

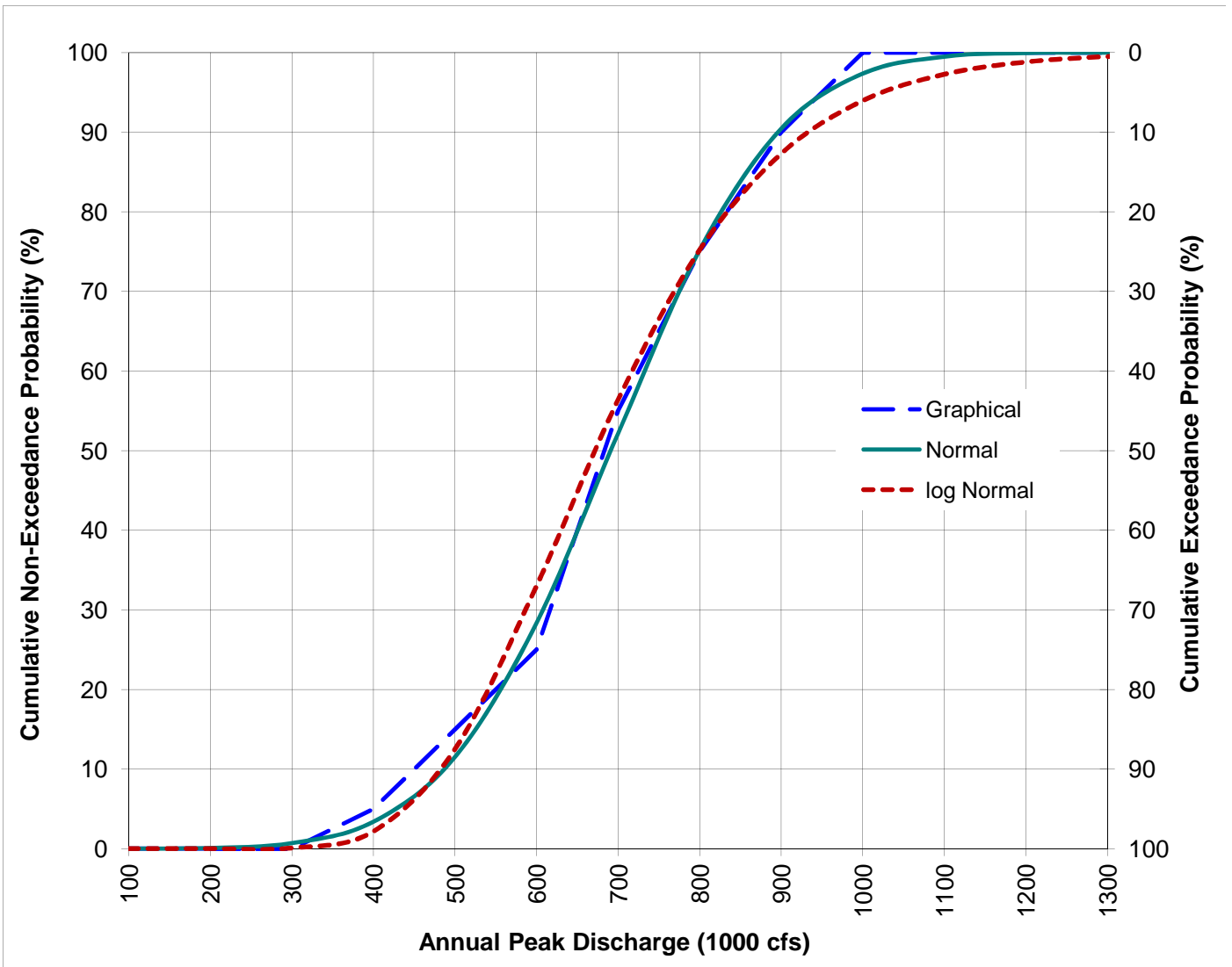
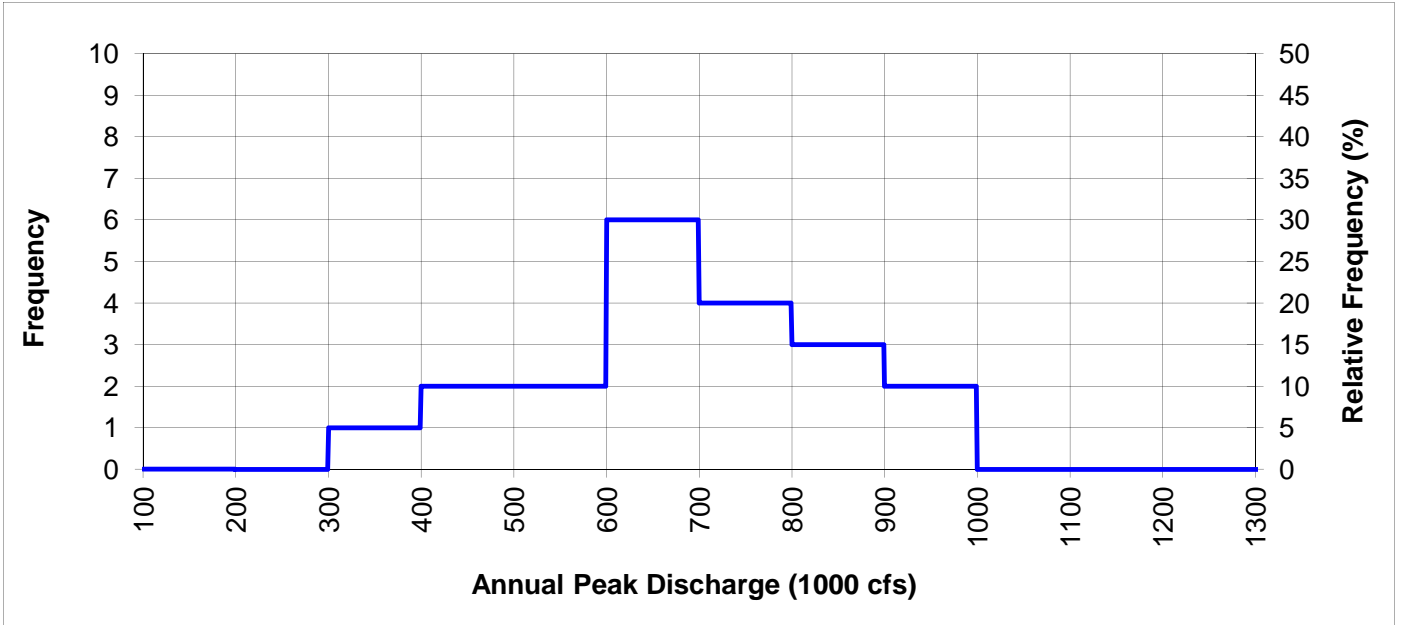
Sample 1

