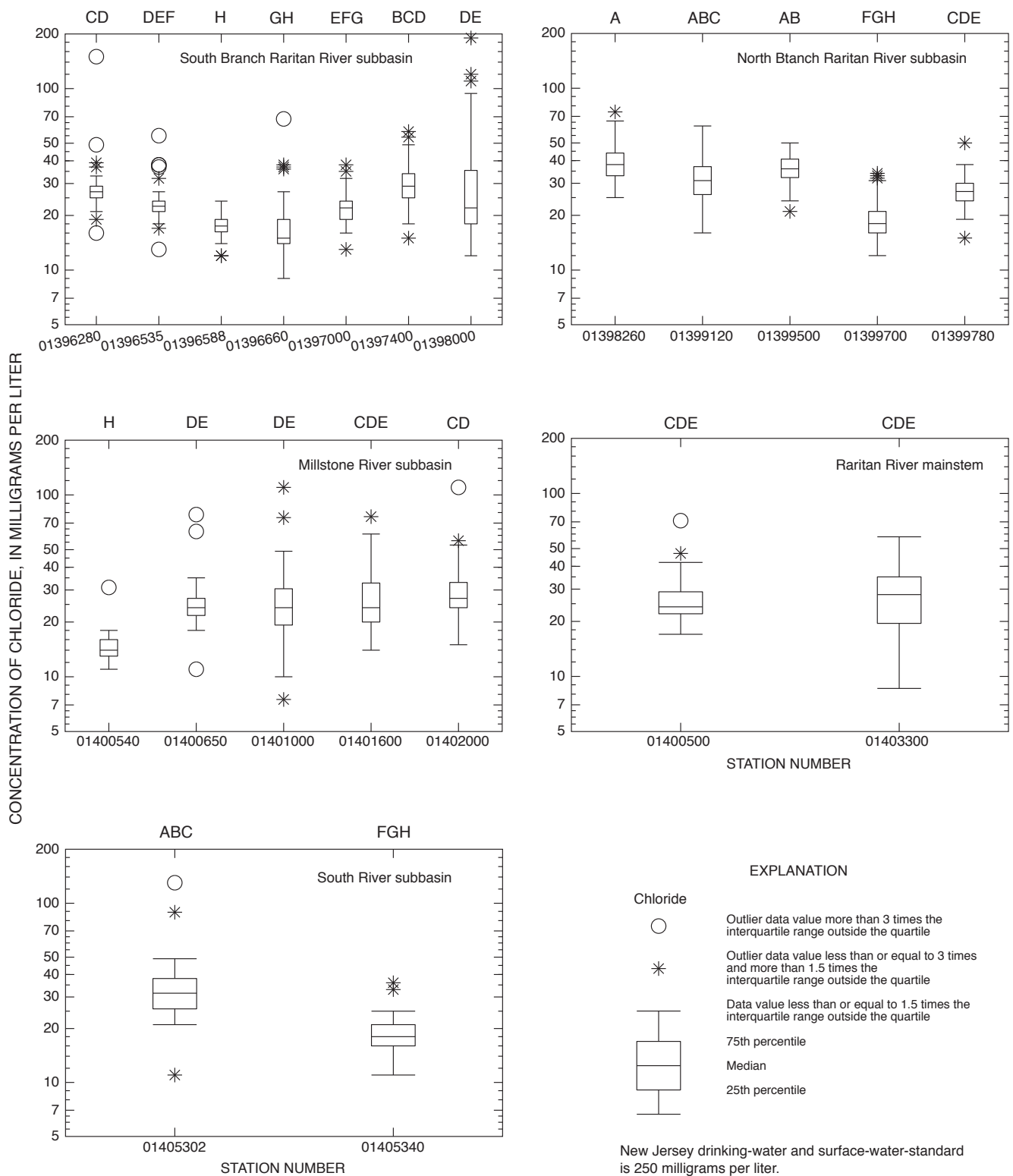


Figure A-4. Distribution of concentrations of chloride in samples collected at 21 surface-water sampling sites in the Raritan River Basin, N.J., 1991-97.

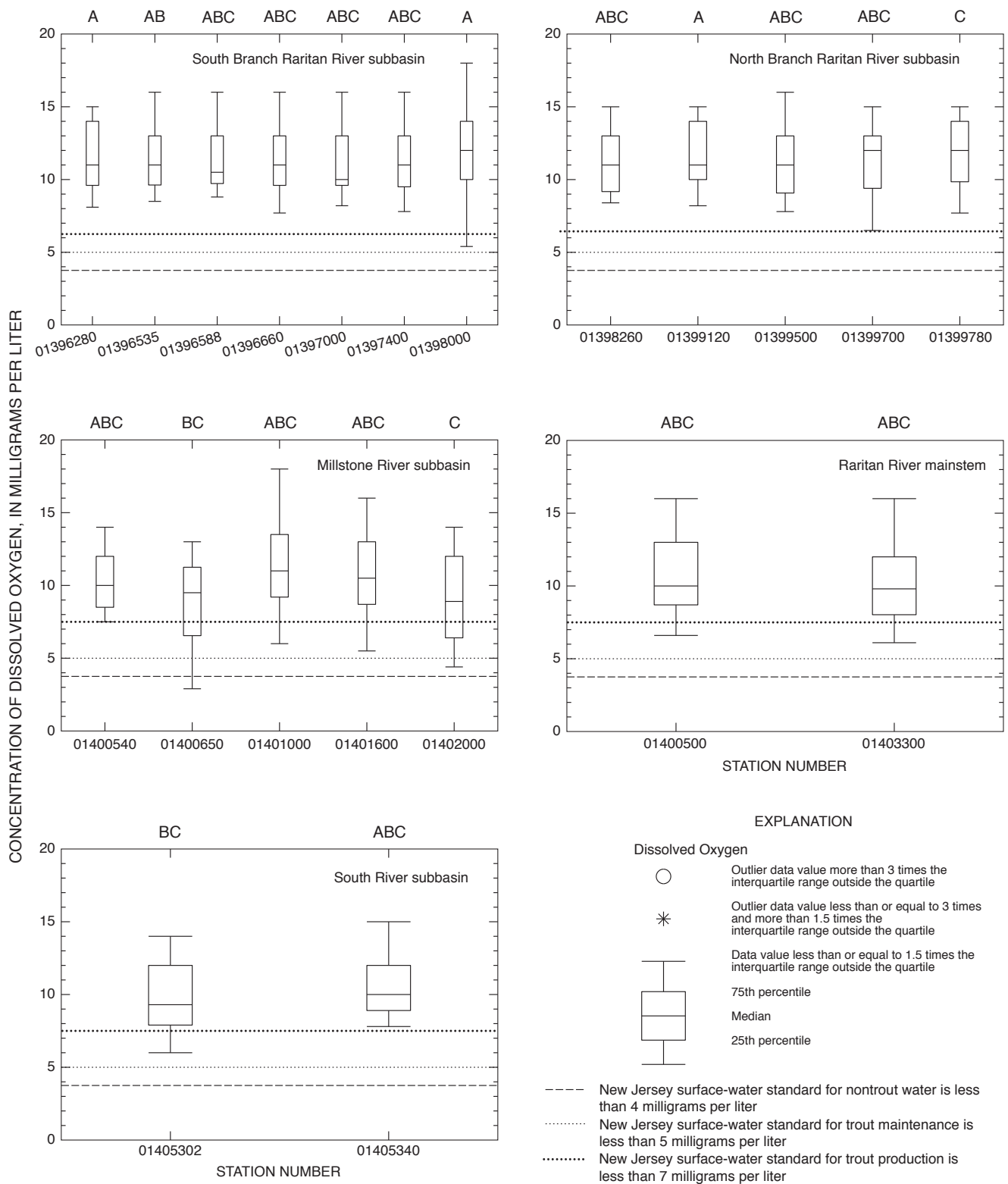


Figure A-5. Distribution of concentrations of dissolved oxygen in samples collected at 21 surface-water sampling sites in the Raritan River Basin, N.J., 1991-97.

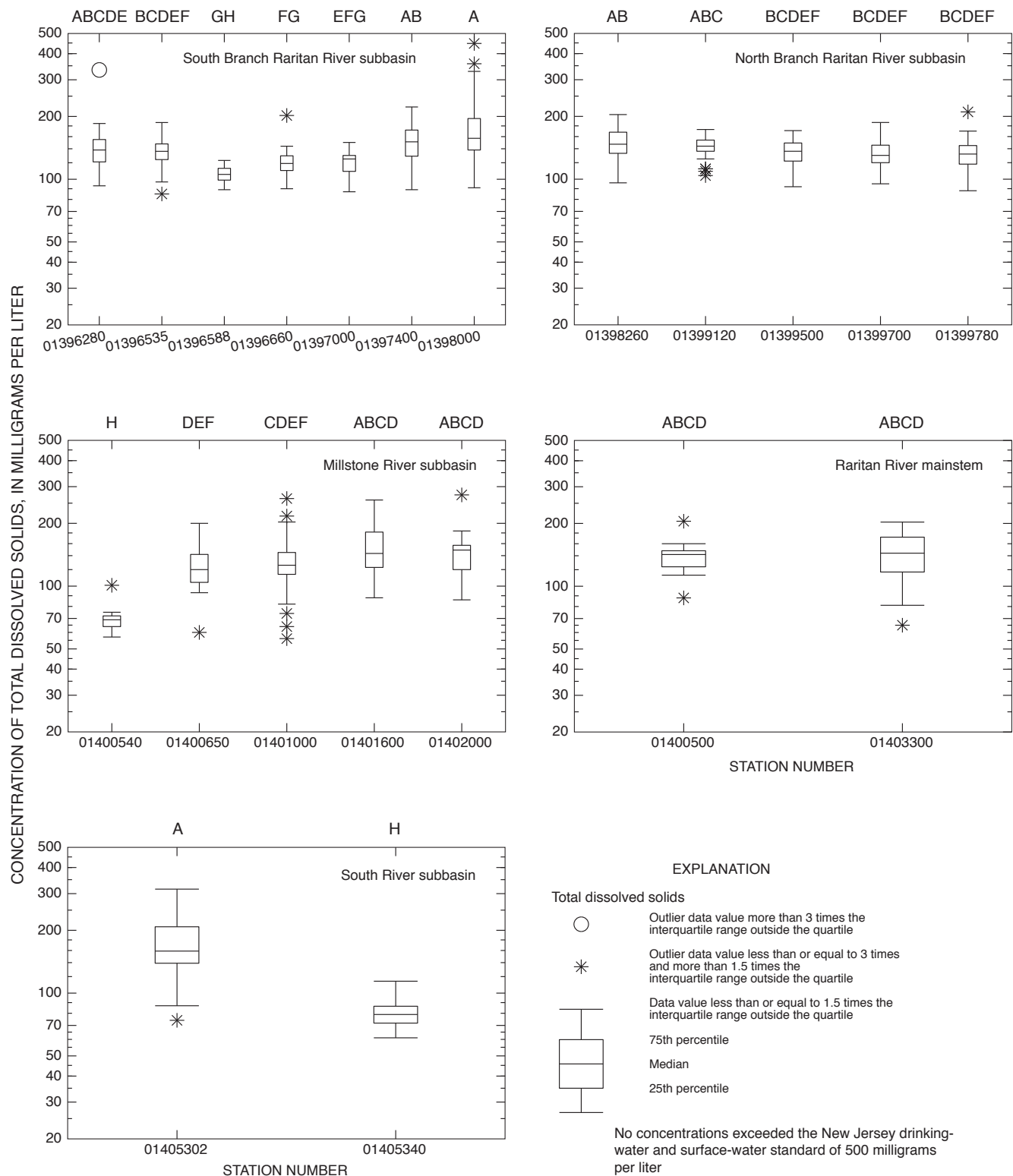


Figure A-6. Distribution of concentrations of dissolved solids in samples collected at 21 surface-water sampling sites in the Raritan River Basin, N.J., 1991-97.

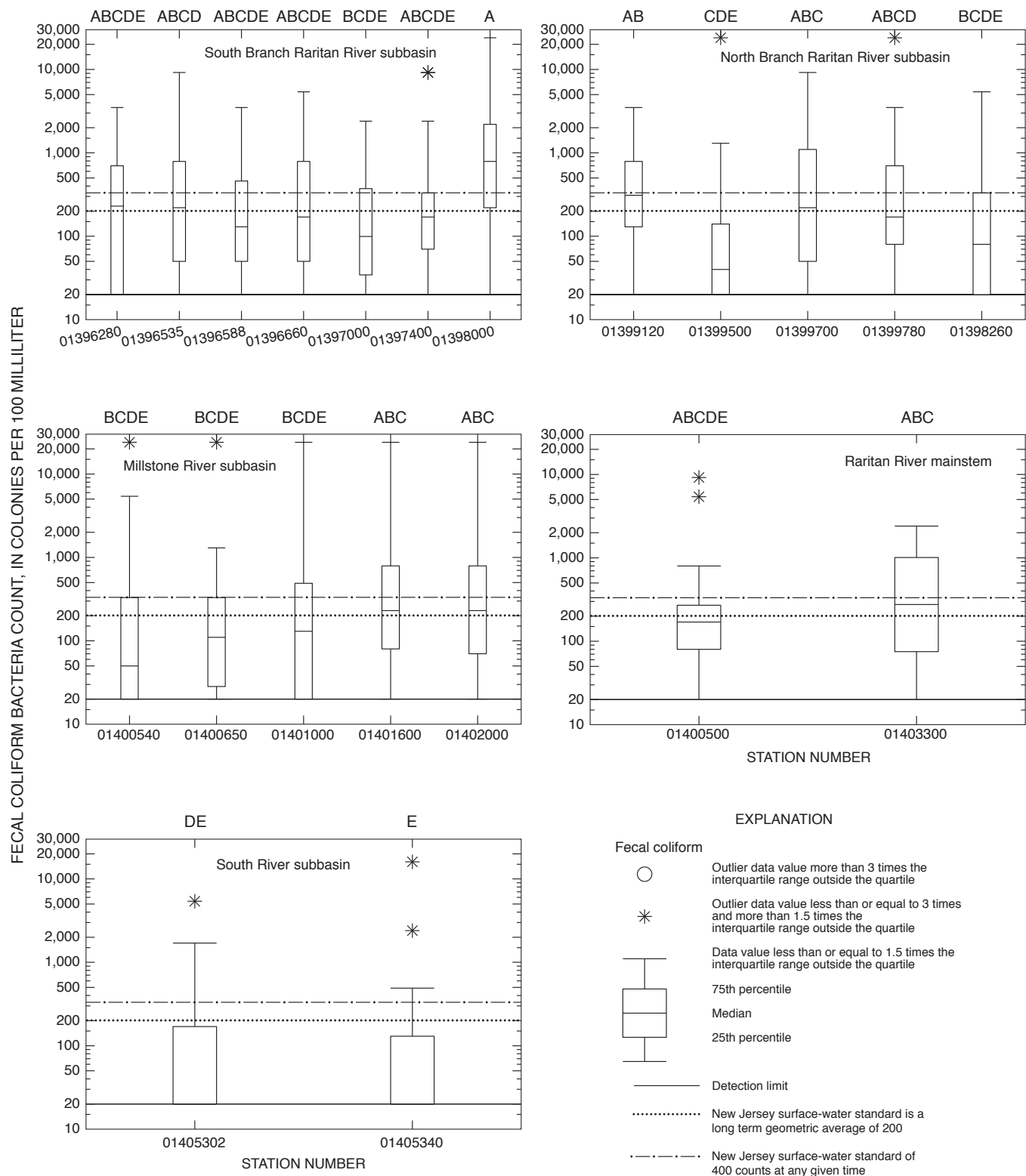


Figure A-7. Distribution of fecal coliform bacteria counts in samples collected at 21 surface-water sampling sites in the Raritan River Basin, N.J., 1991-97.

