Reservoir Sedimentation Surveys in the United States

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Periodically, usually about every 5–10 years, the Committee on Sedimentation of the Water Resources Council summarizes data from known reliable reservoir sedimentation surveys made in the United States. The latest summary includes data from surveys made through 1965 for 1212 reservoirs [*U.S. Department of Agriculture*, 1969]. It includes information on reservoir size, drainage area, sediment accumulation and reservoir storage depletion rates, and, in some cases, rainfall and runoff. This report further summarizes these data in an attempt to provide some insight into the relative magnitude of the reservoir siltation problem in the United States.

DATA

Most of the data used in this report were collected by various agencies of the federal government. Some surveys were reported by state agencies in Ohio and Illinois. The reservoirs range from small pond-type structures to those with capacities exceeding 1.2 billion m^3 (1 million acre-feet). For this study, only those reservoirs with complete information on capacity, total and net drainage areas, period of record, and sediment deposition rates were included. Small debris basins and off-stream structures were excluded. One small reservoir in Utah, which completely filled with sediment during one flash flood soon after construction, and Lake Mead, because of its enormous size and comparatively high siltation rates, were also excluded.

The accuracy of the surveys varied considerably; the surveys ranged from reconnaissance-type measurements of deposited sediment to detailed surveys consisting of closely spaced cross sections or contours. Although attempts were made to check the individual reservoir data sheets for computational and clerical errors, no attempt was made to classify the surveys according to degree of accuracy.

Reservoir sedimentation surveys were reported from each of the conterminous United States except Maine and Florida and from Puerto Rico. Geographical distribution of the selected reservoirs is shown in Figure 1. River basin boundaries and numbers were established by the *Subcommittee on Hydrology of the U.S. Inter-Agency Committee on Water Resources* [1961]. Virtually every section of the country is represented, the heaviest concentrations being in the midwestern states, Texas, and California. Many of the river basins, however, are not adequately represented, and no surveys were reported for 11 basins.

RESERVOIR STORAGE DEPLETION RATES

A general summary of the data from the 1105 reservoirs selected for this study is given in Table 1. The total drainage area includes the entire area upstream from the dam including the reservoir but generally excludes areas that do not contribute runoff. Net drainage area is defined as the net sediment-contributing area and generally does not include areas above upstream structures that were considered effective sediment traps. The initial reservoir capacity is the maximum value reported and usually represents the capacity below the crest of an ungated spillway or at the top of the gates of a gated spillway. Storage depletion is the loss of capacity due to sediment deposition. In most instances the period of record is also the reservoir age at the time of the latest survey. The capacity-weighted period of record was computed by summing the product of the reservoir capacity times the period of record and dividing by the sum of the capacities. These values more nearly represent the true period of sediment accumulation for the total capacity in each of the size categories.

As shown by the data in Table 1, the total storage loss in all of the sampled reservoirs was about 4.2 billion m^3 (3.4 million acre-feet) in