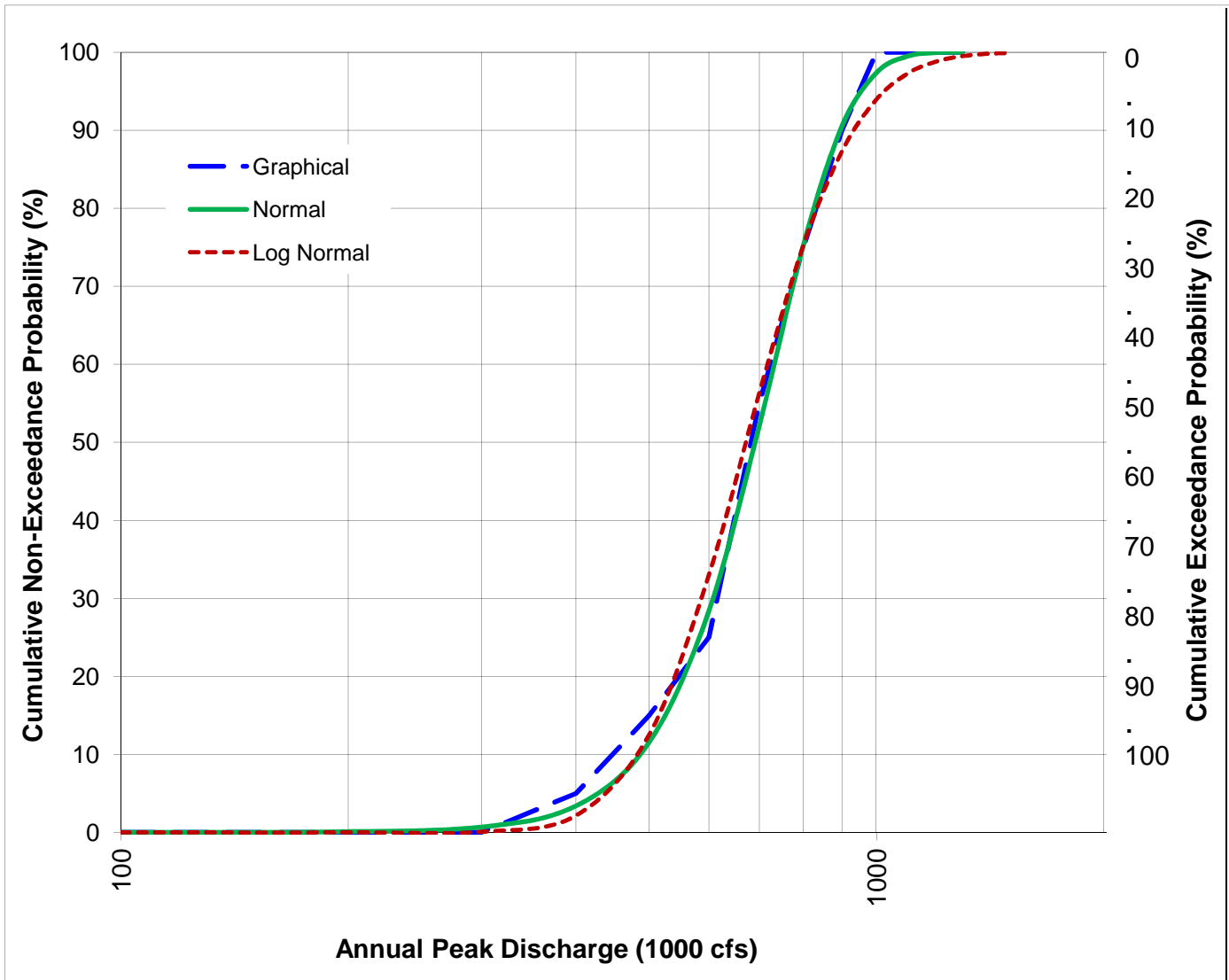
	year	flow Q	$Q - \bar{X}_Q$	$(Q - \bar{X}_Q)^2$
1	1858	563	-128.4	16487
2	1859	847	155.6	24211
3	1860	668	-23.4	548
4	1861	618	-73.4	5388
5	1862	948	256.6	65844
6	1863	777	85.6	7327
7	1864	654	-37.4	1399
8	1865	714	22.6	511
9	1866	839	147.6	21786
10	1867	671	-20.4	416
11	1868	483	-208.4	43431
12	1869	328	-363.4	132060
13	1870	777	85.6	7327
14	1871	856	164.6	27093
15	1872	737	45.6	2079
16	1873	638	-53.4	2852
17	1874	582	-109.4	11968
18	1875	684	-7.4	55
19	1876	958	266.6	71076
20	1877	486	-205.4	42189