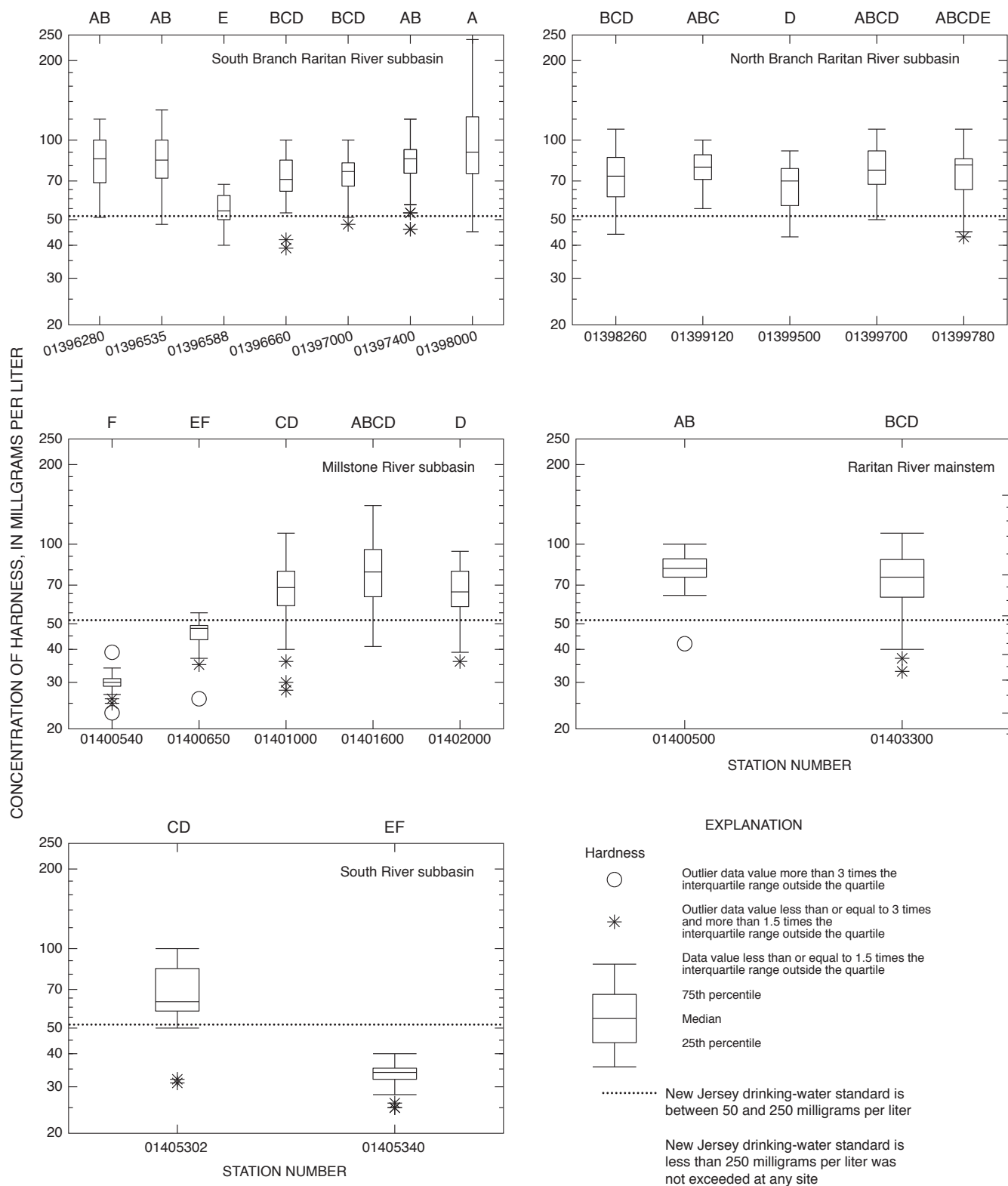


Figure A-8. Distribution of hardness concentrations in samples collected at 21 surface-water sampling sites in the Raritan River Basin, N.J., 1991-97. [Significant differences in mean rank concentrations between sites from Tukey's test are from A, the highest, to F, the lowest]

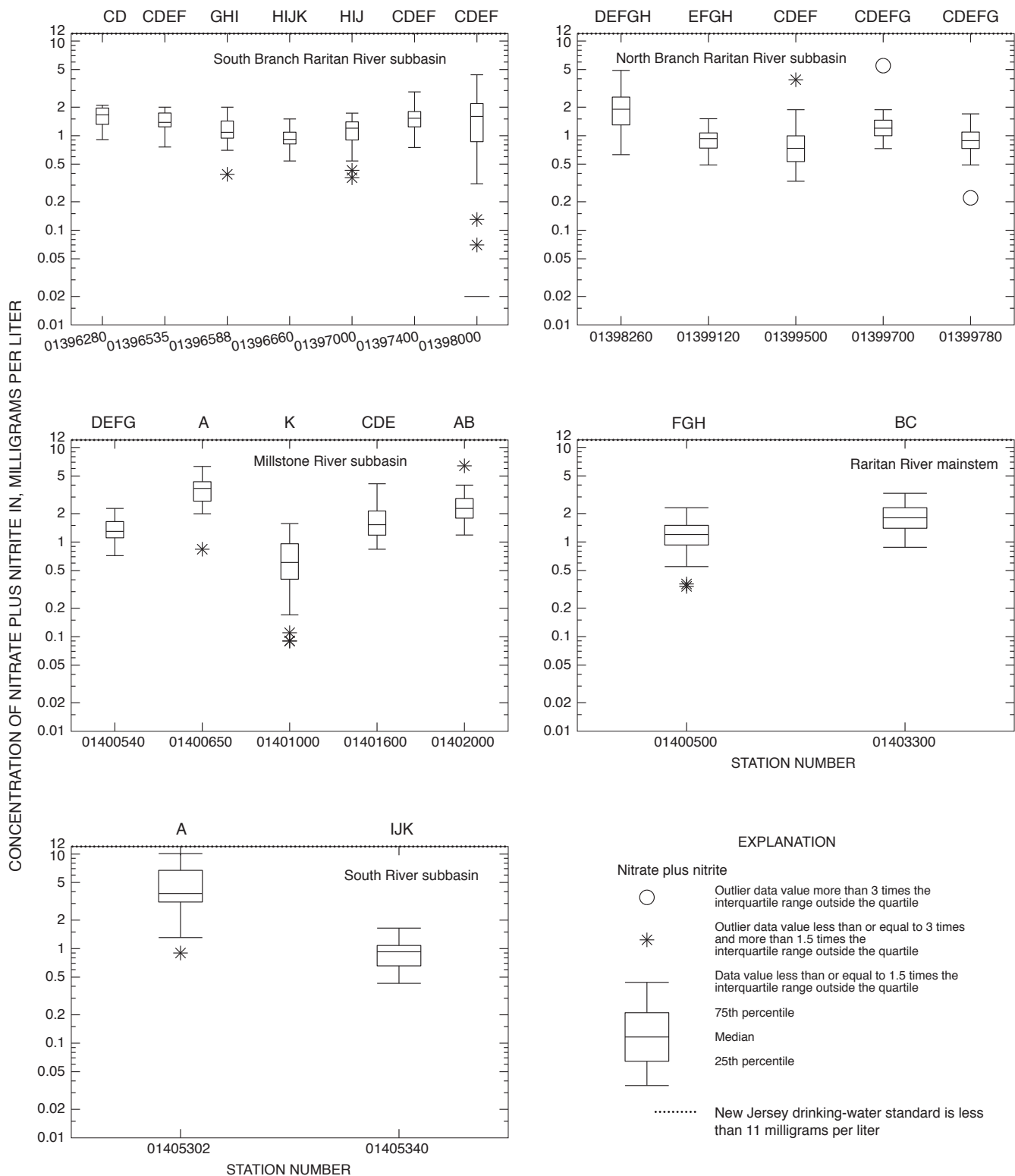


Figure A-9. Distribution of nitrate plus nitrite concentrations in samples collected at 21 surface-water sampling sites in the Raritan River Basin, N.J., 1991-97. [Significant differences in mean rank concentrations between sites from Tukey's test are from A, the highest, to K, the lowest]

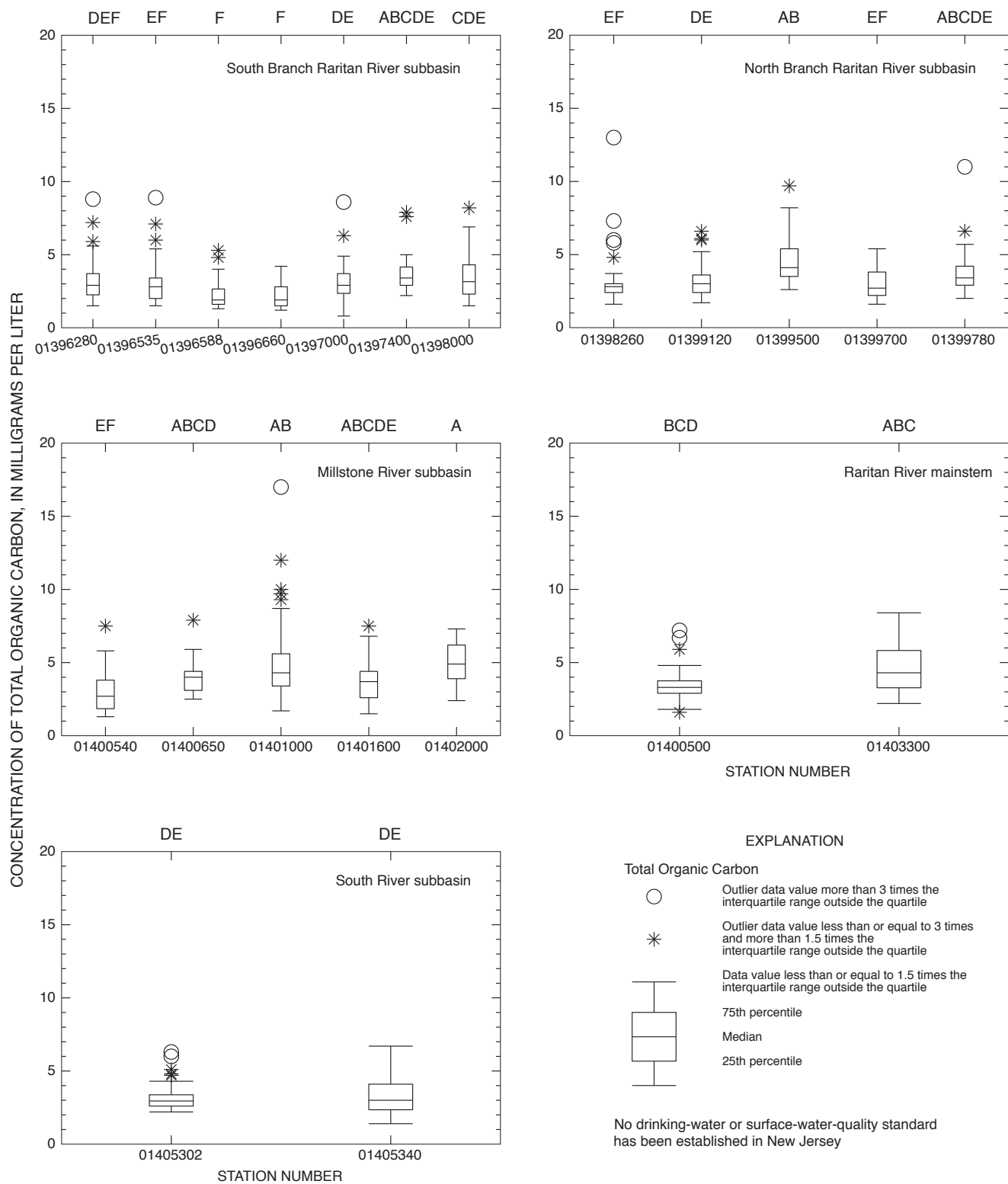


Figure A-10. Distribution of total organic carbon concentrations in samples collected at 21 surface-water sampling sites in the Raritan River Basin, N.J., 1991-97.

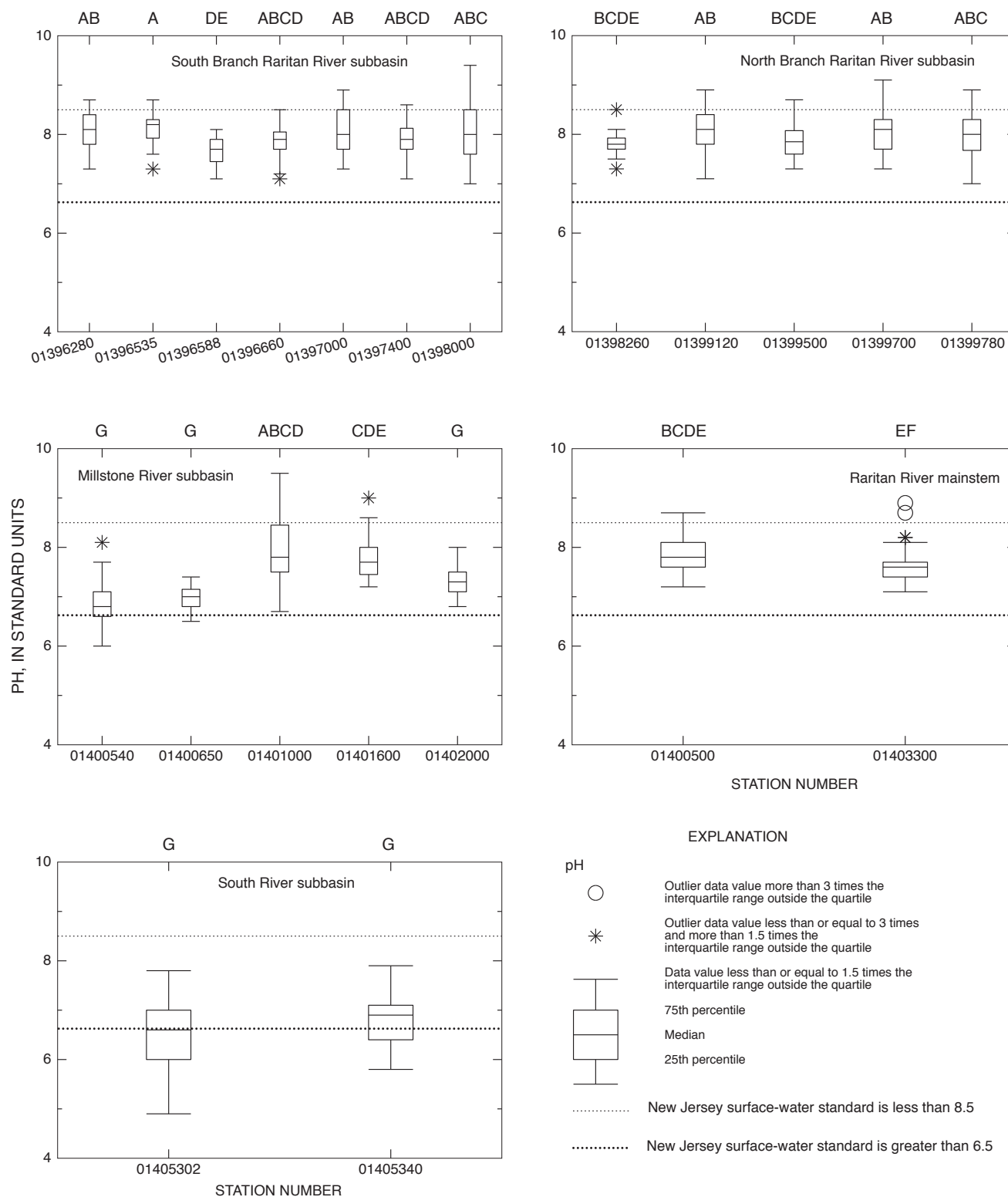


Figure A-11. Distribution of pH measurements in standard units in samples collected at 21 surface-water sampling sites in the Raritan River Basin, N.J., 1991-97.

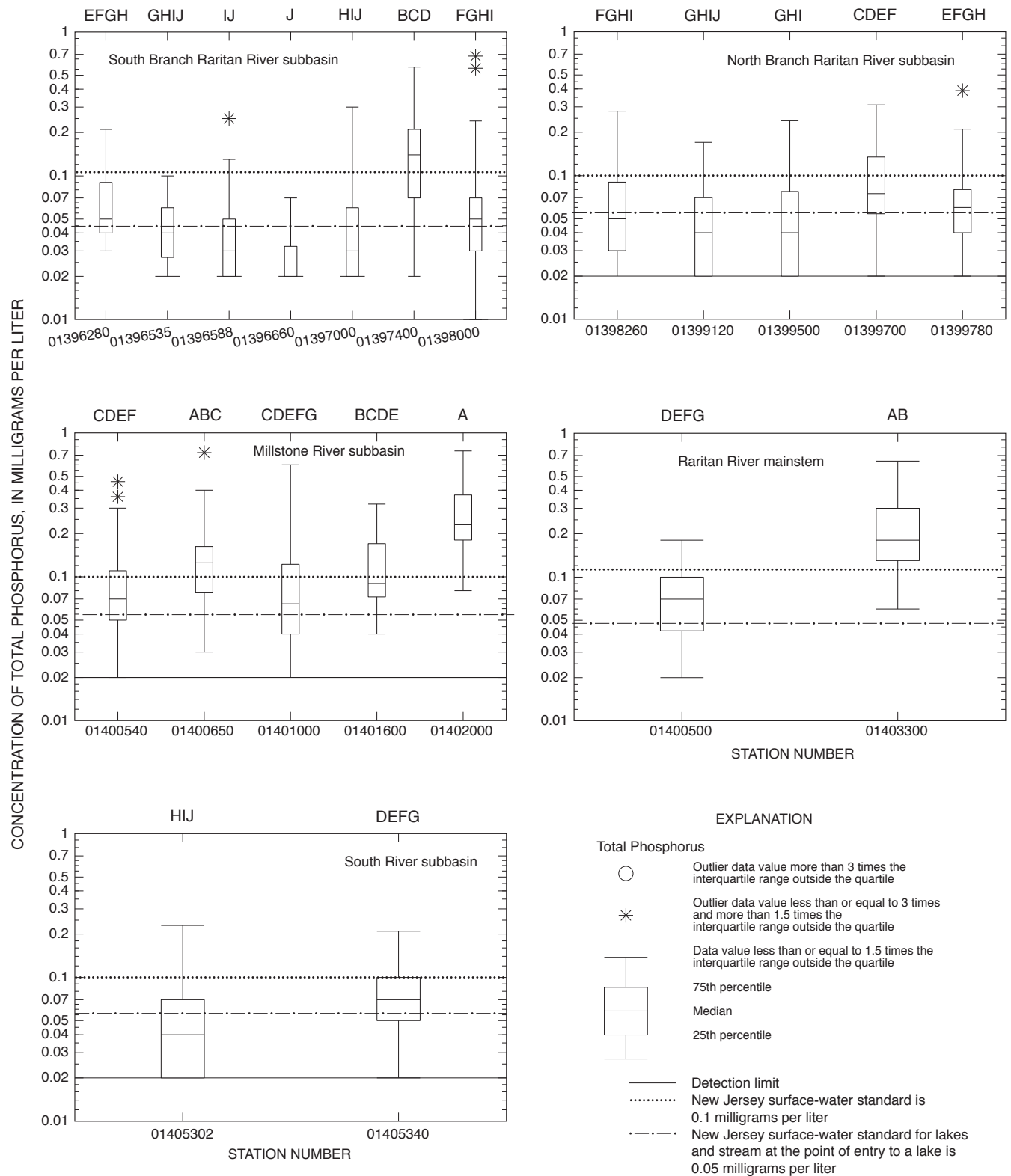


Figure A-12. Distribution of total phosphorus concentrations in samples collected at 21 surface-water sampling sites in the Raritan River Basin, N.J., 1991-97.