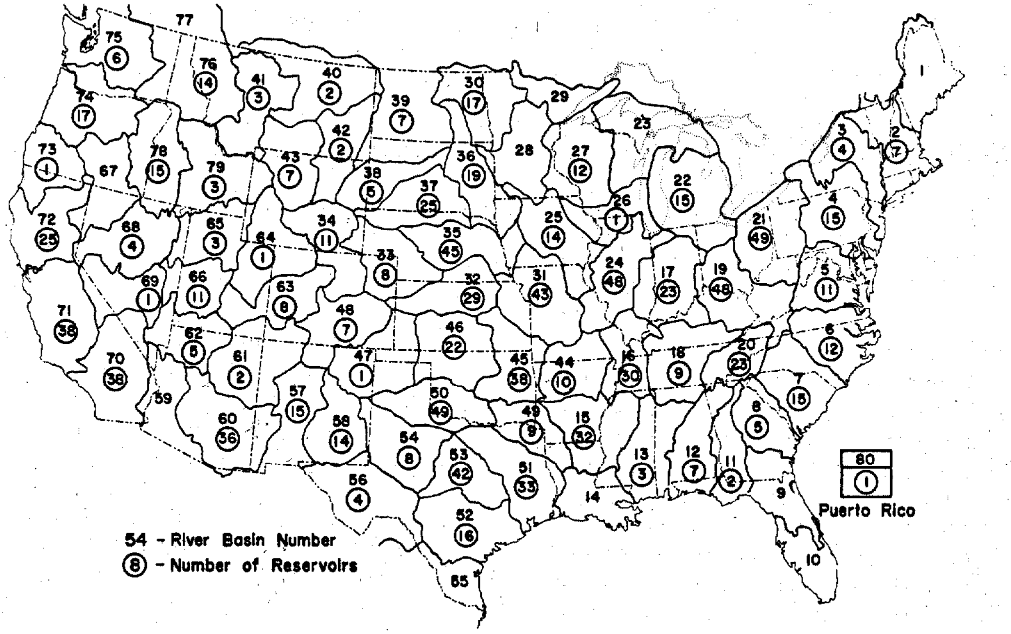

Fig. 1. Geographical distribution of reservoirs.

slightly less than 20 years. This amount represents an average annual loss of about 0.2% of the total capacity. However, this overall depletion rate may not be representative of all reservoirs in the country. The table shows that nearly all of the sampled capacity is in the large reservoirs that have the lowest average depletion rates. Available information on the number of reservoirs in the country indicates that the large reservoirs were much more intensively sampled than the smaller ones [*Martin and Hanson*, 1966; *Soil Conservation Service*, 1970]. Samples representing equal proportions of the total reservoir capacity in each of the size groups would give a higher overall storage depletion rate.

Average annual and median values of individual reservoir storage depletion rates are given in Table 2. They show a remarkably consistent decrease in storage loss rates with increasing reservoir size. For reservoirs with storage capacities of ≤123,300 m^3 (≤100 acre-feet) the average annual storage loss was 2.7% and the median was 1.5%. These statistics suggest that one-half of these smaller structures will be half filled with sediment in ≤33 years.

Storage depletion rates varied widely, particularly among the smaller reservoirs; these rates ranged from 0 to 25%/yr for reservoirs with capacities of ≤12,330 m^3 (≤10 acre-feet). This variation decreased markedly with an increase in reservoir size, as is indicated by the probable error of the mean for each size category in Table 2. Storage depletion rates did not exceed 1.1% for reservoirs with capacities of >123 million m^3 (>100,000 acre-feet) and ranged from 0 to 2.9% for those with capacities of 12.3 and 123 million m^3 (10,000 and 100,000 acre-feet).

Figure 2 shows the proportion of reservoirs in each size category with annual storage loss rates of ≥1%. Again, the highest proportion is in the small reservoirs, and this proportion decreases markedly to only a small fraction of those reservoirs with capacities of >123 million m^3 (>100,000 acre-feet). None of the reservoirs with capacities of >1.2 billion m^3 (>1 million acre-feet) had loss rates in excess of 0.5%. On the other hand, 6% of the reservoirs with capacities of <12,330 m^3 (<10 acre-feet) and 2% of those with capacities of between 12,330 and 123,000 m^3 (10 and 100 acre-feet) had storage loss rates of >10%. The proportion of reservoirs having relatively low storage loss rates corresponds closely to that reported by *Eakin* [1939], *Happ* [1941], and *Brown* [1944] approximately 35 years ago.

WATERSHED SEDIMENT YIELDS

The quantity of sediment trapped in a reservoir is not necessarily a measure of watershed sedi-

TABLE 1. Summary of Reservoir Storage Capacity and Storage Depletion by Capacity Ranges

Reservoir Capacity Range		Number of Reservoirs	Total Drainage Area		Net Drainage Area		Initial Reservoir Storage Capacity		Storage Depletion			Average Period of Record, years	Capacity-Weighted Period of Record, years
ac ft	10^3 m^3		mi^2	km^2	mi^2	km^2	ac ft	10^3 m^3	ac ft	10^3 m^3	%		
0 to 10	0 to 12.33	190	180	466	164	425	844	1,041	217	268	25.7	11.8	12.8
10 to 10^2	12.33 to 123.3	257	454	1,176	437	1,132	9,184	11,328	1,772	2,186	19.3	14.5	16.6
10^2 to 10^3	123.3 to 1,233	283	4,269	11,057	3,634	9,412	112,042	138,204	18,432	22,736	16.5	23.5	22.8
10^3 to 10^4	1,233 to 12,330	176	30,509	79,018	15,191	39,345	567,497	700,008	76,063	93,824	13.4	20.9	21.8
10^4 to 10^5	12,330 to 123,300	107	113,787	294,708	87,458	226,516	4,363,134	5,381,926	395,786	488,202	9.1	23.6	22.5
10^5 to 10^6	123,300 to 1,233,000	69	316,854	820,654	175,636	454,897	23,712,144	29,248,930	864,039	1,065,792	3.6	18.4	17.6
$>10^6$	>1,233,000	23	358,472	928,442	184,227	477,148	60,396,384	74,498,940	2,081,799	2,567,899	3.4	19.1	20.3
		1105	824,525	2,135,521	466,747	1,208,875	89,161,229	109,980,377	3,438,108	4,240,907	3.9	18.6	19.7