sum Q	13,828	$\text{sum}(Q - \bar{X}_Q)^2$	484045
$\bar{X}_Q = \text{sumQ} / N$	691	$S^2 = \text{sum}/(n-1)$	25476.04211
		$S = \sqrt{S}$	160

$\bar{X}_Q =$	691	$\bar{X}_{\log Q} =$	2.827
$S_Q =$	160	$S_{\log Q} =$	0.111

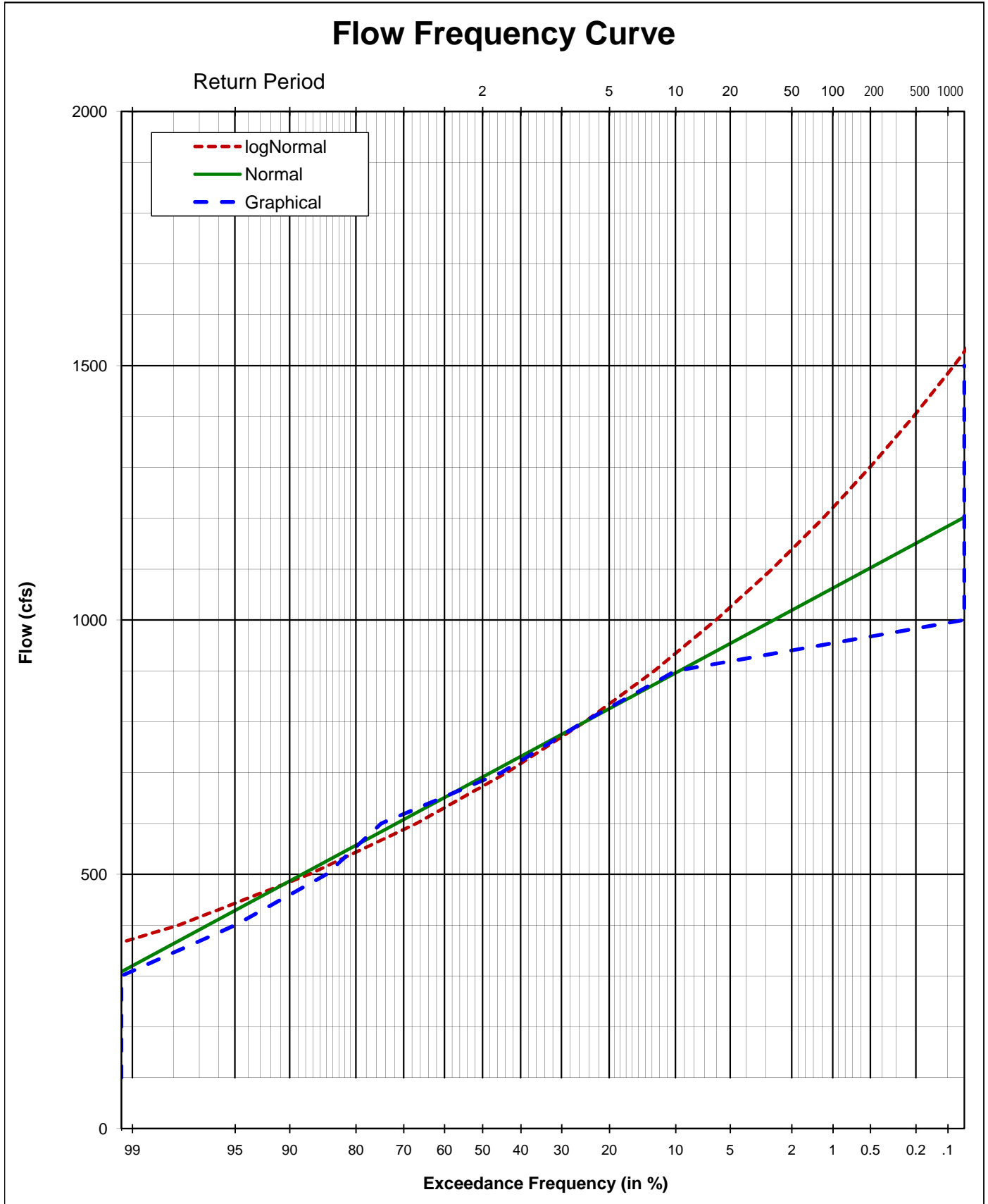
q (1000cfs)	$\frac{q - \bar{X}_Q}{S_Q}$	$P\left(Z \leq \frac{q - \bar{X}_Q}{S_Q}\right)$	log q	$\frac{\log q - \bar{X}_{\log Q}}{S_{\log Q}}$	$P\left(Z \leq \frac{\log q - \bar{X}_{\log Q}}{S_{\log Q}}\right)$
100	-3.71	0.000	2.000	-7.42	0.000
200	-3.08	0.001	2.301	-4.72	0.000
300	-2.45	0.007	2.477	-3.14	0.001
400	-1.83	0.034	2.602	-2.02	0.022
500	-1.20	0.115	2.699	-1.15	0.125
600	-0.57	0.283	2.778	-0.44	0.330
700	0.05	0.521	2.845	0.16	0.564
800	0.68	0.752	2.903	0.68	0.752
900	1.31	0.904	2.954	1.14	0.873
1000	1.93	0.973	3.000	1.55	0.939
1100	2.56	0.995	3.041	1.92	0.973
1200	3.19	0.999	3.079	2.26	0.988
1300	3.81	1.000	3.114	2.57	0.995
1400	4.44	1.000	3.146	2.86	0.998
1500	5.07	1.000	3.176	3.13	0.999
1600	5.69	1.000	3.204	3.38	1.000
1700	6.32	1.000	3.230	3.62	1.000