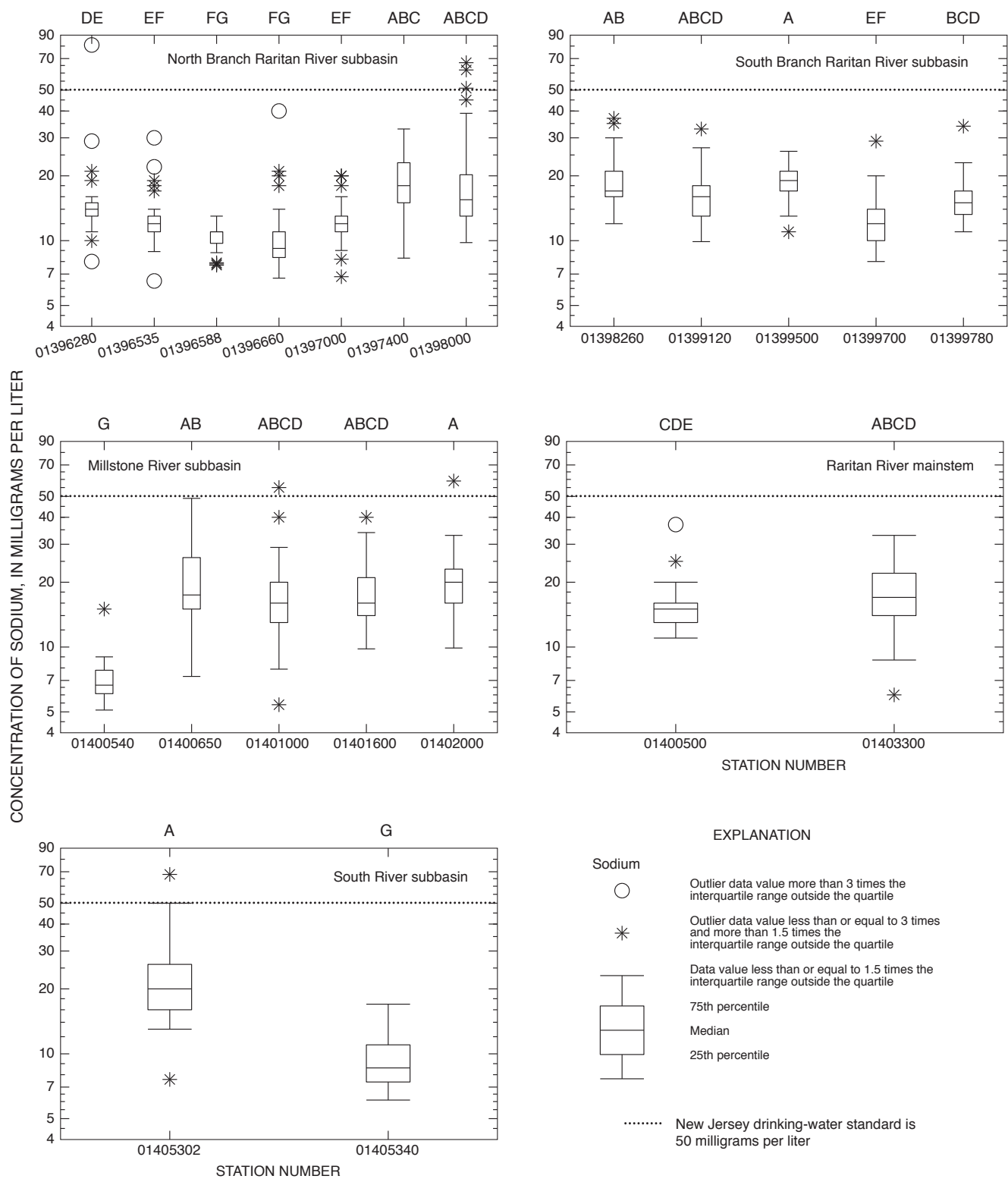


Figure A-13. Distribution of sodium concentrations in samples collected at 21 surface-water sampling sites in the Raritan River Basin, N.J., 1991-97.

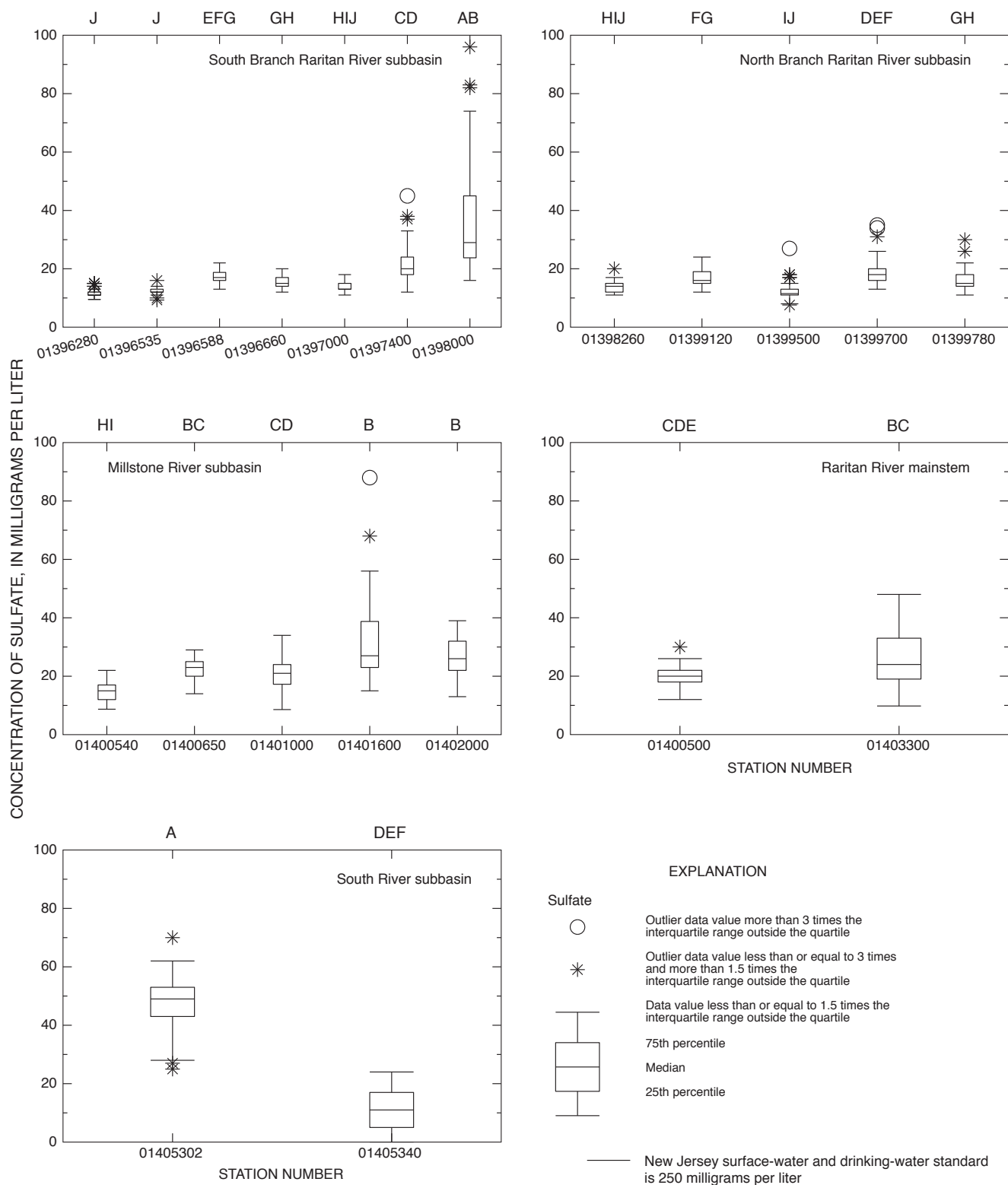


Figure A-14. Distribution of sulfate concentrations in samples collected at 21 surface-water sampling sites in the Raritan River Basin, N.J., 1991-97.

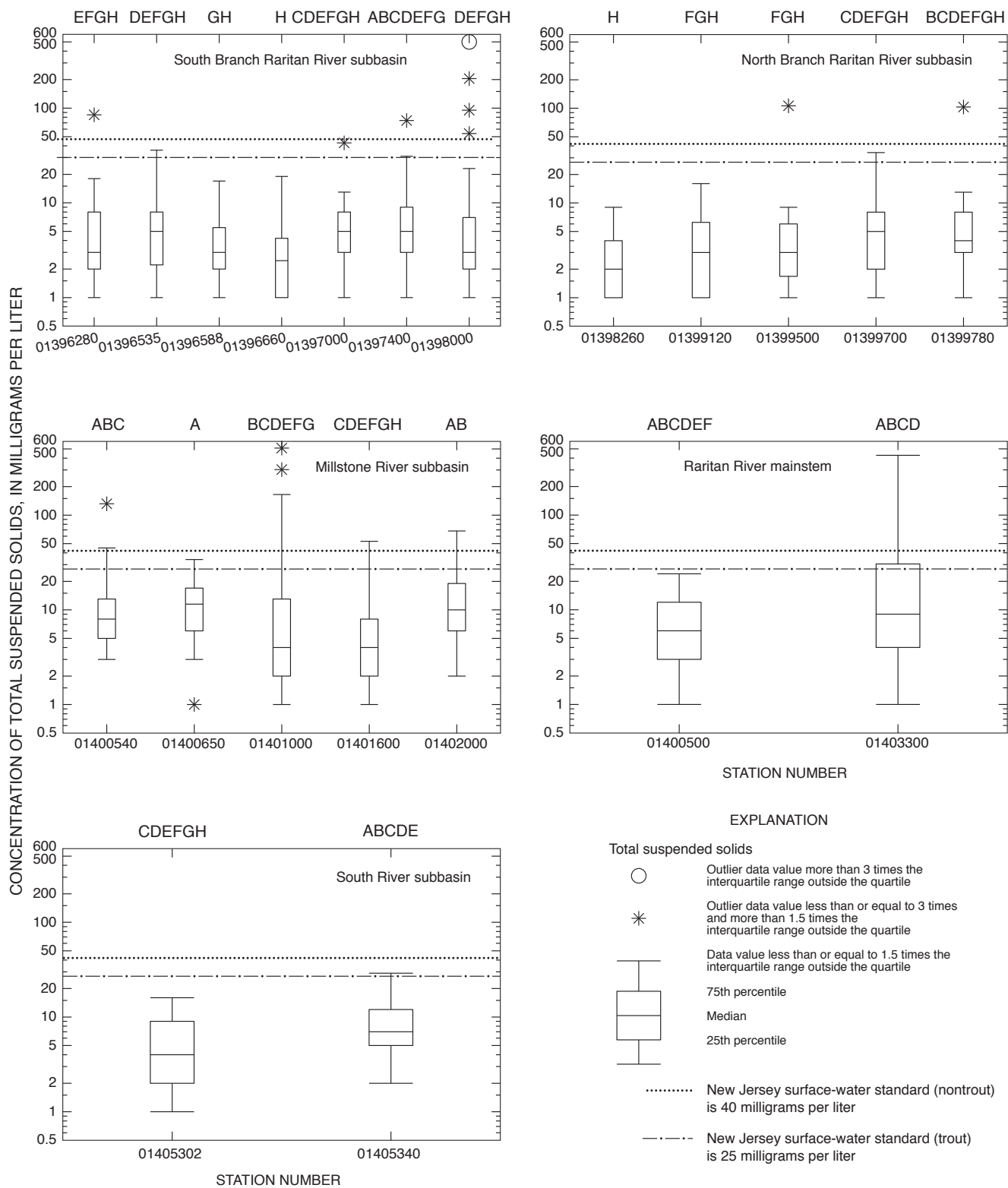


Figure A-15. Distribution of total suspended solids concentrations in samples collected at 21 surface-water sampling sites in the Raritan River Basin, N.J., 1991-97.

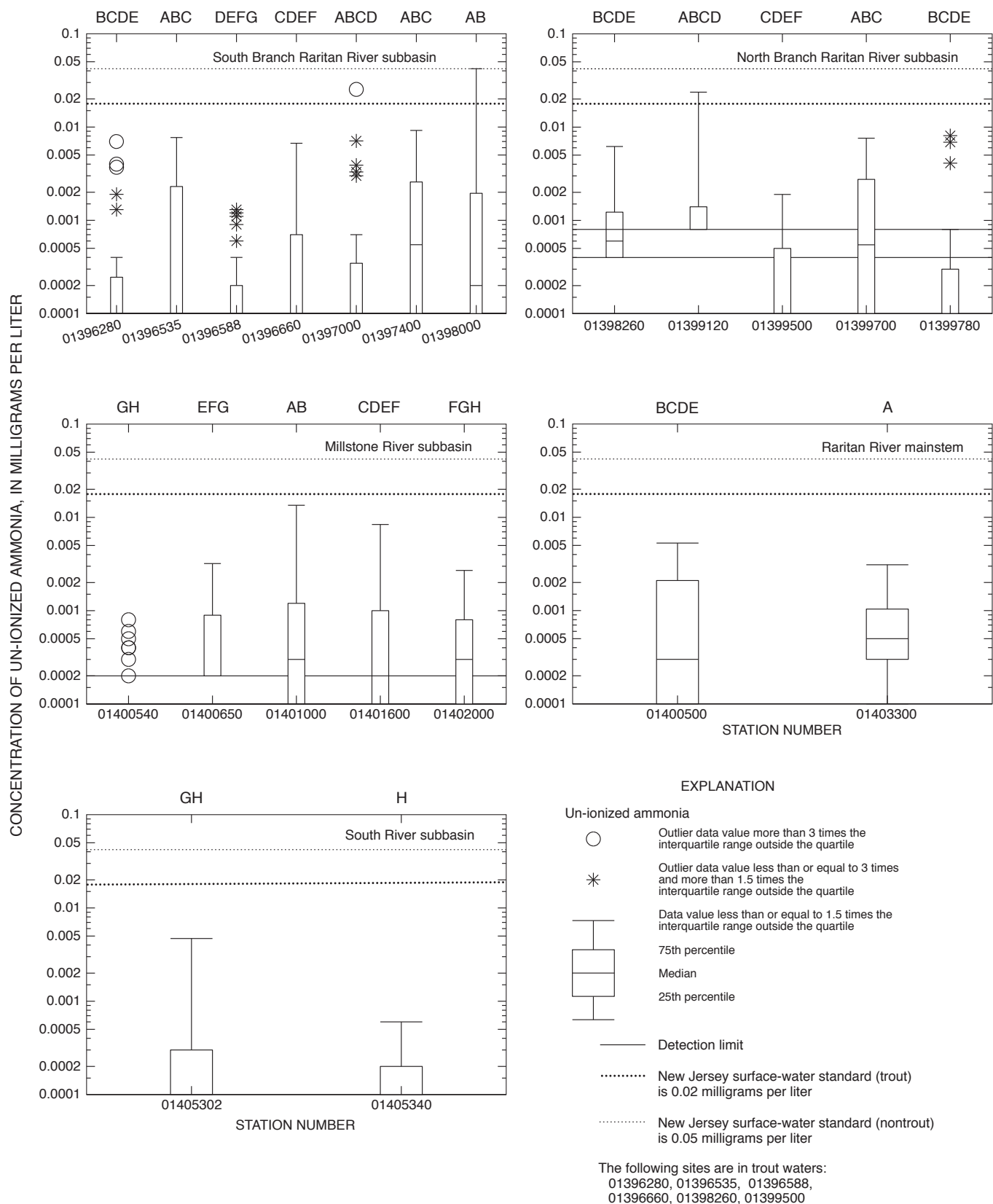


Figure A-16. Distribution of un-ionized ammonia concentrations in samples collected at 21 surface-water sampling sites in the Raritan River Basin, N.J., 1991-97.