ment yield since it does not include deposits above the spillway elevation or sediment transported through the reservoir. Nevertheless, watershed sediment yield is usually the predominant factor controlling siltation rates in reservoirs.

Average sediment yields, as reflected by reservoir deposits, were much higher in the smaller upland watersheds and decreased markedly with increasing drainage area (Table 3). This finding is in accord with the generally held hypothesis of decreasing sediment delivery with increasing drainage area [*Glymph*, 1954; *Happ et al.*, 1940; *Roehl*, 1962]. The sharp drop in sediment accumulation rates for watersheds of ≥25.9 km^2 (≥10 mi^2) and the comparatively moderate decline as drainage area increased above 25.9 km^2 (10 mi^2) suggest that most of the reduction in sediment yield occurs in the smaller upland drainage areas. This suggestion tends to pinpoint most of the sediment problems in the smaller upland reservoirs where sediment yields are highest.

The lower Mississippi River basin (number 15) is a good example of decreasing sediment yield with increasing drainage area. Six of the 32 reservoirs in this basin had drainage areas ranging from 104 to 4000 km^2 (40 to 1545 mi^2) and an annual sediment accumulation rate of 281 m^3/km^2 (0.59 ac ft/mi^2). The remaining 26 reservoirs, all small pond-sized structures with drainage areas of <2.59 km^2 (<1 mi^2), had an average sediment accumulation rate of 3191 $m^3/km^2/yr$ (6.7 ac ft/mi^2/yr), which is >10 times greater than that for the large reservoirs.

The proportion of reservoirs in each drainage area size category with annual sediment accumulation rates of >476 m^3/km^2 (>1 ac ft/mi^2) is shown in Figure 3. Most of these reservoirs have small drainage areas, i.e., <259 km^2 (<100 mi^2). Annual sediment accumulation rates did not exceed 310 m^3/km^2 (0.65 ac ft/mi^2) for reservoirs with total drainage areas of ≥25,900 km^2 (≥10,000 mi^2).

SEDIMENT ACCUMULATION AND RESERVOIR STORAGE LOSS BY RIVER BASINS

Average annual sediment accumulation and storage depletion rates for river basins with 10 or more surveyed reservoirs are given in Table 4. The first-line entry in this table for each river basin gives data for all reservoirs in the basin. The second-line entry gives data for reservoirs with drainage areas of ≥25.9 km^2 (≥10.0 mi^2). The

TABLE 2. Reservoir Storage Depletion Rates

Reservoir Capacity Range		Number of Reservoirs	Annual Storage Depletion Rate		Probable Error of the Mean, %	Average Date of Last Survey
ac ft	10^3 m^3		Mean, %	Median, %		
0 to 10	0 to 12.33	190	3.56	2.00	0.21	1954
10 to 10^2	12.33 to 123.3	257	2.00	1.20	0.09	1954
10^2 to 10^3	123.3 to 1,233	283	1.02	0.62	0.05	1951
10^3 to 10^4	1,233 to 12,330	176	0.81	0.55	0.05	1949
10^4 to 10^5	12,330 to 123,300	107	0.43	0.27	0.04	1949
10^5 to 10^6	123,300 to 1,233,000	69	0.23	0.14	0.02	1955
$>10^6$	>1,233,000	23	0.16	0.11	0.02	1958

area-weighted sediment accumulation rate for each basin was computed by summing the products of the net drainage areas times the sediment accumulation rate and dividing by the sum of the net drainage areas. The capacity-weighted storage loss was computed in the same manner except that the annual storage loss rate and reservoir capacity were used.