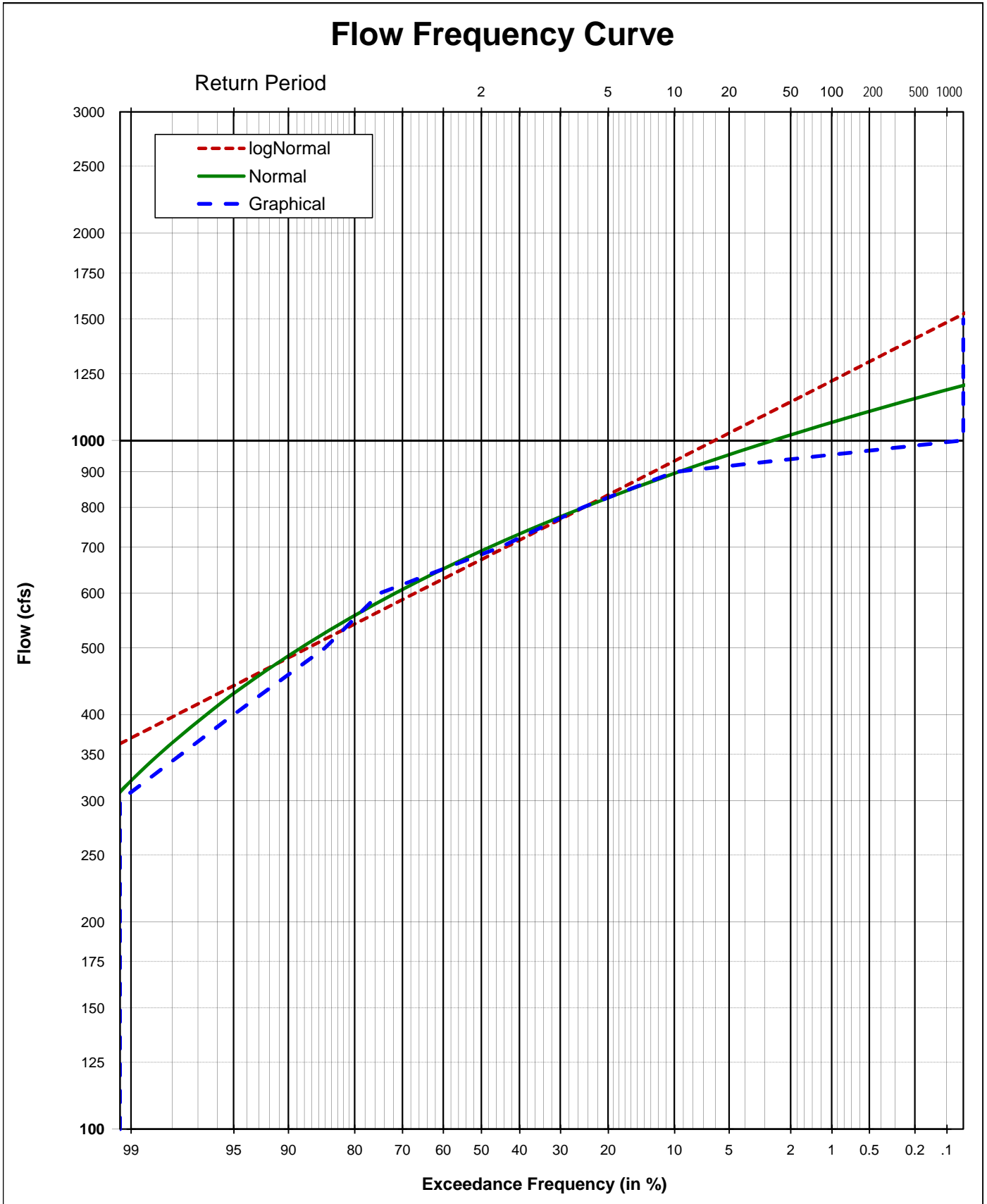




Problem 6

		Graphic	Normal	LogNormal
a)	$P(Q < 700) =$	0.55	0.52	0.56
	$P(Q < 800) =$	0.75	0.75	0.75
	$P(700 < Q < 800) =$	0.20	0.23	0.19
b)	$P(Q < 450) =$	0.10	0.07	0.07
c)	$P(Q > 1000) =$	0.00	0.03	0.06
d)	$Q(0.01) =$	990,000	1,080,000	1,230,000
	$Q(0.5) =$	680,000	690,000	670,000





## Entire Data Set

	year	flow Q	$Q - \bar{X}_Q$	$(Q - \bar{X}_Q)^2$
1	1858	563	-82.1	6740
2	1859	847	201.9	40765
3	1860	668	22.9	525
4	1861	618	-27.1	734
5	1862	948	302.9	91751
6	1863	777	131.9	17399
7	1864	654	8.9	79
8	1865	714	68.9	4748
9	1866	839	193.9	37599
10	1867	671	25.9	671
11	1868	483	-162.1	26275
12	1869	328	-317.1	100550
13	1870	777	131.9	17399
14	1871	856	210.9	44480
15	1872	737	91.9	8446
16	1873	638	-7.1	50
17	1874	582	-63.1	3981
18	1875	684	38.9	1513
19	1876	958	312.9	97909
20	1877	486	-159.1	25312
21	1878	486	-159.1	25312
22	1879	644	-1.1	1
23	1880	915	269.9	72848
24	1881	600	-45.1	2034
25	1882	885	239.9	57554
26	1883	575	-70.1	4913
27	1884	700	54.9	3014
28	1885	485	-160.1	25631
29	1886	676	30.9	955
30	1887	899	253.9	64467
31	1888	567	-78.1	6099
32	1889	306	-339.1	114986
33	1890	638	-7.1	50
34	1891	453	-192.1	36901
35	1892	612	-33.1	1095
36	1893	685	39.9	1592
37	1894	1246	600.9	361085
38	1895	482	-163.1	26600
39	1896	792	146.9	21581
40	1897	788	142.9	20421
41	1898	658	12.9	167
42	1899	797	151.9	23075
43	1900	557	-88.1	7761
44	1901	673	27.9	779
45	1902	656	10.9	119
46	1903	800	154.9	23995
47	1904	643	-2.1	4