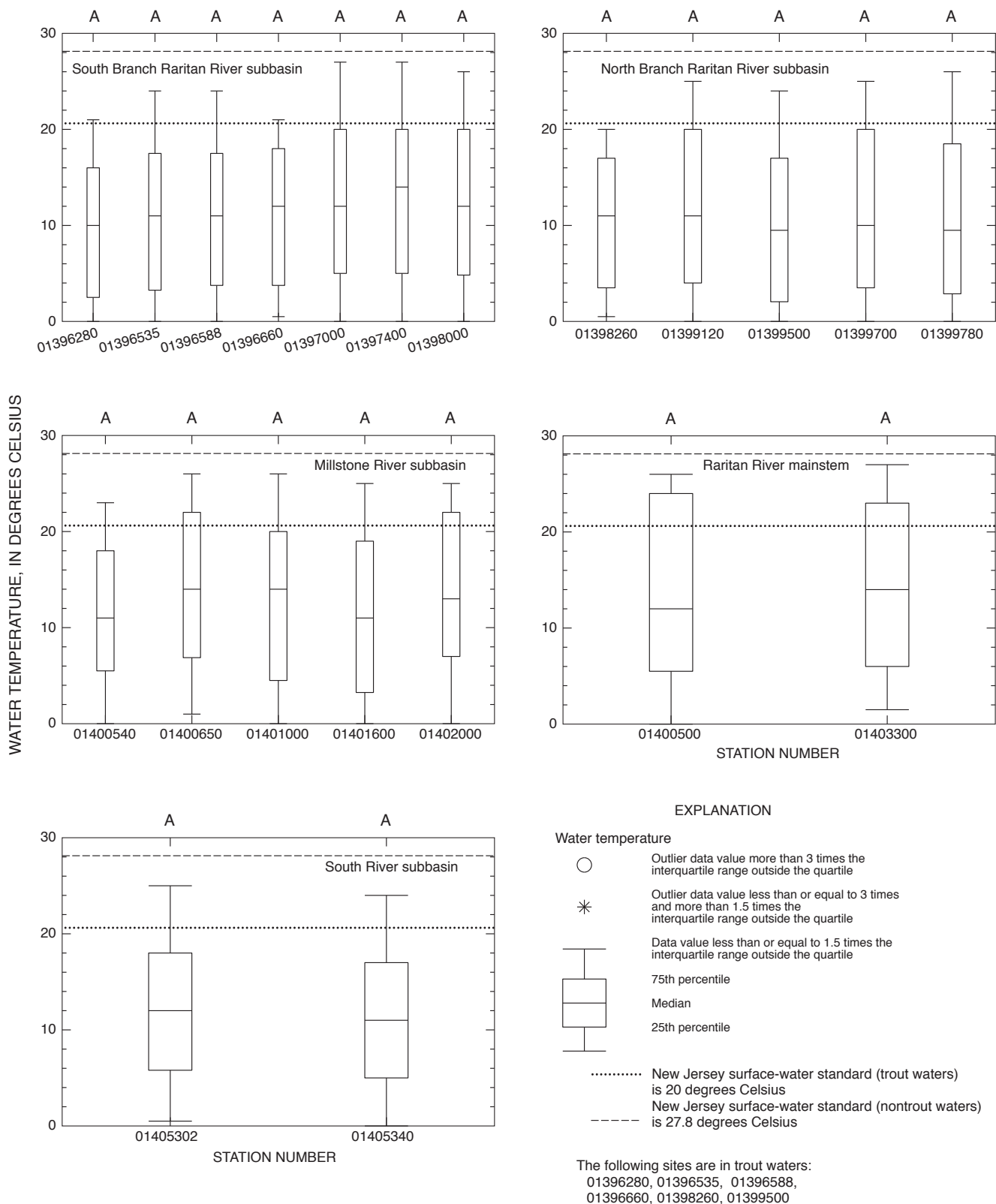


Figure A-17. Distribution of water temperatures in samples collected at 21 surface-water sampling sites in the Raritan River Basin, N.J., 1991-97.

**APPENDIX B. WATER-QUALITY STANDARDS AND PERCENTAGE
OF SAMPLES THAT DO NOT MEET THE REFERENCE LEVELS**

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Table B-1. Water-quality standards and percentage of samples that do not meet nontrout water reference levels at the 14 U.S. Geological Survey sites designated nontrout waters, Raritan River Basin, N.J., 1991-97

[Alkalinity, biochemical-oxygen demand, total ammonia + organic nitrogen and total organic carbon do not have standards; concentrations are in milligrams per liter, coliform is in colonies /milligrams per liter at 01403300 and most probable number at other sites, pH is in standard units, and temperature is in degrees Celsius; <, less than the reference level; >, greater than the reference level; L, criteria in lakes, and in reservoirs and tributaries at point of entry to such water bodies; G, geometric average; **Blue** cells = high flow; **Green** cells = low flow; **Bold text** = greater than 50 percent do not meet reference levels; --, no standard]

Reference levels	Chloride	Dissolved oxygen	Dissolved solids, total	Fecal coliform	Hardness	Nitrate plus nitrite	pH	Phosphorus, total	Sodium	Sulfate	Suspended solids, total	Un-ionized ammonia	Water temperature
Drinking water standard	250	--	500	--	>50, <250	10	--	--	50	250	--	--	--
New Jersey Surface Water standard	250	> 4	500	400	--	--	>6.5, <8.5	L0.05, 0.1	--	250	40	0.05	27.8
	Percentage of samples that do not meet the reference level at all sites designated nontrout waters												
All samples from all nontrout sites	0	0.1	0	31	<25, >0	0	<8.9, >11	L74 , 42	1.5	0	7.6	0	0
	By season												
All growing season samples	0	0.3	0	46	<22, >0	0	<5.3, >13	L80 , 50	0.9	0	9.0	0	0
All nongrowing season samples	0	0	0	13	<30, >0	0	<14, >6.8	L66 , 30	1.8	0	5.4	0	0
	By flow condition												
All high-flow samples	0	0	0	27	<29, >0	0	<9.3, >6.3	L61 , 30	1.4	0	7.5	0	0
All low-flow samples	0	0.3	0	32	<10, >0	0	<4, >15	L69 , 36	1.2	0	0.9	0	0
Surface-water sampling site number and name	Percentage of samples that do not meet nontrout water reference level by site												
01397400 S.B. Raritan River	0	0	0	23	<3, >0	0	<3, >6	L83, 60	0	0	3	0	0
	0	0	0	30	<4, >0	0	<4, >0	L83, 52	0	0	5	0	0
	0	0	0	8	0	0	<0, >8	L83, 75	0	0	0	0	0
01398000 Neshanic River	0	0	0	69	< 5, >0	0	<2, >29	L51 , 13	8.9	0	8	0	0
	0	0	0	56	<10, >0	0	<16, >0	L50, 20	13	0	14	0	0
	0	0	0	79	0	0	<46, >4	L52 , 4	4	0	0	0	0
01399120 N.B. Raritan River	0	0	0	46	0	0	<0, >14	L49, 11	0	0	0	0	0
	0	0	0	22	0	0	<0, >11	L39, 11	0	0	0	0	0
	0	0	0	71	0	0	<0, >18	L59 , 12	0	0	0	0	0
01399700 Rockaway Creek	0	0	0	46	< 3, >0	0	<3, >15	L76 , 41	0	0	0	0	0
	0	0	0	42	<4.2, >0	0	<0, >17	L71 , 29	0	0	0	0	0
	0	0	0	54	0	0	<9, >10	L90, 70	0	0	0	0	0

Table B-1. Water quality standards and frequency of samples not meeting nontrot water reference levels at the 14 USGS sites designated nontrot waters from samples in the Raritan River basin from 1991-97--Continued

Reference levels	Chloride	Dissolved oxygen	Dissolved solids, total	Fecal coliform	Hardness	Nitrate plus nitrite	pH	Phos-phorus, total	Sodium	Sulfate	Sus-pended solids, total	Un-ionized ammonia	Water tempera-ture
Surface-water sampling site number and name	Percentage of samples that do not meet nontrot water reference level by site--Continued												
01399780 Lamington River	0	0	0	34	< 10, >0	0	<0, >21	L72 , 19	5.3	0	3	0	0
	0	0	0	41	<17, 0	0	<0, >5	L59 , 12	5.6	0	7	0	0
	0	0	0	28	<5, 0	0	<0, >8	L84 , 26	5	0	0	0	0
01400500 Raritan River	0	0	0	17	< 3, >0	0	<3, >9	L75 , 34	0	0	0	0	0
	0	0	0	24	<6, 0	0	<6, >6	L56 , 19	0	0	0	0	0
	0	0	0	11	0	0	<0, >11	L94, 50	0	0	0	0	0
01400540 Millstone River	0	0	0	23	< 100 , >0	0	<26, >0	L80 , 31	43	0	6	0	0
	0	0	0	26	< 100 , >0	0	<30, >0	L83 , 39	35	0	10	0	0
	0	0	0	17	< 100 , >0	0	0	L75 , 17	58	0	0	0	0
01400650 Millstone River	0	3	0	21	< 80 , >0	0	<10, >0	L97, 70	0	0	0	0	0
	0	0	0	13	< 93 , >0	0	<13, 0	L93, 60	0	0	0	0	0
	0	6	0	29	< 68 , >0	0	<0, >7	L100, 80	0	0	0	0	0
01401000 Stony Brook	0	0	0	26	< 50 , >0	0	<3, >25	L67 , 38	8.5	0	15	0	0
	0	0	0	27	<41, >0	0	<3, >21	L71 , 46	17	0	32	0	0
	0	0	0	26	0	0	<3, >28	L63 , 30	0	0	0	0	0
01401600 Beden Brook	0	0	0	40	< 16, >0	0	<0, >8	L89 , 47	2.7	0	3	0	0
	0	0	0	33	<38, >0	0	<12, 0	L80 , 20	6	0	0	0	0
	0	0	0	45	0	0	<0, >5	L95, 67	0	0	0	0	0
01402000 Millstone River	0	0	0	29	< 13, >0	0	0	L100, 97	3.2	0	9	0	0
	0	0	0	20	<27, 0	0	0	L100, 93	6.7	0	6.7	0	0
	0	0	0	38	0	0	0	100	0	0	12	0	0
01403300 Raritan River	0	0	0	30	< 18, >0	0	<2, >4	L100, 86	7.1	0	15	0	0
	0	0	0	14	<26, 0	0	<5.9, >3	L100, 79	8.6	0	24	0	0
	0	0	0	67	<4.8, 0	0	0	100	4.8	0	0	0	0
01405302 Matchaponix Brook	0	0	0	8.6	< 9, >0	0	<49, >0	L40, 14	5.7	0	0	0	0
	0	0	0	12	<19, 0	0	< 75 , >00	L50, 25	0	0	0	0	0
	0	0	0	5	0	0	<26, >0	L32, 5.3	10	0	0	0	0
01405340 Manalapan Brook	0	0	0	11	< 100 , >0	0	<37, >0	L77 , 31	2.9	0	0	0	0
	0	0	0	5	< 100 , 0	0	< 57 , >0	L71 , 33	5	0	0	0	0
	0	0	0	29	< 100 , 0	0	<7, >0	L86 , 29	0	0	0	0	0

Table B-2. Water-quality standards and percentage of samples that do not meet reference levels at the seven U.S Geological Survey sites located in designated trout waters, Raritan River Basin, N.J., 1991-97

[Alkalinity, biochemical oxygen demand, total ammonia + organic nitrogen, and total organic carbon do not have standards; concentrations are in milligrams per liter, coliform is in colonies /milligrams per liter at 01403300 and most probable number at other sites, pH is in standard units, and temperature is in degrees Celsius; <, less than the reference level; >, greater than the reference level; *, trout maintenance; ** trout production; L, criteria in lakes, and reservoirs and tributaries at point of entry to such water bodies; G, geometric mean; **Blue** cells = high flow; **Green** cells = low flow; **Bold text** = greater than 50 percent do not meet reference levels; --, no standard

Reference levels	Chloride	Dissolved oxygen	Dissolved solids, total	Fecal coliform	Hardness	Nitrate plus nitrite	pH	Phosphorus, total	Sodium	Sulfate	Suspended solids, total	Un-ionized ammonia	Water temperature
Drinking water standard	250	--	500	--	>50, <250	10	--	--	50	250	--	--	--
New Jersey surface water standard	250	*>5, **>7	500	400	--	--	>6.5, <8.5	L0.05, 0.1	--	250	*25	*0.02	*20
	Percentage of samples not meeting the reference levels from all sites in trout waters												
All samples from all trout sites	0	0	0	27	10.8	0	11.6	L41.7, 10.6	0.4	0	2.0	0.4	12.0
	By season												
All growing season samples	0	0	0	40.6	<4.3, >0	0	<0.7, >10.2	L51 , 13	0	0	2.4	0.8	21.7
All nongrowing season samples	0	0	0	10.3	<19, >0	0	<4.5, >8.5	L31, 7.5	0.9	0	1.6	0	0
	By flow condition												
All high-flow samples,	0	0	0	26.5	<20, >0	0	<2.9, >2.2	L36, 6.9	0.7	0	4.2	0	6.5
All low-flow samples,	0	0	0	28	<0, >0	0	<1.8, >18	L49, 15	0	0	0	1.0	19
Surface-water sampling site number and name	Percentage of samples that do not meet the trout water reference levels by site												
**01396280 S.B. Raritan River	0	0	0	37	0	0	<6, >21	L64 , 18	2.9	0	3	0	11
	0	0	0	39	0	0	<5.9, >5.6	L39, 5.6	5.6	0	6.3	0	5.6
	0	0	0	35	0	0	<6, >37	L93 , 33	0	0	0	0	18
*01396535 S.B. Raritan River	0	0	0	40	< 5, >0	0	<3, >14	L44, 2.9	5.4	0	6	0	19
	0	0	0	26	<10, 0	0	<5, >0	L39, 5.6	10	0	12	0	5
	0	0	0	56	0	0	<0, >29	L50, 0	0	0	0	0	35
**01396588 Spruce Run	0	0	0	29	< 30,>0	0	0	L32, 12	2.7	0	0	0	8.1
	0	0	0	32	<46,>0	0	0	L27, 4.5	4.2	0	0	0	0
	0	0	0	23	0	0	0	L42, 25	0	0	0	0	23

Table B-2. Water-quality standards and percentage of samples that do not meet reference levels at the seven U.S Geological Survey sites located in designated trout waters, Raritan River Basin, N.J., 1991-97--Continued

Reference levels	Chloride	Dissolved oxygen	Dissolved solids, total	Fecal coliform	Hardness	Nitrate plus nitrite	pH	Phosphorus, total	Sodium	Sulfate	Suspended solids, total	Un-ionized ammonia	Water temperature
Surface-water sampling site--number and name	Percentage of samples that do not meet the trout water reference level by site--Continued												
*01396660 Mulhockaway Creek	0	0	0	29	< 8, >0	0	<0,>3	L18, 0	2.7	0	0	0	16
	0	0	0	31	<18,>0	0	<0,>6	L25, 0	6	0	0	0	5.9
	0	0	0	26	0	0	0	L11, 0	0	0	0	0	25
*01397000 S.B. Raritan River	0	0	0	23	< 3, >0	0	<3, >27	L32, 13	0	0	3	3.4	26
	0	0	0	33	<6,>0	0	<6,>7	L31, 19	0	0	6.3	0	31
	0	0	0	13	0	0	<0,>47	L33, 7	0	0	0	7	20
**01398260 N.B. Raritan River	0	0	0	17	< 9, >0	0	<3, >3	L58, 18	0	0	0	0	3
	0	0	0	17	<12,>0	0	0	L48, 8.7	0	0	0	0	4.2
	0	0	0	18	<0,>0	0	<10,>9.1	L80, 40	0	0	0	0	0
**01399500 Lamington River	0	0	0	14	< 19,>0	0	<0, >3	L44, 11	2.7	0	3	0	3
	0	0	0	11	<37, 0	0	<5.3,>0	L39, 5.6	5.3	0	6	0	0
	0	0	0	18	0	0	<0,>5.6	L50, 17	0	0	0	0	5.6

Table B-3. Geometric mean of fecal coliform bacteria counts per 100/milliliter and exceedances of surface-water reference level

