what it can afford to pay for the utility rather than build its own works. The valuator estimates at present prices the cost of construction of an exactly equivalent plant, from which he deducts a proper allowance for accrued depreciation. To the remainder he adds the value of the acquired revenue and obtains a valuation based on the cost of reproduction—usually designated as "the cost of reproduction less depreciation plus going value."

The municipality may or may not be able to prevent the water company from continuing its business when the new municipal plant is completed. If it cannot the going value will be a maximum, as the city can afford to pay the water company a high price rather than be subjected to disastrous competition. If the city can prevent the water company from continuing its business, it is sure to secure all the revenue within a few years after the new works are completed.

To determine what the going value should be for either of these cases, it is necessary to make a comparison of the financial operation of each plant from the present time up to the time when the new plant is receiving the same gross and net revenues as the old plant is then receiving. The annual differences in favor of the old plant reduced to a present-worth basis will be the going value.

Some broad assumptions have to be made—length of time required to build the new plant, annual operating expenses, depreciation, interest and gross revenue for each plant up to the time at which they are equivalent, and the value of money to be used in calculating the present worth. While the calculation is subject to uncertainty, it is likely to reach much nearer the truth than a mere guess.

Graphs to Forecast Future

Prognostication of the future is much aided by the graphical method. As shown in the illustration, curves can be drawn to indicate the variation of gross revenue and operating expenses for the old plant, and these can be extended into the future years, preferably by straight lines. From these straight lines an equation of operating expenses is derived in the form O = a + bR, in which O is annual operating expenses, R is gross revenue and a and b are constants. Substituting known values of O and R for two points on each of the straight lines, the constant values of a and b are obtained.

The estimated annual gross revenue for the new plant is tabulated and from this an equation may be used to calculate the operating expenses. This gives sufficient data to complete the table. To reduce the net-revenue differences to present worth, it would seem that the rate of interest which the municipality has to pay for money should be used rather than that which the water company should receive as a fair return.

Table I.—Valuation Based on Actual Cost, Including a Fair Return of 8% on Investment, and 1% Depreciation

	1 Plant Cost	2 Operating Expenses	3	4	5	6	7
Year	and Improvements from Year to Year	Including Taxes and Insurance but Not Interest or Depreciation	Gross Receipts from Operation	Total Expenses $(1+2+7^*)$	Total Expenses Minus Receipts (4-3)	Fair Return 8%, Plus 1% Depreciation = 9% on Col. 5	Valuation of Plant at end of Each Year (5 + 6)
1889	\$42,000.00			\$ 42,000.00	\$42,000.00		\$42,000.00
1890	6,535.40	\$2,025.39	\$ 2,249.67	50,560.79	48,311.12	\$ 4,347.99	52,659.11
1891	2,879.92	1,885.36	3,606.66	57,424.39	53,817.73	4,843.59	58,661.32
1892	6,936.30	1,819.99	5,101.43	67,417.61	62,316.16	5,608.43	67,924.63
1893	1,903.61	1,955.96	6,186. 5 9	71,784.20	65,597.61	5,903.78	71,501.39
1894	1,425.85	1,559.92	7,128.58	74,487.16	67,358.58	6,062.26	73,420.84
1895	7,780.83	2,020.84	8,152.77	83,222.51	75,069.74	6,756.27	81,826.01
1896	1,607.65	3,437.83	9,056.45	86,871.49	77,815.04	7,003.35	84,818.39
1897	10,747.41	3,025.36	9,716.35	98,591.16	88,874.81	7,998.73	96,873.54
1898	1,290.32	4,470.75	9,562.28	102,634.61	93,072.33	8,326.50	101,398.83
1899 1900 1901 1902 1903	1,862.82	2,089.35	10,413.49	105,351.00	94,937.51	8,544.37	103,481.88
	532.78	3,479.73	10,803.68	107,494.39	96,690.71	8,702.16	105,392.87
	2,870.80	4,596.83	12,774.14	112,860.50	100,086.36	9,007.77	109,094.13
	3,279.23	4,151.63	11,627.44	116,524.99	104,897.55	9,440.78	114,338.33
	2,779.56	5,252.57	13,207.14	122,370.46	109,163.32	9,824.70	118.988.02
1904 1905 1906 1907 1908	4,322.97	6,284.04	14,363.17	129,605.03	115,241.86	10,371.77	125,613.63
	1,636.30	5,885.11	14,272.20	133,135.04	118,862.84	10,697.65	129,560.49
	7,262.56	6,196.80	16,257.90	143,019.85	126,761.95	11,408.57	138,170.52
	26,412.27	8,209.25	17,772.66	172,792.04	155,019.38	13,951.74	168,971.12
	217.71	7,330.24	17,903.87	176,519.07	158,615.20	14,275.37	172,890.57
1909 1910 1911 1912 1913	522.41	6,631.18	19,253.54	180,044.16	160,790.62	14,471.15	175,261.77
	6,543.13	7,585.01	19,277.86	189,389.91	170,112.05	15,310.08	185,422.13
	11,816.56	4,615.73	21,141.01	201,854.42	180,713.41	16,264.21	196,977.62
	3,560.60	5,464.42	23,856.75	206,002.64	182,145.89	16,393.13	198,539.02
	7,250.51	8,785.21	26,599.76	214,574.74	187,974.98	16,917.75	204,892.73
1914	13,929.53	6,389.78	27,204.29	225,212.04	198,007.75	17,820.70	215,828.45
1915	14,602.90	9,646.46	27,403.57	240,077.81	212,674.24	19,140.68	231,814.92
1916	11,518.71	- 6,698.41	28,775.06	250,032.04	221,256.98	19,913.13	241,170.11
1917	369.93	2,036.63	1,080.62	243,576.67	242,496.05	5,456.16	247,952.21

*Figures for 7 in Col. 4 are for end of previous year.

(Valuation as of January 1st, 1917, by this method, \$241,170.11.)