48	1905	425	-220.1	48442
49	1906	390	-255.1	65074
50	1907	602	-43.1	1857
51	1908	669	23.9	571
52	1909	694	48.9	2392

## Workshop 1.3 SOLUTION

53	1910	586	-59.1	3492
54	1911	598	-47.1	2218
55	1912	596	-49.1	2410
56	1913	790	144.9	20997
57	1914	524	-121.1	14664
58	1915	358	-287.1	82424
59	1916	761	115.9	13434
60	1917	764	118.9	14138
61	1918	608	-37.1	1376
62	1919	589	-56.1	3147
63	1920	446	-199.1	39639
64	1921	811	165.9	27524
65	1922	714	68.9	4748
66	1923	617	-28.1	789
67	1924	470	-175.1	30659
68	1925	679	33.9	1149
69	1926	303	-342.1	117030
70	1927	738	92.9	8631
71	1928	805	159.9	25569
72	1929	501	-144.1	20764
73	1930	358	-287.1	82424
74	1931	338	-307.1	94308
75	1932	630	-15.1	228
76	1933	759	113.9	12974
77	1934	474	-171.1	29274
78	1935	521	-124.1	15400
79	1936	576	-69.1	4774
80	1937	414	-231.1	53405
81	1938	652	6.9	48
82	1939	423	-222.1	49327
83	1940	411	-234.1	54801
84	1941	353	-292.1	85320
85	1942	477	-168.1	28256
86	1943	586	-59.1	3492
87	1944	365	-280.1	78454
88	1945	542	-103.1	10629
89	1946	622	-23.1	533
90	1947	580	-65.1	4238
91	1948	1078	432.9	187406
92	1949	700	54.9	3014
93	1950	864	218.9	47919
94	1951	694	48.9	2392
95	1952	640	-5.1	26
96	1953	720	74.9	5611
97	1954	639	-6.1	37
98	1955	660	14.9	222
99	1956	972	326.9	106866
100	1957	868	222.9	49686
101	1958	786	140.9	19854
102	1959	691	45.9	2107
103	1960	548	-97.1	9428
104	1961	846	200.9	40362
105	1962	566	-79.1	6256
106	1963	540	-105.1	11045
107	1964	824	178.9	32007
108	1965	731	85.9	7379