Both sediment accumulation and storage depletion rates varied considerably among river basins. There were also large variations between reservoirs in the same river basin. For this reason and because siltation rates were usually much smaller in the larger reservoirs, the area-weighted sediment accumulation rates and the capacity-weighted storage loss rates may more nearly reflect overall basin conditions. Similarly, the data for drainage areas of ≥25.9 km² (≥10.0 mi²) more accurately reflect conditions in the larger reservoirs.

The maximum sediment accumulation rate reported was 29,050 m³/km²/yr (61 ac ft/mi²/yr) for a small reservoir in Iowa. The highest area-weighted accumulation rate was 905 m³/km²/yr (1.9 ac ft/mi²/yr) in the Colorado River basin above Halls Crossing (number 63). The nine reservoirs measured in this basin were small (drainage area of <13 km², or <5 mi²) and the average period of record was only 7 years.

Although some of the highest accumulation rates were reported from arid regions, this generally true situation was not always the case. For example, in the Gila River basin (number 60) in southern Arizona the weighted rate was only 152 m³/km²/yr (0.32 ac ft/mi²/yr) for 36 reservoirs, including 28 structures with drainage areas of <25.9 km² (<10 mi²).

High siltation rates in individual reservoirs and relatively high average basin rates occurred in most sections of the country. River basins 6, 15, 16, 35, 50, 51, 70 and 72, all with an adequate number of structures, had area-weighted basin rates in excess of 286 m³/km²/yr (0.6 ac ft/mi²/yr). Accumulation rates in the larger reservoirs were also much higher than the average. These basins represent a wide range in rainfall, runoff, land use, and types and amount of vegetative cover.

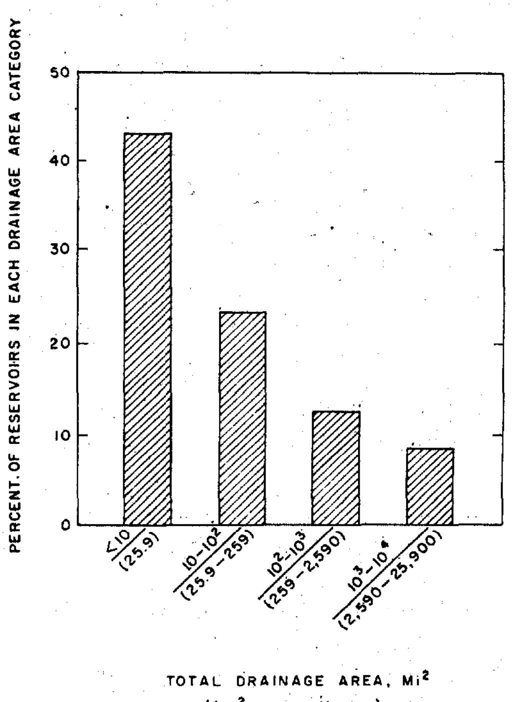

Fig. 2. Proportion of reservoirs in each size category with average annual storage loss rates of ≥1%.

DISCUSSION

Studies of selected groups of reservoirs have established relationships between reservoir siltation rates and various hydrologic, watershed, and reservoir parameters [*Brune*, 1953; *Farnham et al.*, 1966; *Flaxman*, 1966; *Maner*, 1958; *Roehl*, 1962; *Stall and Bartelli*, 1959]. Generally, however, the investigators have pointed out that their findings

TABLE 3. Sediment Accumulation per Unit of Net Drainage Area

Drainage Area		Number of Reservoirs	Average Annual Sediment Accumulation*		Median Annual Sediment Accumulation*	
mi²	km²		ac ft/mi²	10^3 m³/km²	ac ft/mi²	10^3 m³/km²
0 to 5	0 to 12.9	648	1.56	0.74	0.82	0.39
5 to 10	12.9 to 25.9	70	1.45	0.69	0.69	0.33
0 to 10	0 to 25.9	718	1.55	0.74	0.80	0.38
10 to 10^2	25.9 to 259	189	0.71	0.34	0.44	0.21
10^2 to 10^3	259 to 2,590	103	0.53	0.25	0.27	0.13
10^3 to 10^4	2,590 to 25,900	70	0.38	0.18	0.26	0.12
10^4 to 10^5	25,900 to 259,000	25	0.36	0.17	0.39	0.19

*Annual sediment accumulation rates are based on the net drainage area (sediment-contributing area).

were applicable only in the areas where developed. Many complex processes are involved, and the relative importance of controlling factors varies from region to region and even within a region.