Station number	Number of samples			Geometric mean (counts per 100 milliliters)		
	Total	High flow	Low flow	All samples	High flow	Low flow
01396280	35	18	17	158	146	172
01396535	35	20	17	158	116	227
01396588	35	24	13	106	102	115
01396660	35	17	20	132	138	128
01397000	30	16	15	94.8	138	63.3
01397400	35	23	12	178	207	133
01398000	35	17	18	668	262	1,618
01398260	35	24	11	90	90.5	87.9
01399120	35	18	17	263	153	467
01399500	35	19	18	52.4	50.3	54.7
01399700	35	24	11	223	190	314
01399780	35	18	20	145	214	102
01400500	35	17	18	149	182	123
01400540	35	23	12	76.3	80.8	68.3
01400650	29	15	15	93.7	75.9	116
01401000	34	16	18	121	97.7	144
01401600	35	16	21	215	97.4	392
01402000	31	15	16	234	150	354
01403300	30	16	14	282	217	381
01405302	35	16	19	48.3	31.6	69.1
01405340	35	21	14	48.6	36.9	73.3
Samples from all sites by season						
Season	Number of samples			Geometric mean		
Growing	425			218		
Nongrowing	305			82.7		
Samples from all sites by flow condition						
Flow condition	Number of samples			Geometric mean		
High flow	393			126		
LowfFlow	337			171		

APPENDIX C. CUMULATIVE PROBABILITY CURVES FOR CONCENTRATIONS OF EACH OF 17 CONSTITUENTS AT EACH OF THE 21 SURFACE-WATER SAMPLING SITES, 1991-97

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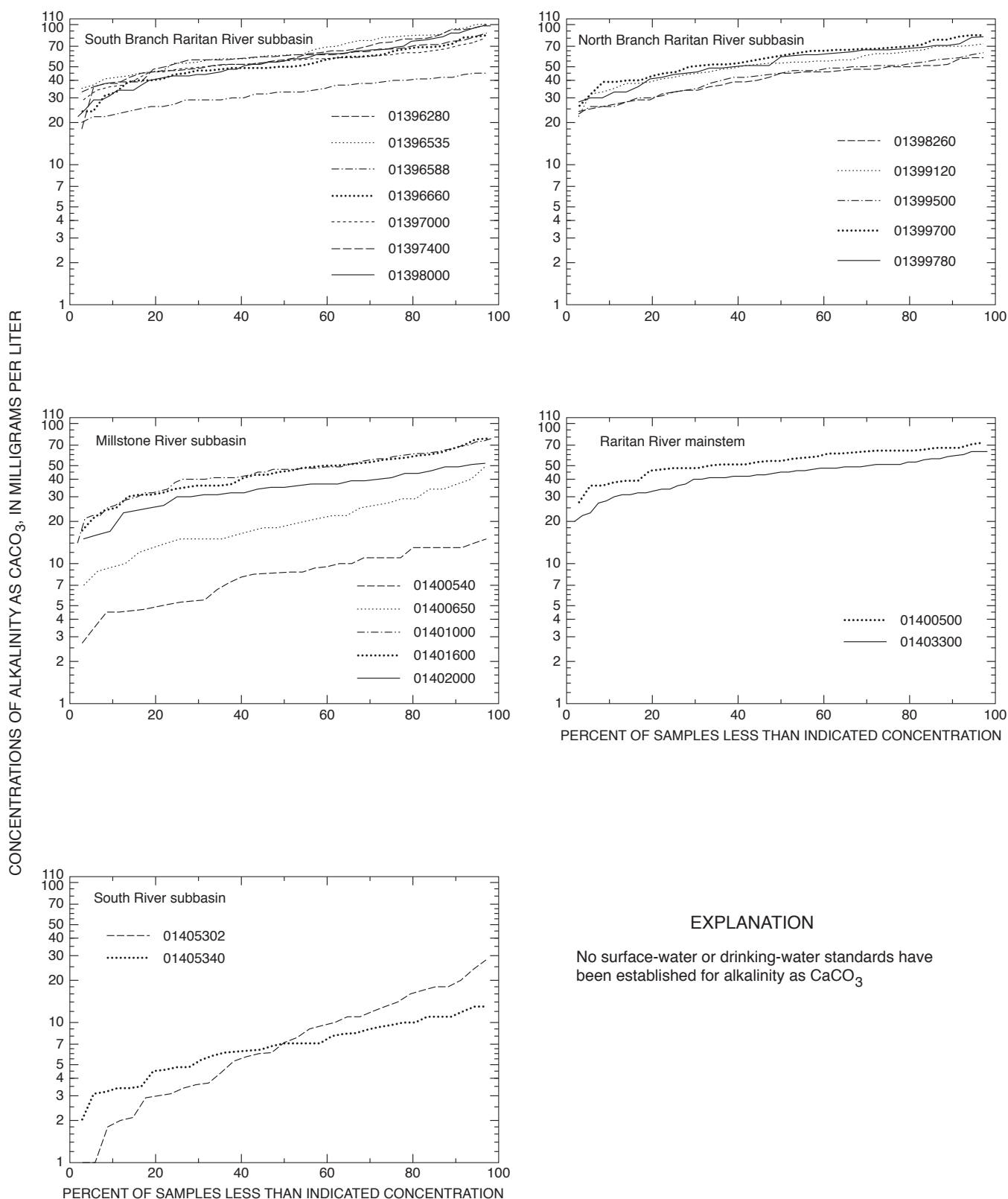


Figure C-1. Cumulative probability curve for concentrations of alkalinity as CaCO_3 in samples collected at 21 surface-water sampling sites in the Raritan River Basin, N.J., 1991-97.

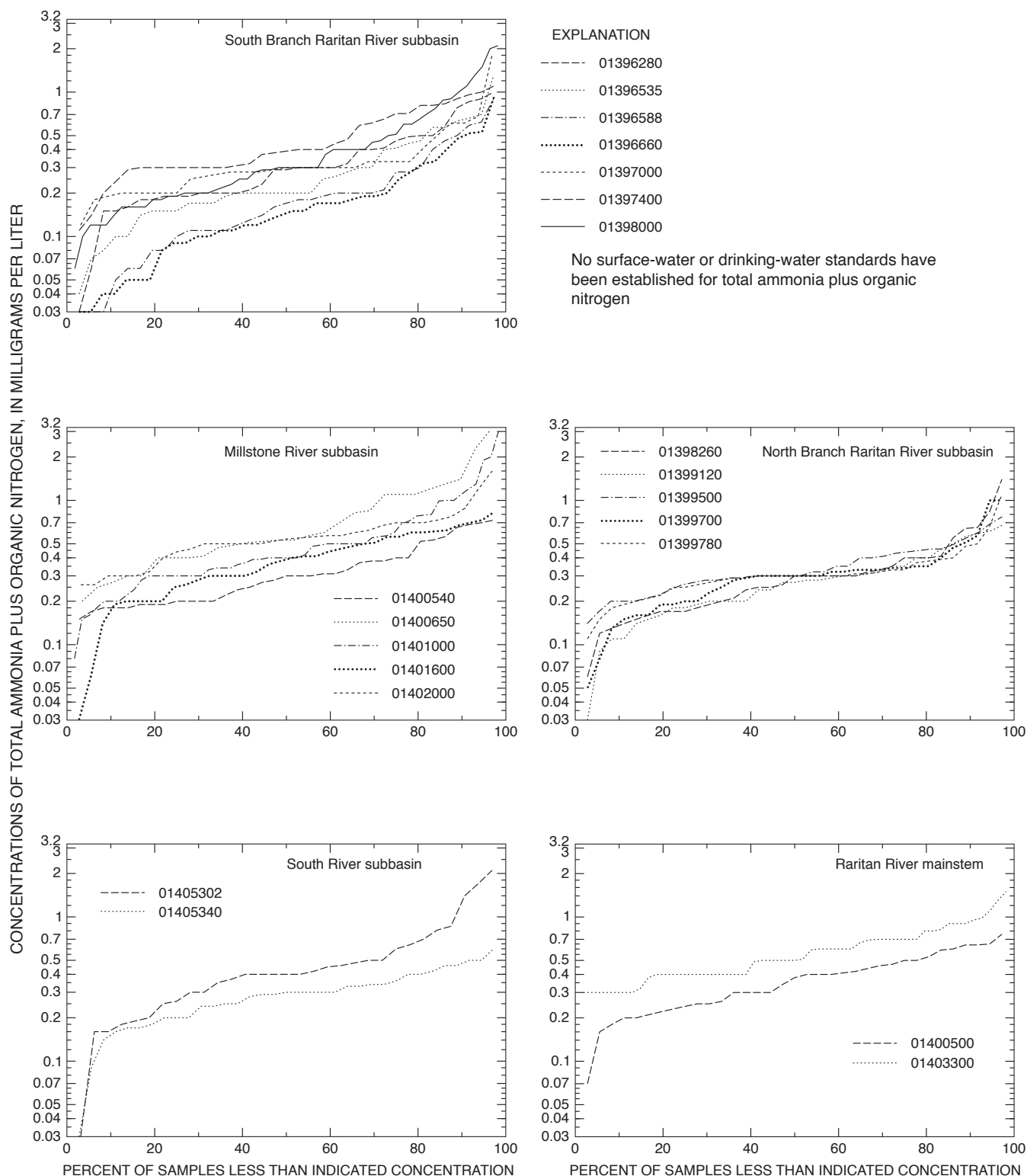


Figure C-2. Cumulative probability curve for concentrations of alkalinity as CaCO_3 in samples collected at 21 surface-water sampling sites in the Raritan River Basin, N.J., 1991-97.

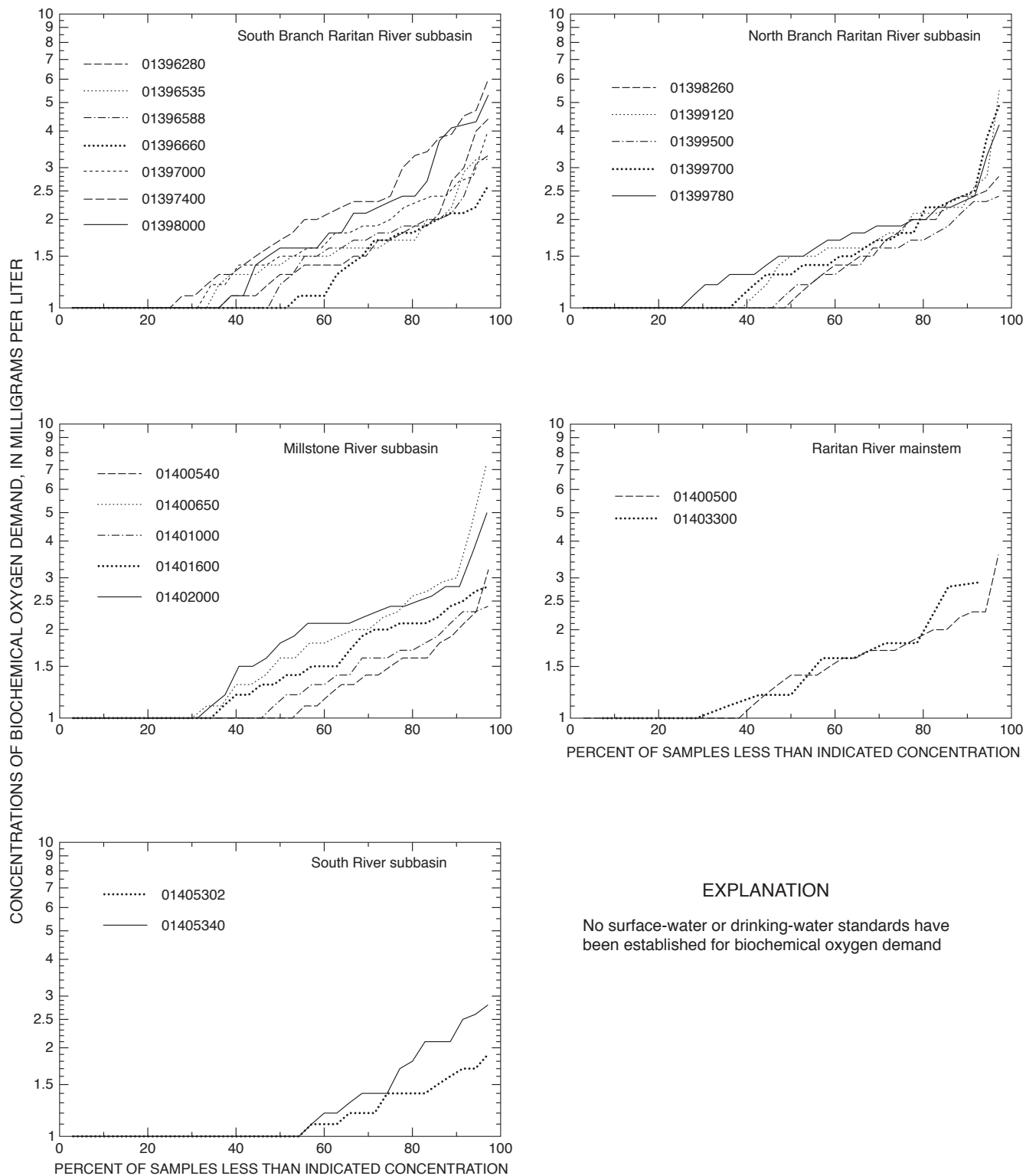


Figure C-3. Cumulative probability curve for concentrations of biochemical oxygen demand in samples collected at 21 surface-water sampling sites in the Raritan River Basin, N.J., 1991-97.

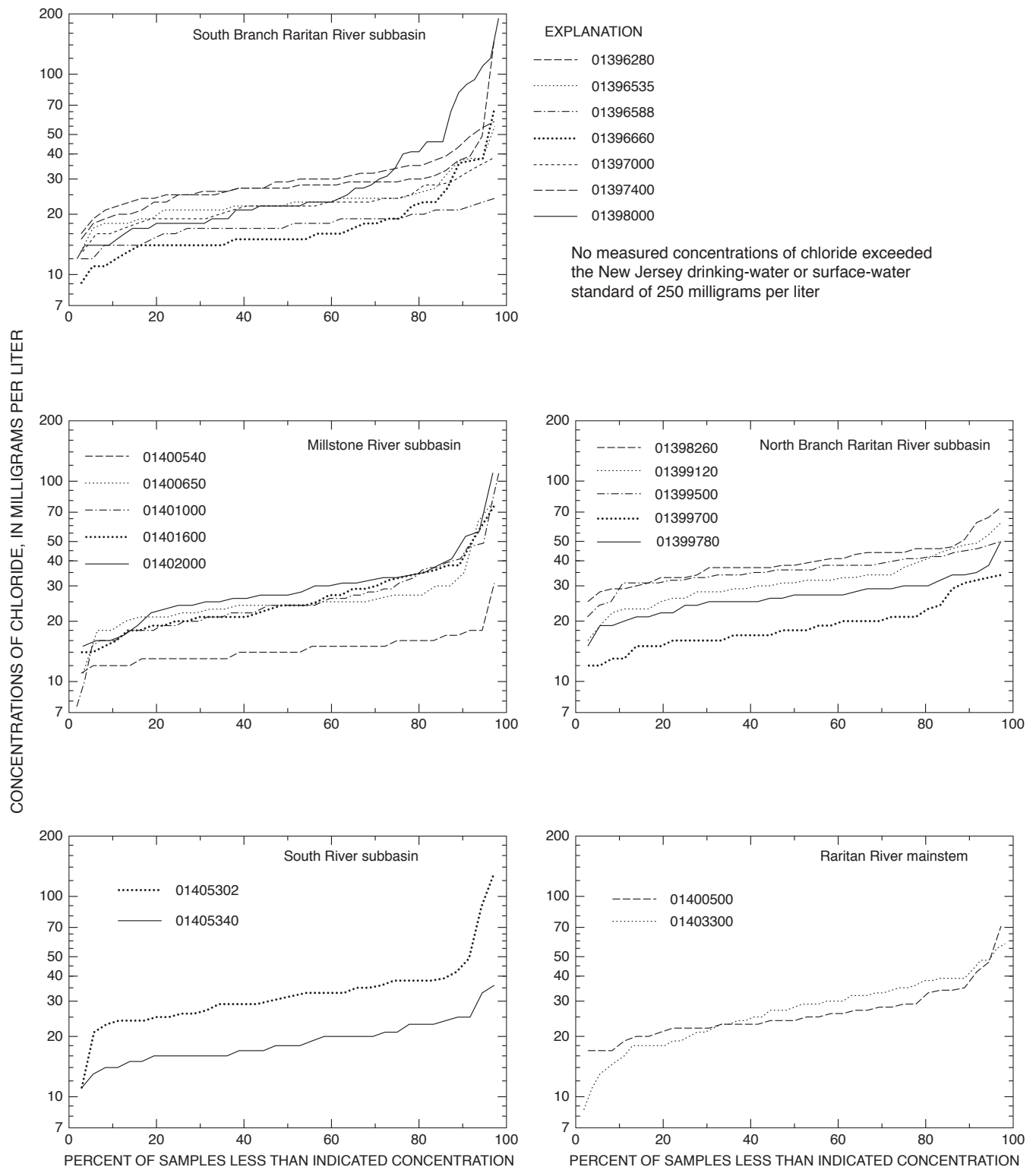


Figure C-4. Cumulative probability curve for concentrations of chloride in samples collected at 21 surface-water sampling sites in the Raritan River Basin, N.J., 1991-97.