Workshop 1.3 SOLUTION

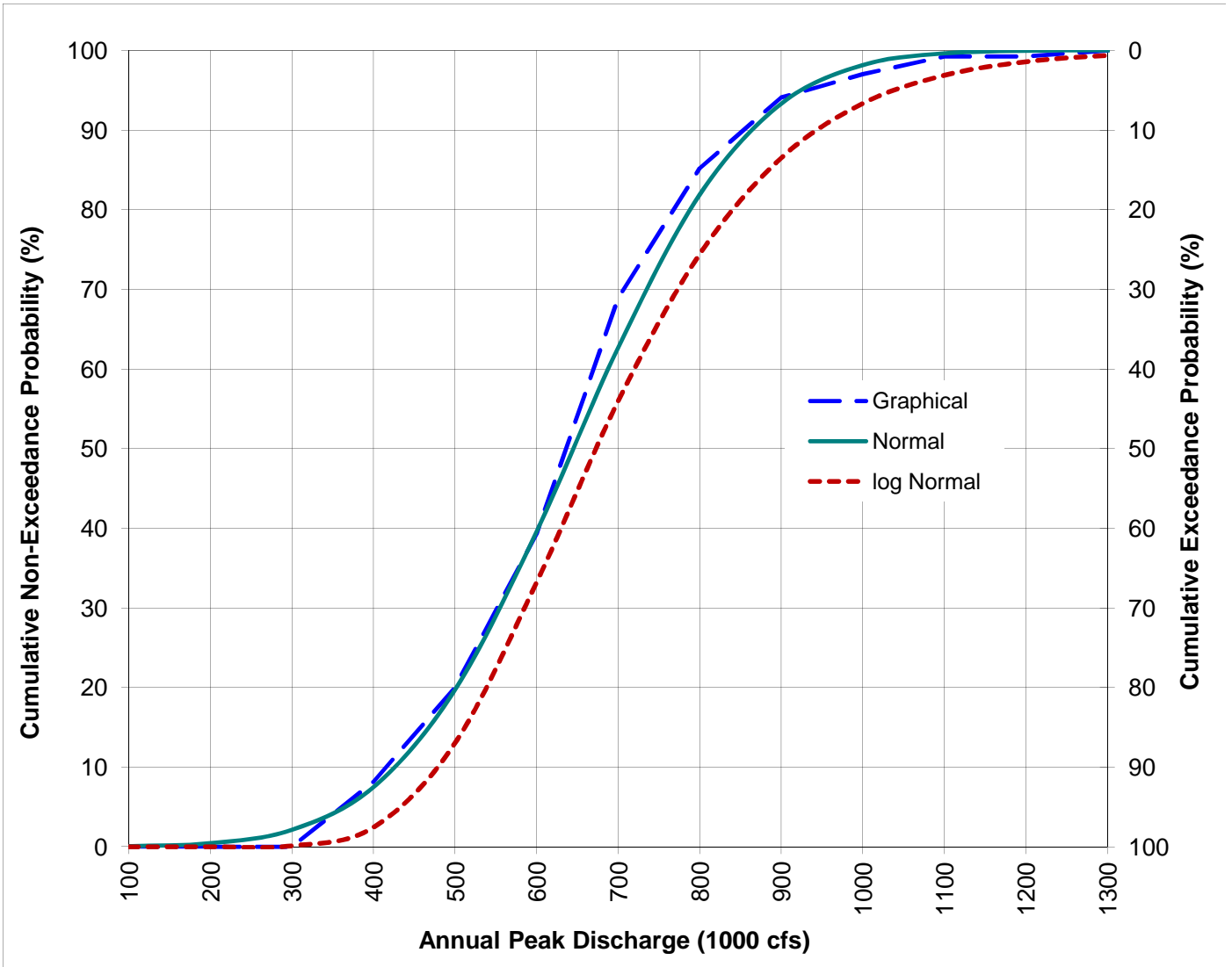
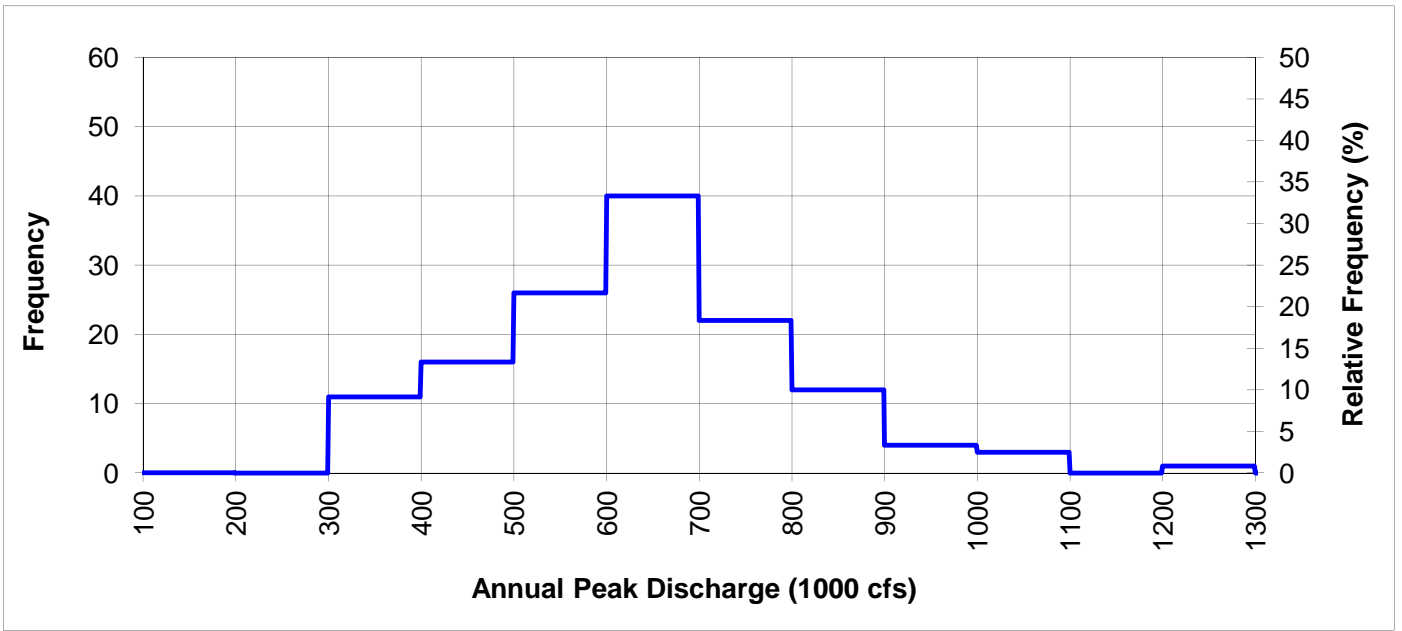
109	1966	518	-127.1	16153
110	1967	845	199.9	39961
111	1968	594	-51.1	2611
112	1969	682	36.9	1362
113	1970	671	25.9	671
114	1971	740	94.9	9007
115	1972	1053	407.9	166385
116	1973	454	-191.1	36518
117	1974	1074	428.9	183958
118	1975	732	86.9	7552
119	1976	685	39.9	1592
120	1977	342	-303.1	91867
121	1978	633	-12.1	146
122	1979	542	-103.1	10629
123	1980	603	-42.1	1772
124	1981	626	-19.1	365
125	1982	793	147.9	21876
126	1983	764	118.9	14138
127	1984	682	36.9	1362
128	1985	614	-31.1	967
129	1986	784	138.9	19294
130	1987	501	-144.1	20764
131	1988	462	-183.1	33524
132	1989	572	-73.1	5343
133	1990	571	-74.1	5490
134	1991	626	-19.1	365
135	1992	393	-252.1	63553