It is not the intent or purpose of this paper to establish average reservoir siltation rates for a given locality or river basin to be used as a guide. The wide range in deposition rates in reservoirs of similar size and drainage area, even within a given land resource area, suggests that average rates would be of little value in predicting the useful life of a particular reservoir. Furthermore, the wide range in siltation rates, particularly in the smaller reservoirs, indicates that local parameters rather than climatic or geographic factors govern individual reservoir siltation rates. Widely varying siltation rates in reservoirs with drainage areas of <25.9 km² (<10 mi²) no doubt reflect great contrast in vegetative cover, land use, topography, and perhaps other factors affecting sediment yield.

The data as compiled do provide some insight into the nation's reservoir siltation problems. The smaller reservoirs and ponds (capacities of <123,300 m³, or <100 acre-feet) are filling with sediment at relatively high average rates. A median storage loss rate of 1.5% annually suggests that one-half of these smaller reservoirs and ponds will be filled with sediment in 66 years Furthermore, the utility of many of them will have been seriously impaired by the time they are half full in about 30 years.

Although the overall storage loss rate was low in the large reservoirs, rates were relatively high for many of these structures. For example, 14% of those with capacities of >1.23 million m³ (>1000 acre-feet) and 6% with capacities of >12.3 million m³ (>10,000 acre-feet) had average annual storage loss rates of >1%, which may not be an acceptable depletion rate for structures of this size.

It is difficult to ascertain how representative these data are of all reservoirs in the country. Many of the surveys were made a long time ago; the latest survey dates ranged from 1918 to 1965. Thus the siltation rates reported for many of these reservoirs may not be representative of current conditions. It is doubtful that the soil conservation measures applied to the land in the last 25 years are reflected in many of these data.

The size of the sample appears to be adequate for the larger reservoirs. *Martin and Hanson* [1966] reported approximately 443 billion m³ (359 million acre-feet) of usable storage in 1562 reservoirs with individual capacities of >6.17

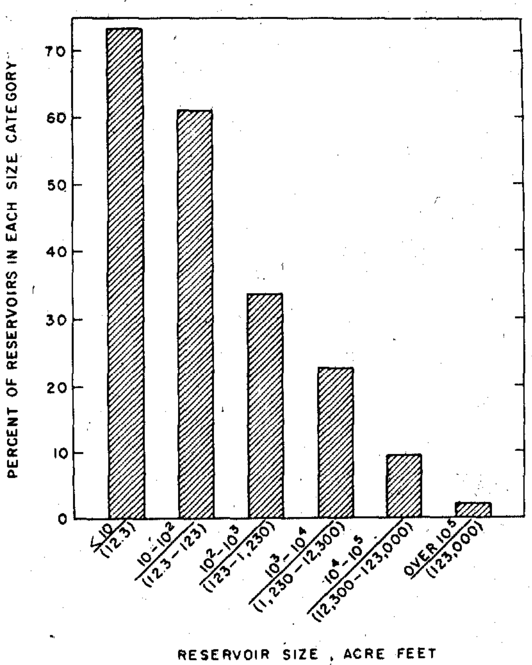

Fig. 3. Proportion of reservoirs in each drainage category with sediment accumulation rates of ≥476 m³/km²/yr (≥1 ac ft/mi²/yr).

TABLE 4. Summary of Reservoir Sedimentation Data by River Basins (Average Values Except as Noted)