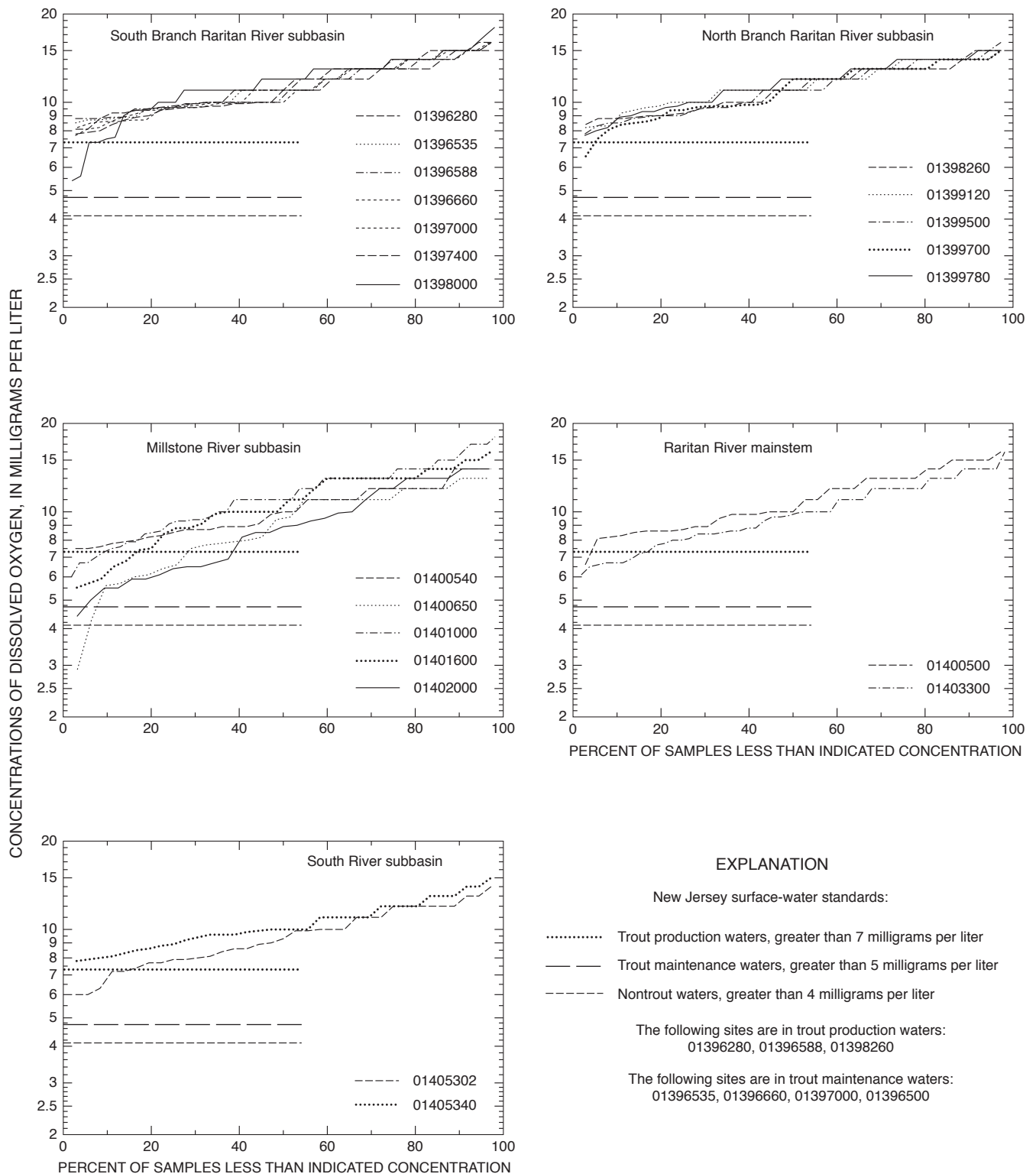


Figure C-5. Cumulative probability curve for concentrations of dissolved oxygen in samples collected at 21 surface-water sampling sites in the Raritan River Basin, N.J., 1991-97.

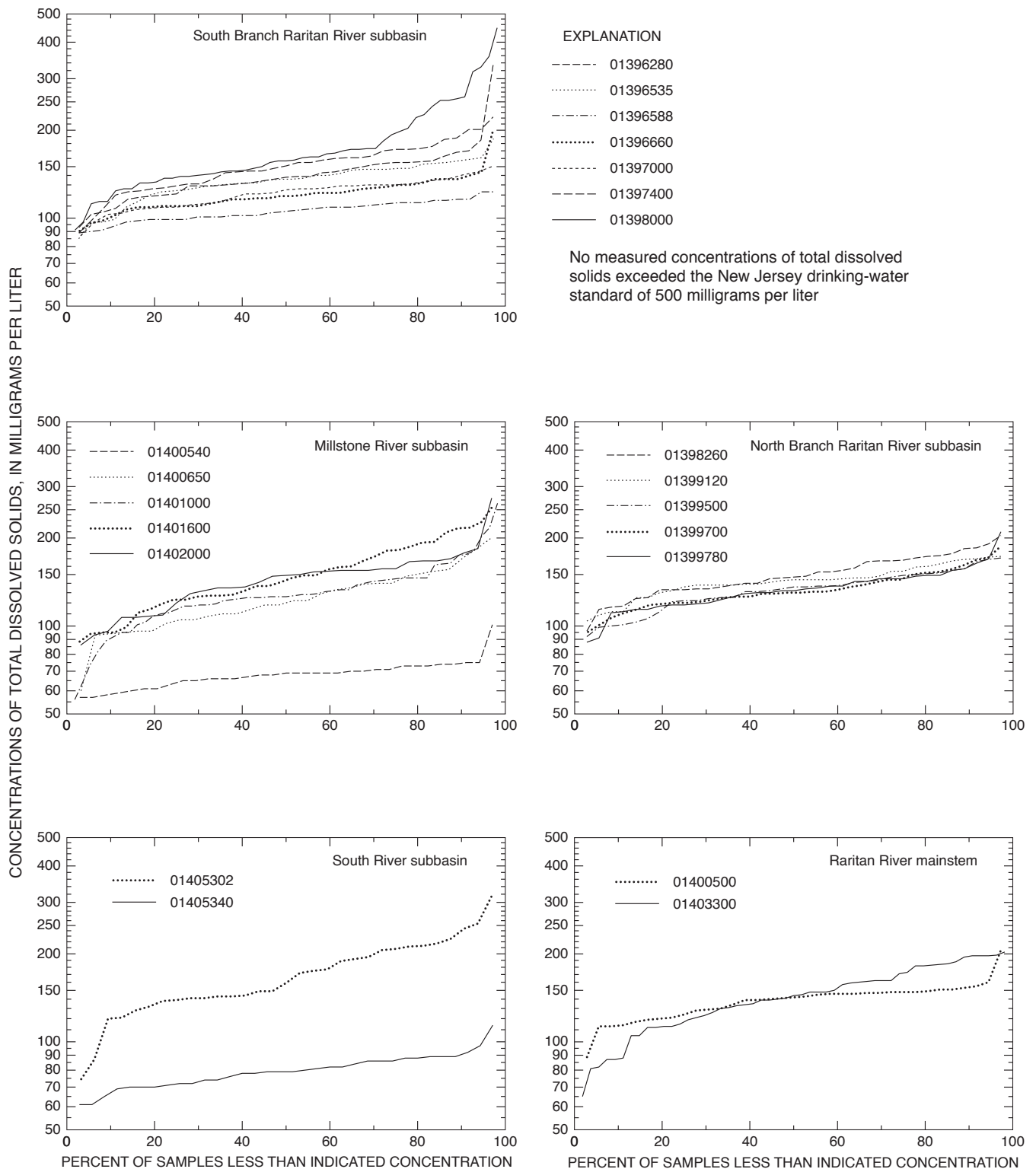


Figure C-6. Cumulative probability curve for concentrations of total dissolved solids in samples collected at 21 surface-water sampling sites in the Raritan River Basin N.J., 1991-97.

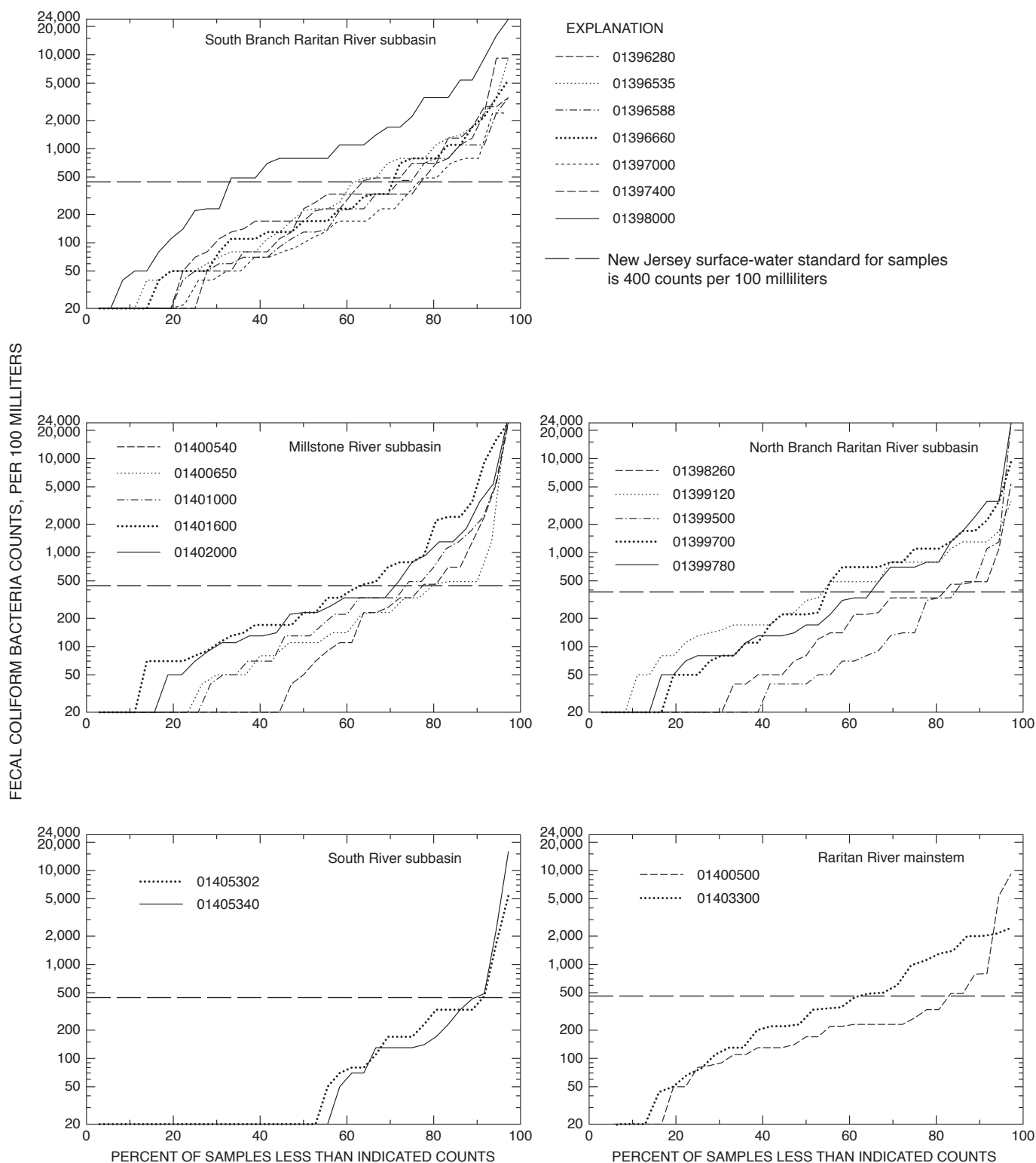


Figure C-7. Cumulative probability curve for fecal coliform bacteria counts in samples collected at 21 surface-water sampling sites in the Raritan River Basin, N.J., 1991-97.

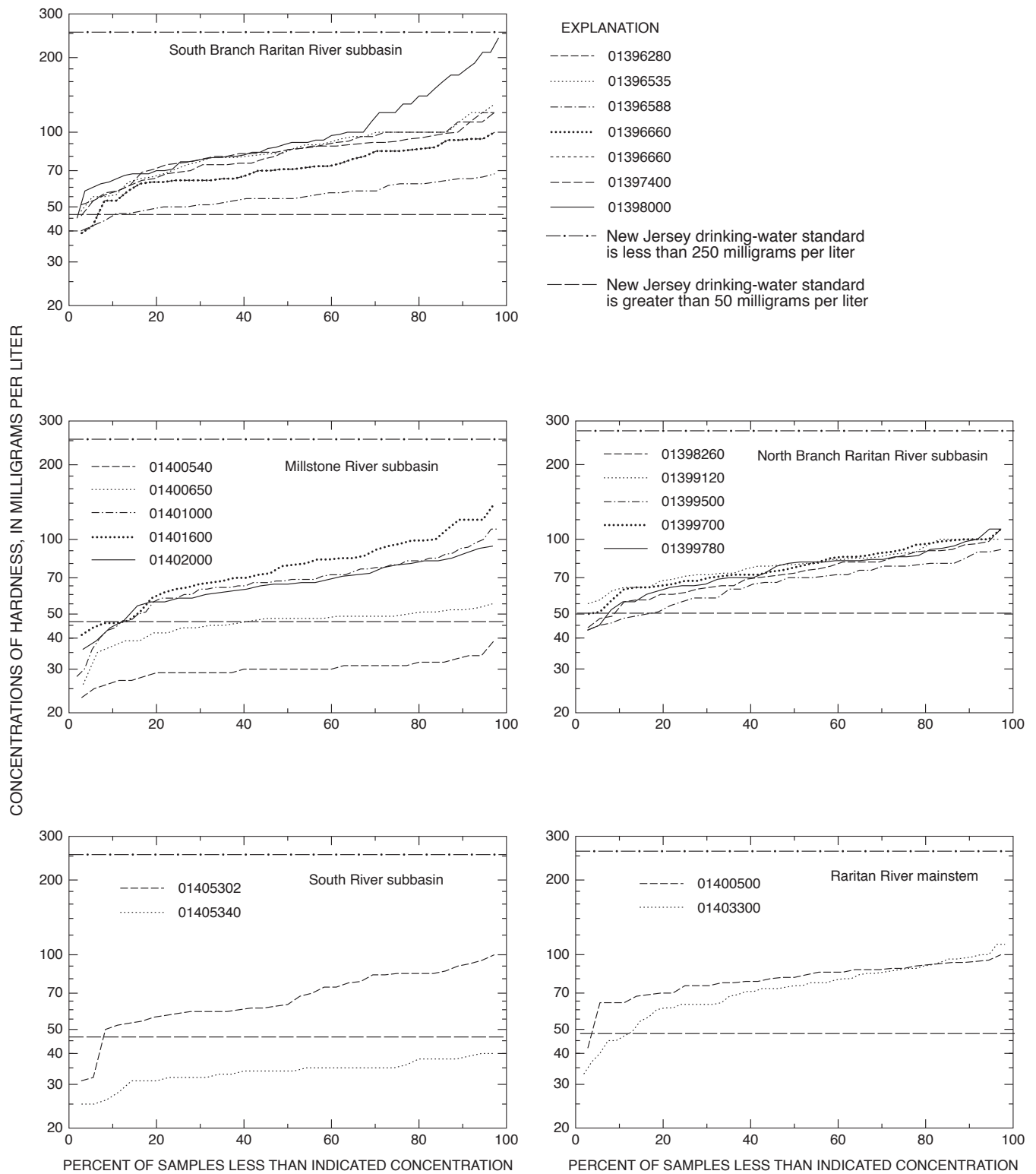


Figure C-8. Cumulative probability curve for concentrations of hardness in samples collected at 21 surface-water sampling sites in the Raritan River Basin, N.J., 1991-97.