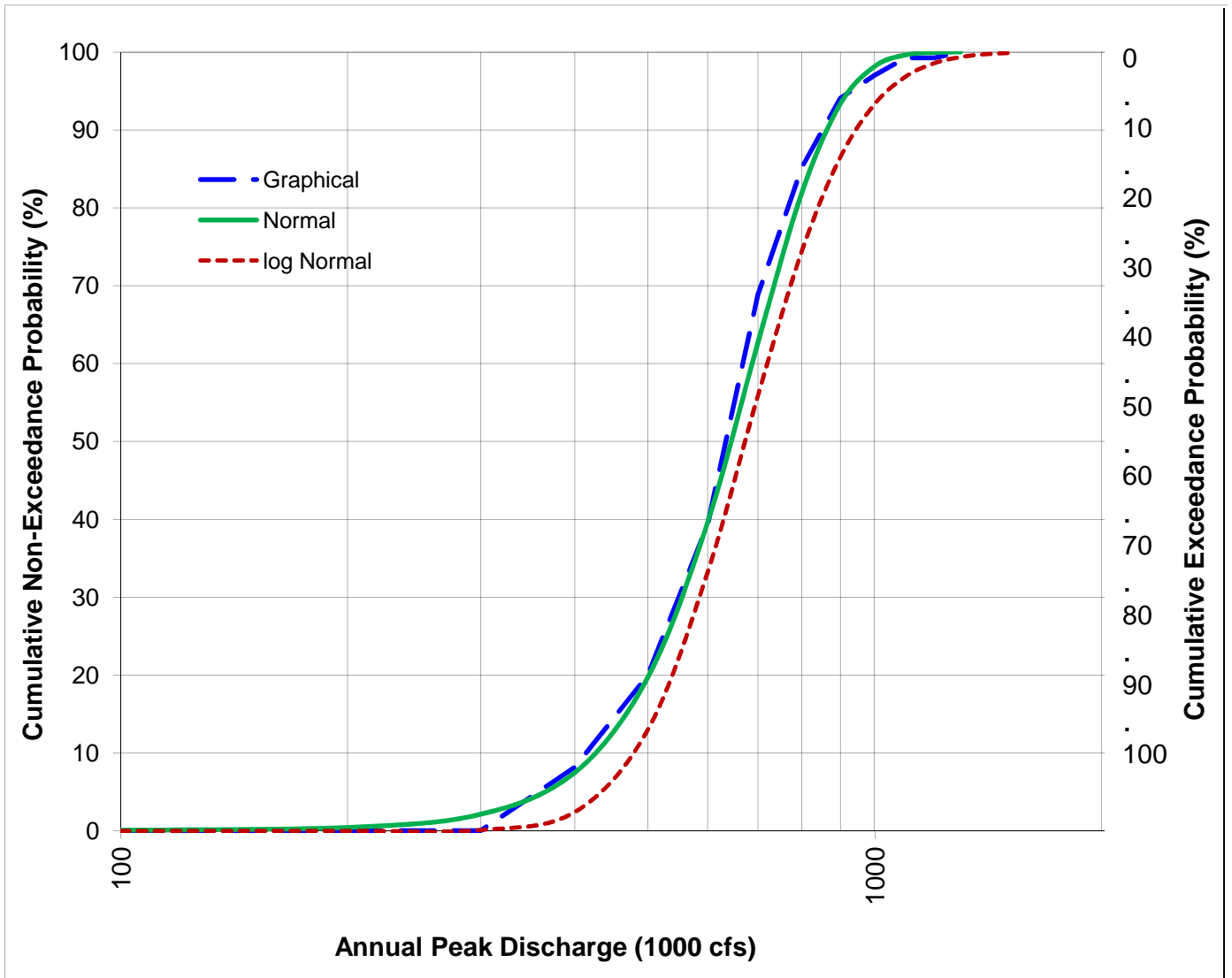
$\bar{X}_Q = \frac{\text{sum} Q}{N}$	87,088	$\text{sum}(Q - \bar{X}_Q)^2$	3879836
	645	$S^2 = \text{sum}/(n-1)$	28954
		$S = \sqrt{S^2}$	170

$\bar{X}_Q =$	645	$\bar{X}_{\log Q} =$	2.828
$S_Q =$	170	$S_{\log Q} =$	0.115

Q (1000cfs)	$\frac{q - \bar{X}_Q}{S_Q}$	$P\left(Z \leq \frac{q - \bar{X}_Q}{S_Q}\right)$	logQ	$\frac{\log q - \bar{X}_{\log Q}}{S_{\log Q}}$	$P\left(Z \leq \frac{\log q - \bar{X}_{\log Q}}{S_{\log Q}}\right)$
100	-3.20	0.001	2.000	-7.23	0.000
200	-2.62	0.004	2.301	-4.60	0.000
300	-2.03	0.021	2.477	-3.06	0.001
400	-1.44	0.075	2.602	-1.97	0.024
500	-0.85	0.197	2.699	-1.13	0.130
600	-0.27	0.395	2.778	-0.44	0.332
700	0.32	0.627	2.845	0.15	0.559
800	0.91	0.819	2.903	0.66	0.744
900	1.50	0.933	2.954	1.10	0.865
1000	2.09	0.981	3.000	1.50	0.933
1100	2.67	0.996	3.041	1.86	0.969
1200	3.26	0.999	3.079	2.19	0.986
1300	3.85	1.000	3.114	2.50	0.994
1400	4.44	1.000	3.146	2.78	0.997
1500	5.02	1.000	3.176	3.04	0.999
1600	5.61	1.000	3.204	3.28	0.999
1700	6.20	1.000	3.230	3.51	1.000







Problem 6

		Graphic	Normal	LogNormal
a)	$P(Q < 700) =$	0.69	0.63	0.56
	$P(Q < 800) =$	0.85	0.82	0.74
	$P(700 < Q < 800) =$	0.16	0.19	0.18
b)	$P(Q < 450) =$	0.14	0.14	0.08
c)	$P(Q > 1000) =$	0.03	0.02	0.07
d)	$Q(0.01) =$	1,090,000	1,060,000	1,250,000
	$Q(0.5) =$	640,000	650,000	670,000