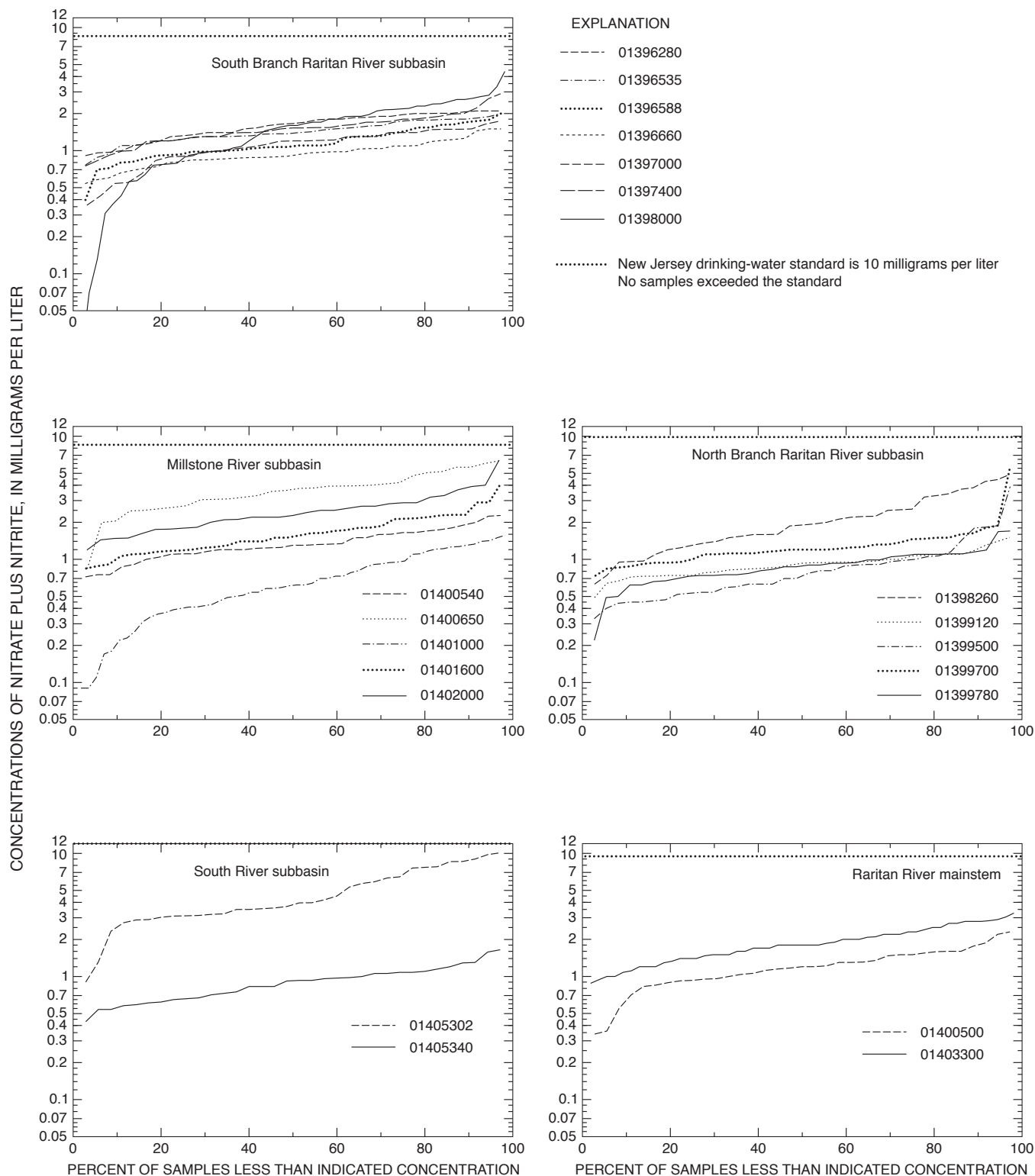


Figure C-9. Cumulative probability curve for concentrations of nitrate plus nitrite in samples collected at 21 surface-water sampling sites in the Raritan River Basin, N.J., 1991-97.

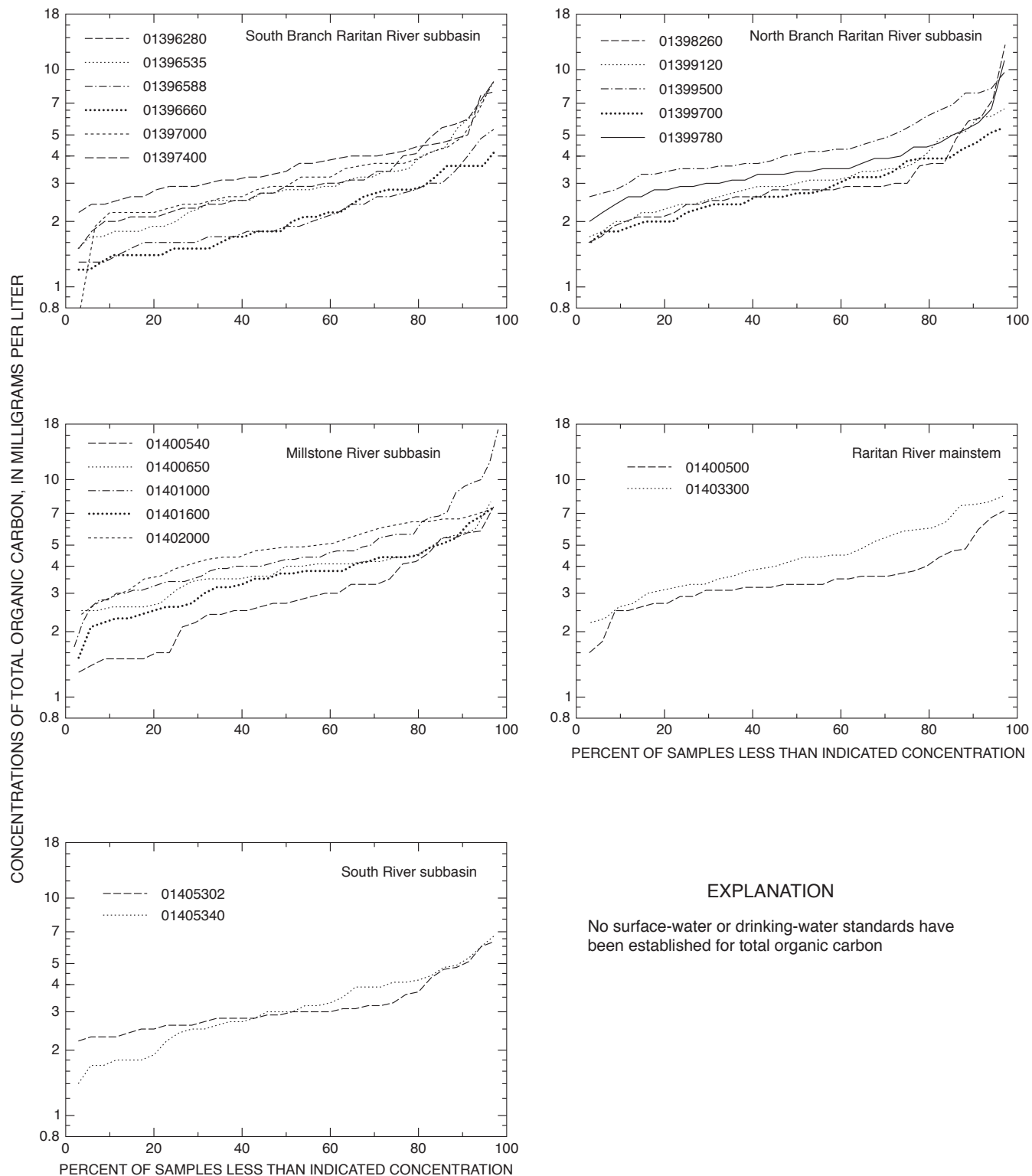


Figure C-10. Cumulative probability curve for concentrations of total organic carbon in samples collected at 21 surface-water sampling sites in the Raritan River Basin, N.J., 1991-97.

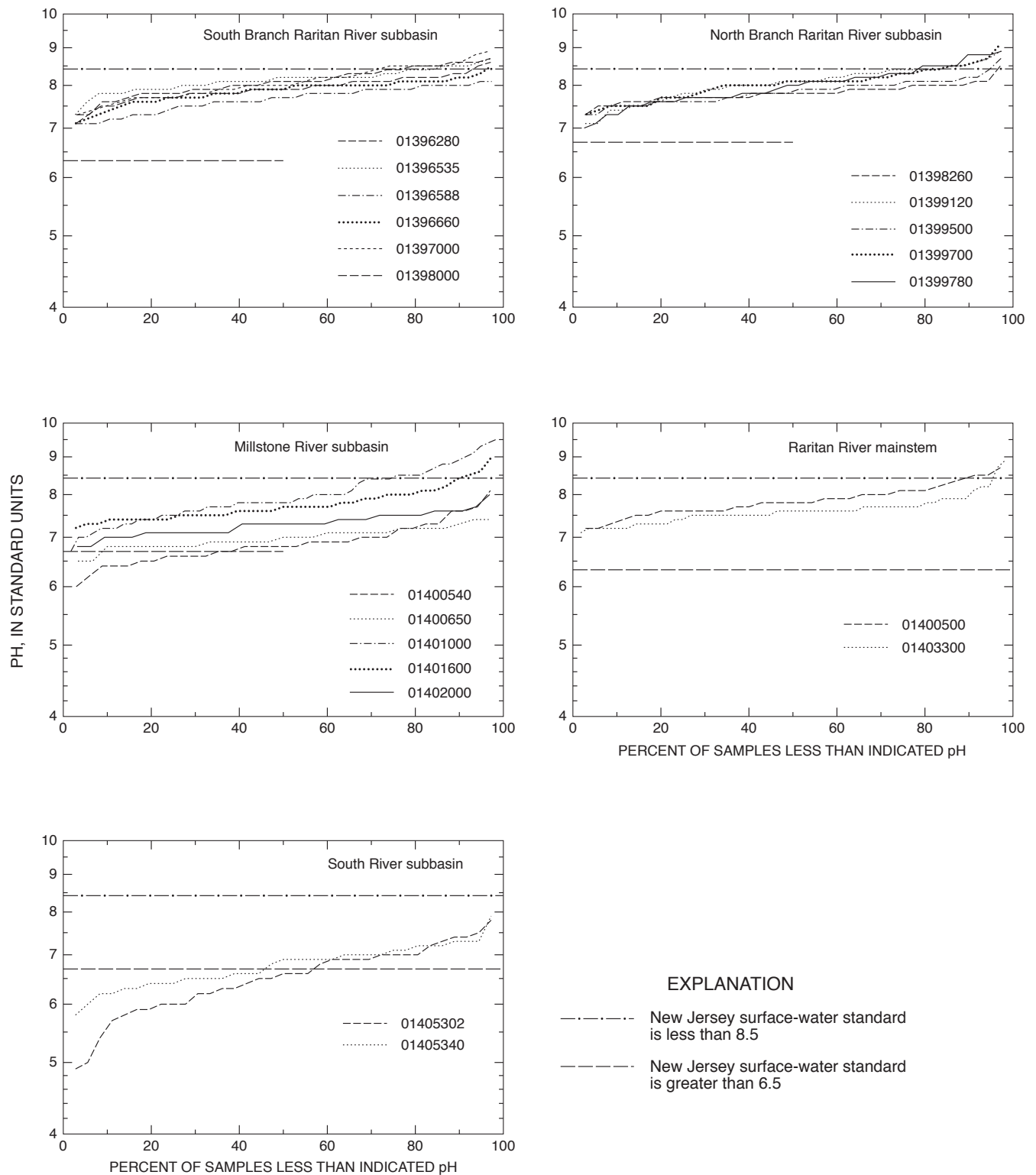


Figure C-11. Cumulative probability curves for pH in standard units in samples collected at 21 surface-water sampling sites in the Raritan River Basin, N.J., 1991-97.

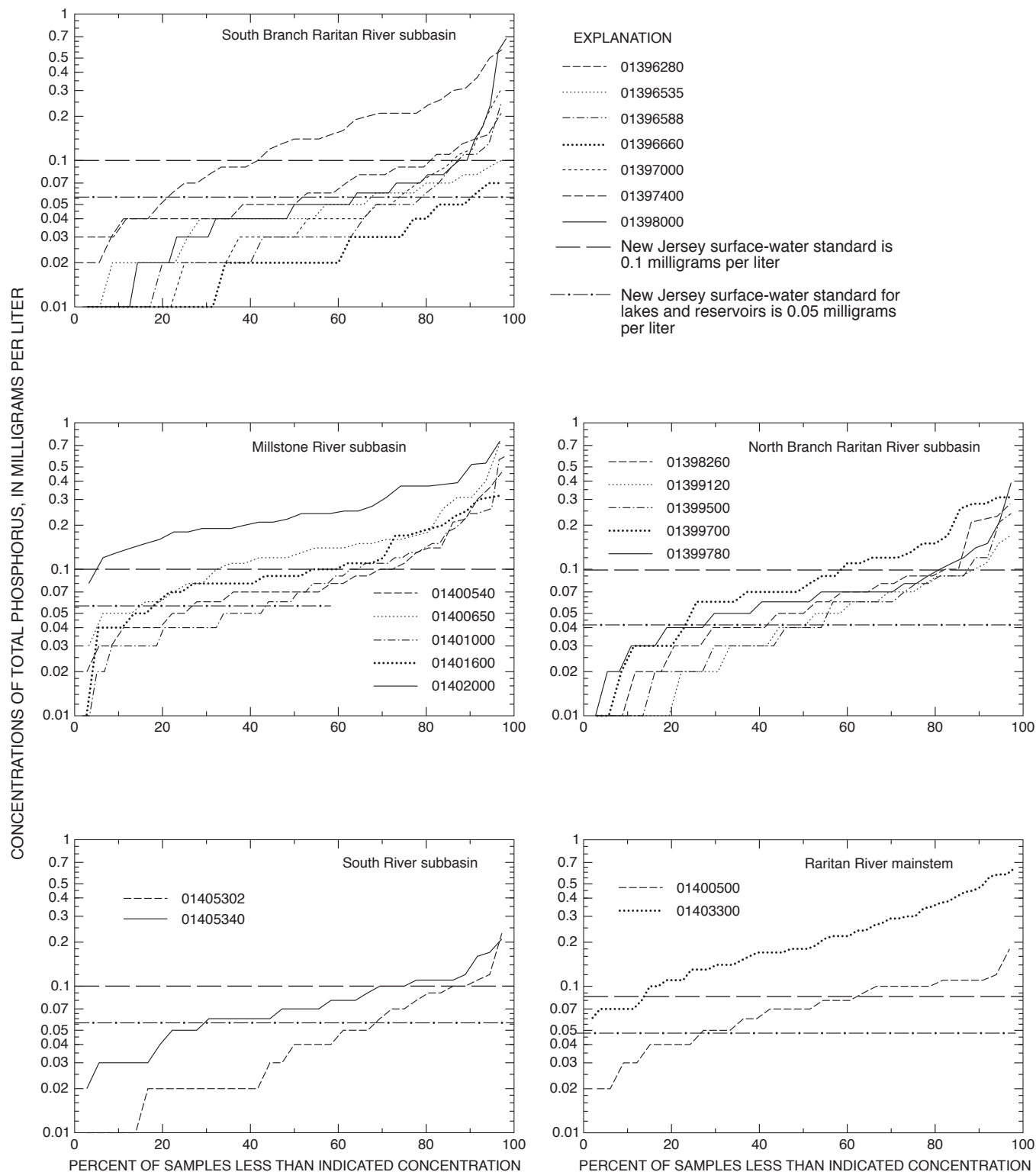


Figure C-12. Cumulative probability curve for concentrations of total phosphorus in samples collected at 21 surface-water sampling sites in the Raritan River Basin, N.J., 1991-97.

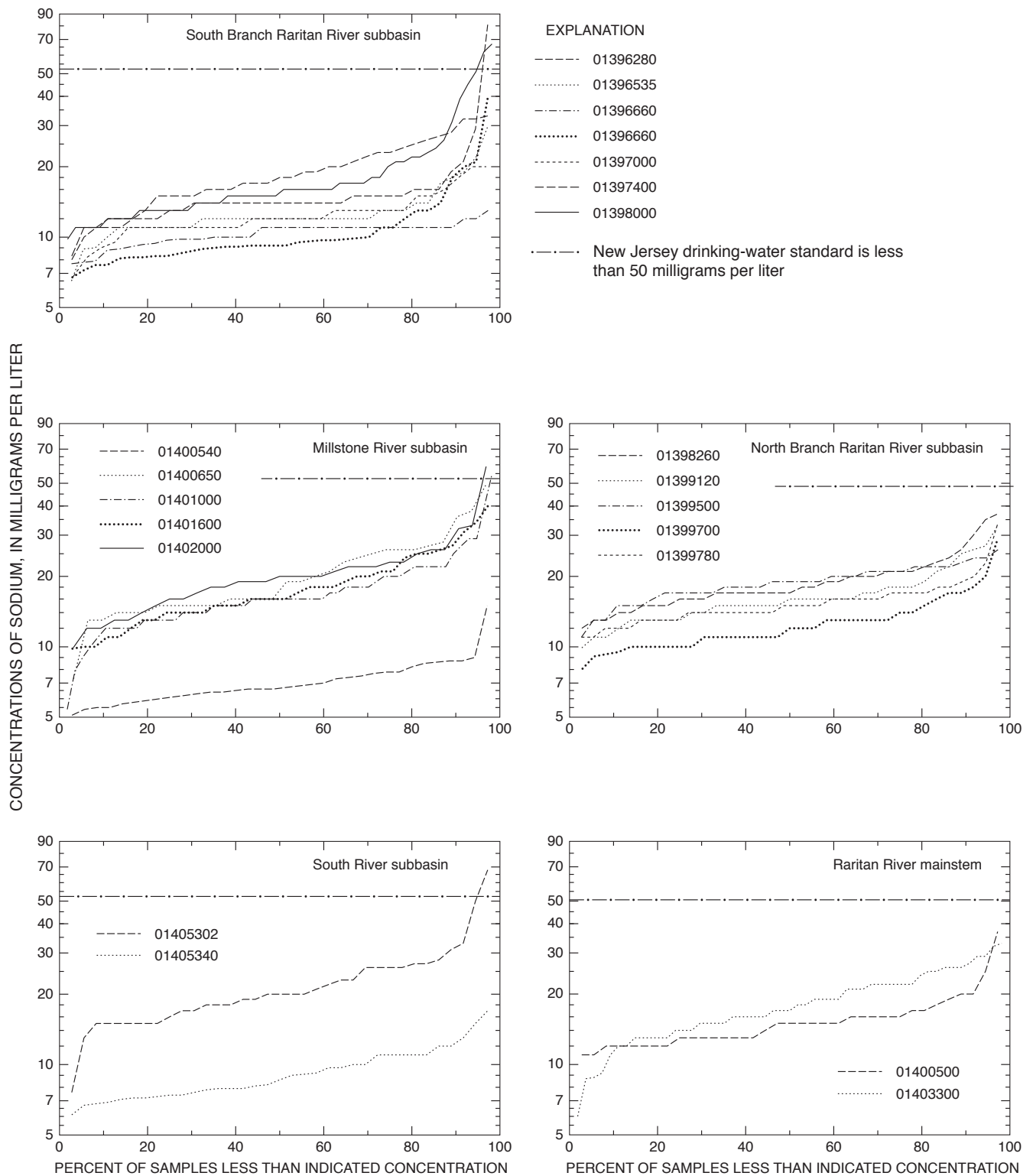


Figure C-13. Cumulative probability curve for concentrations of sodium in samples collected at 21 surface-water sampling sites in the Raritan River Basin, N.J., 1991-97.

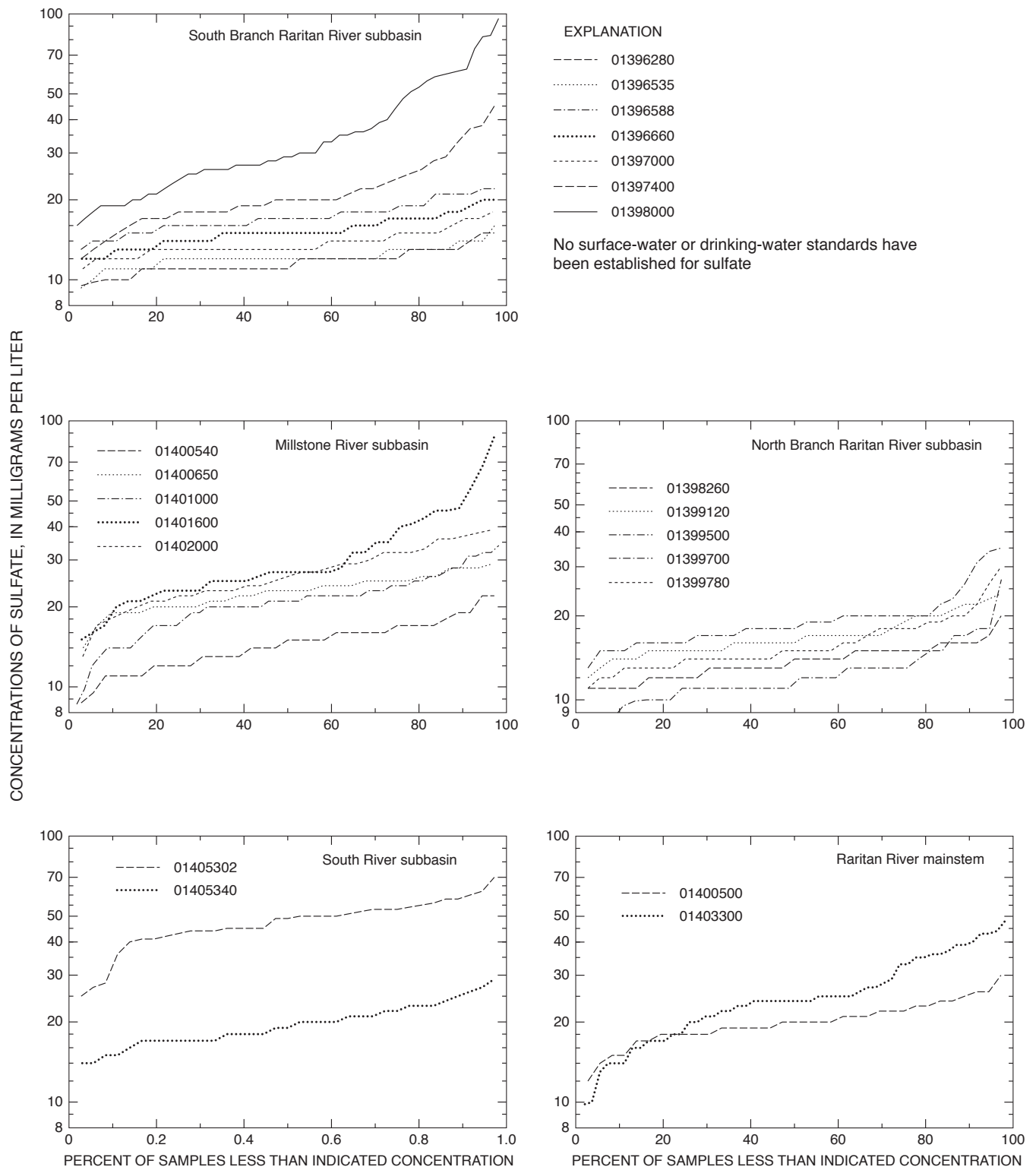


Figure C-14. Cumulative probability curve for concentrations of sulfate in samples collected at 21 surface-water sampling sites in the Raritan River Basin, N.J., 1991-97.

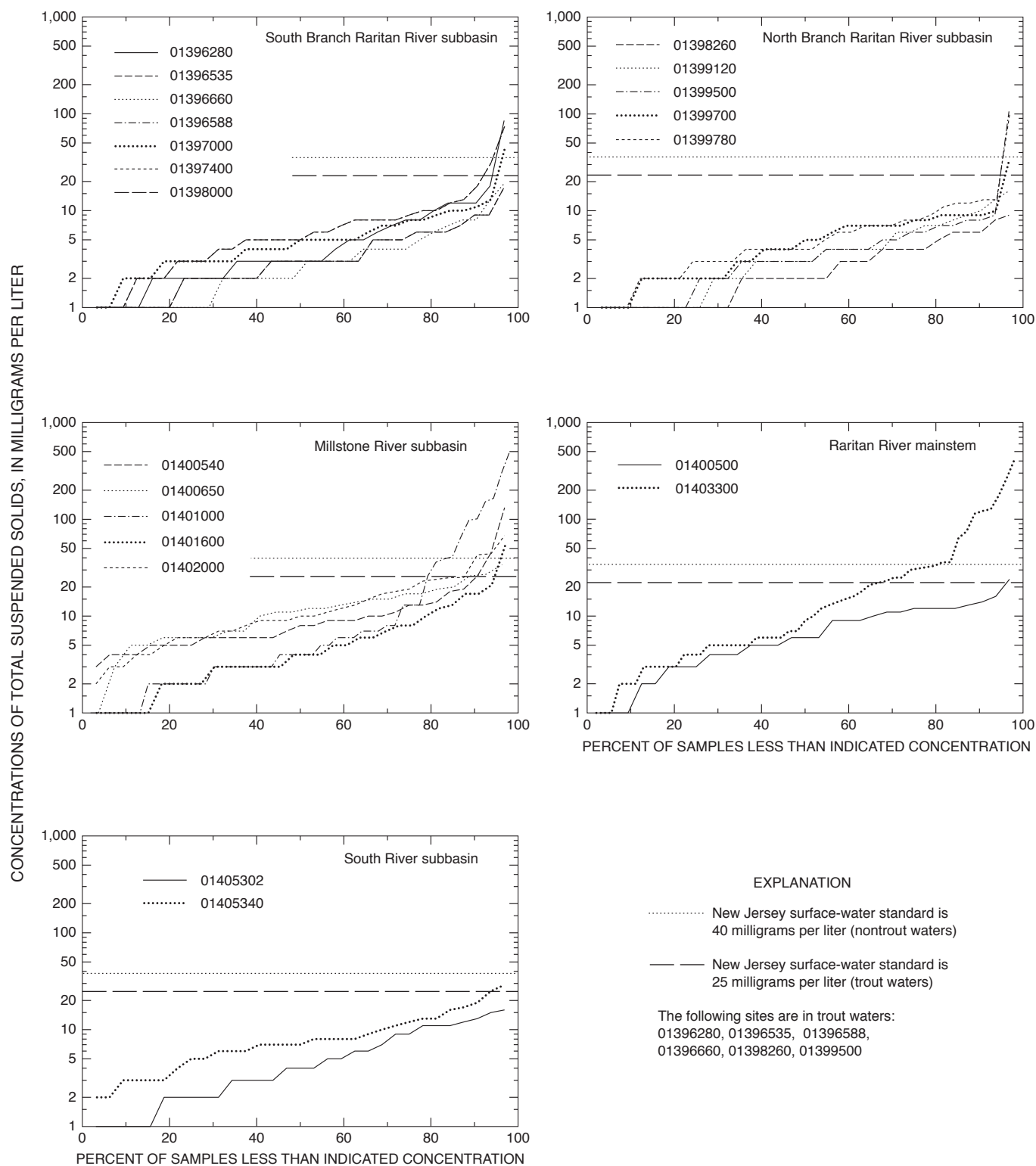


Figure C-15. Cumulative probability curve for concentrations of total suspended solids in samples collected at 21 surface-water sampling sites in the Raritan River Basin, N.J., 1991-97.

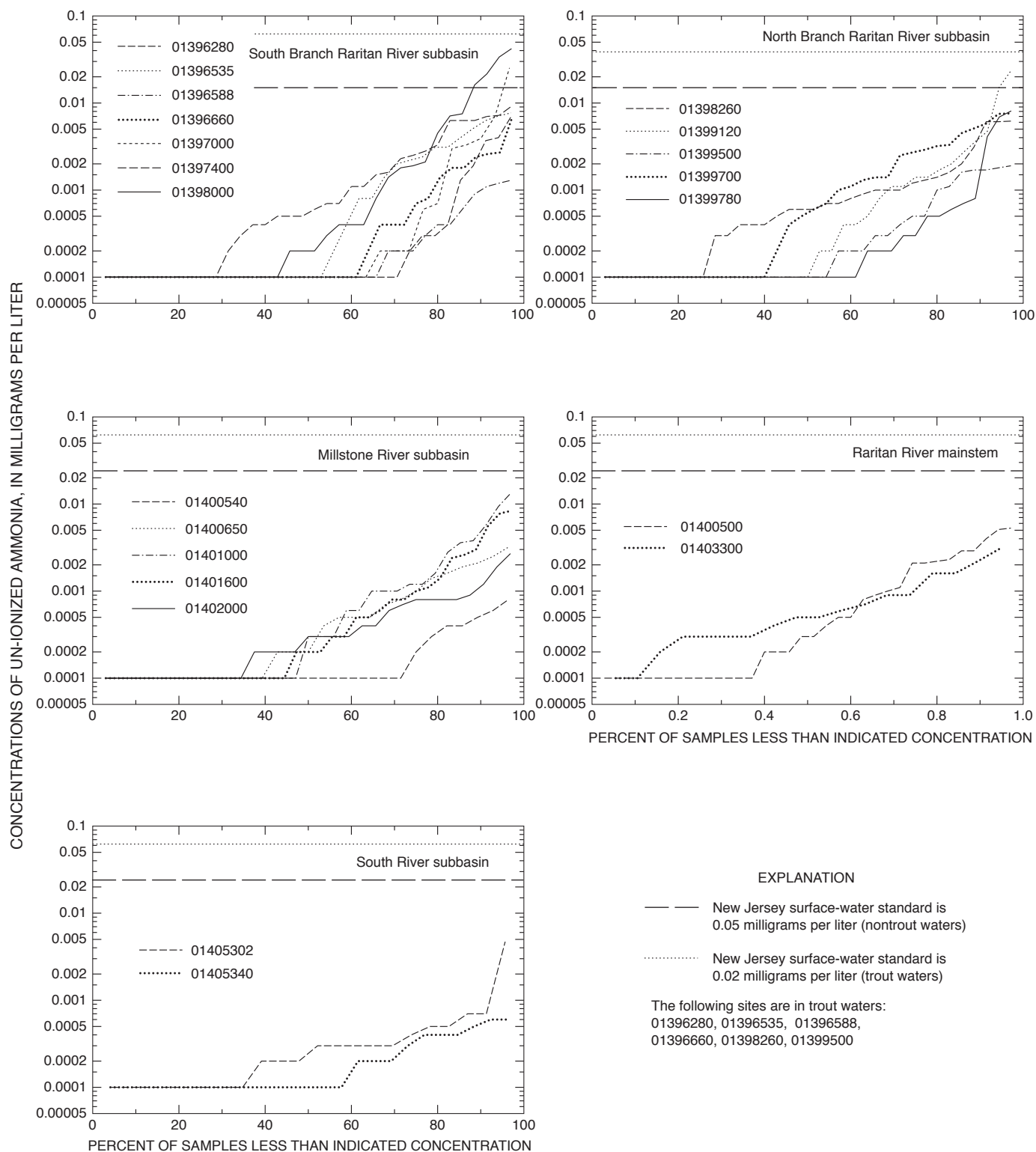


Figure C-16. Cumulative probability curve for concentrations of un-ionized ammonia in samples collected at 21 surface-water sampling sites in the Raritan River Basin, N.J., 1991-97.

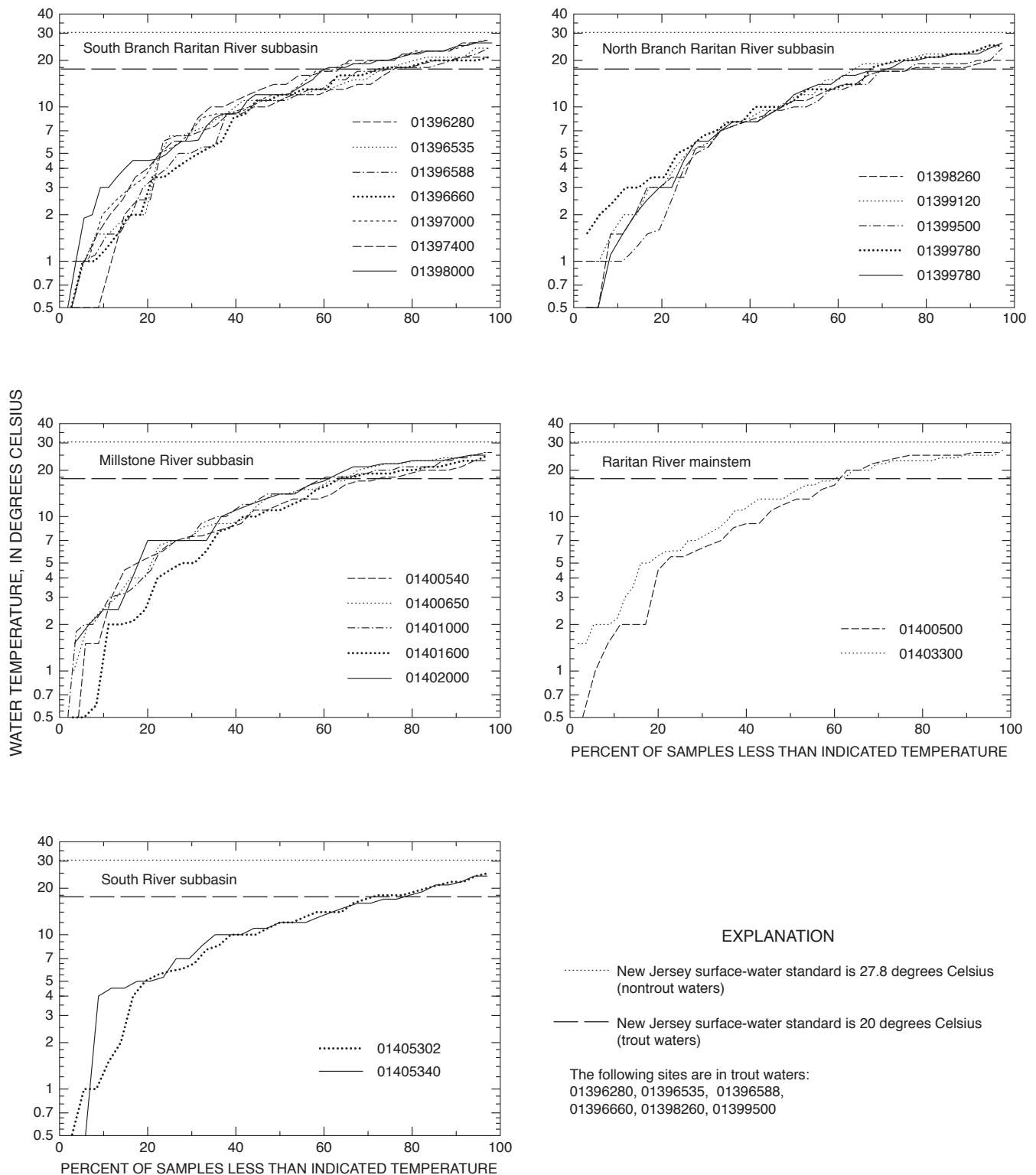


Figure C-17. Cumulative probability curve for water temperatures in samples collected at 21 surface-water sampling sites in the Raritan River Basin, N.J., 1991-97.