River Basin No.	No. of Reservoirs	Total Drainage Area		Net Drainage Area		Original Reservoir Capacity		Average Annual Sediment Accumulation*		Weighted Annual Sediment Accumulation*†		Annual Storage Depletion, %		Period of Record, years
		mi^2	km^2	mi^2	km^2	ac ft	10^3 m^3	ac ft/mi^2	10^3 m^3/km^2	ac ft/mi^2	10^3 m^3/km^2	Average	Weighted§	
4	15	139.3	360.8	128.8	333.6	43,198	53,285	0.27	0.13	0.28	0.13	0.59	0.08	32
	11	188.5	488.2	174.1	450.9	58,531	72,198	0.26	0.12	0.28	0.13	0.51	0.08	32
5	11	80.1	207.5	66.8	173.0	7,441	9,178	0.58	0.28	0.35	0.17	0.91	0.30	19
	10	88.0	227.9	73.4	190.1	8,166	10,073	0.38	0.18	0.34	0.16	0.89	0.30	19
6	12	738.8	1,913.5	702.3	1,819.0	252,912	311,967	0.55	0.26	1.00	0.48	1.39	0.28	12
	8	1,106.1	2,864.8	1,051.4	2,723.1	379,272	467,832	0.66	0.31	1.00	0.48	1.64	0.28	10
7	15	630.9	1,634.0	328.3	850.3	29,613	36,528	0.46	0.22	0.45	0.21	0.76	0.50	22
	12	786.9	2,038.1	408.6	1,058.3	36,857	45,463	0.36	0.17	0.45	0.21	0.71	0.50	24
15	32	184.2	477.1	174.9	453.0	133,891	165,155	6.74	3.21	0.63	0.30	3.45	0.08	11
	6	981.5	2,542.1	931.9	2,413.6	713,918	880,618	0.59	0.28	0.63	0.30	0.08	0.08	16
16	30	53.8	139.3	49.8	129.0	24,475	30,190	1.33	0.63	0.62	0.30	0.71	0.13	21
	5	311.7	807.3	288.3	746.7	144,176	177,841	1.19	0.57	0.60	0.29	0.37	0.12	19
17	23	101.1	261.8	100.1	259.3	11,481	14,162	1.21	0.58	0.12	0.06	0.70	0.11	18
	5	460.4	1,192.4	456.3	1,181.8	51,244	63,209	0.37	0.18	0.11	0.05	0.99	0.10	15
19	48	122.8	318.1	122.0	316.0	18,622	22,970	0.79	0.38	0.17	0.08	1.63	0.11	16
	22	265.3	687.1	263.7	683.0	40,208	49,597	0.43	0.20	0.16	0.08	2.45	0.10	19
20	23	3,089.4	8,001.5	918.2	2,378.1	509,710	628,727	0.45	0.21	0.37	0.18	0.36	0.07	21
	21	3,383.4	8,763.0	1,005.4	2,604.0	558,226	688,572	0.44	0.21	0.37	0.18	0.35	0.07	20
21	49	93.9	243.2	90.8	235.2	29,636	36,556	0.53	0.25	0.30	0.14	1.52	0.09	23
	24	189.2	490.0	182.8	473.5	60,346	74,437	0.41	0.20	0.30	0.14	0.33	0.09	31
22	15	188.7	488.7	182.9	473.7	9,870	12,175	0.92	0.44	0.13	0.06	1.08	0.24	25
	6	469.9	1,217.0	455.5	1,179.7	24,575	30,313	0.59	0.28	0.13	0.06	1.11	0.24	40
24	48	30.2	78.2	29.9	77.4	2,385	2,942	1.01	0.48	0.37	0.18	1.06	0.47	31
	8	171.3	443.7	169.4	438.7	12,892	15,902	0.66	0.31	0.34	0.16	0.83	0.45	23
25	14	248.1	642.6	244.0	632.0	36,285	44,758	1.41	0.67	0.55	0.26	2.61	0.37	13
	9	384.6	996.1	378.3	979.8	56,251	69,386	1.51	0.72	0.54	0.26	3.34	0.37	10
27	12	763.0	1,976.2	71.3	184.7	8,599	10,607	0.48	0.23	0.54	0.26	0.84	0.45	19
	4	2,287.3	5,924.1	212.2	549.6	25,622	31,605	0.27	0.13	0.54	0.26	1.10	0.45	44
30	17	305.0	790.0	165.7	429.2	5,106	6,298	0.17	0.08	0.10	0.05	0.69	0.31	23
	11	470.4	1,218.3	255.2	661.0	7,857	9,692	0.07	0.03	0.10	0.05	0.62	0.31	24
31	43	328.3	850.3	325.9	844.1	49,013	60,458	1.98	0.94	0.47	0.22	2.20	0.31	13
	2	7,020.9	18,184.1	6,970.7	18,054.1	1,045,338	1,289,424	0.50	0.24	0.46	0.22	0.48	0.31	14
32	29	1,004.8	2,602.4	425.2	1,101.3	44,774	55,229	1.22	0.58	0.15	0.07	2.33	0.14	13
	4	7,281.6	18,859.3	3,080.1	7,977.5	324,444	400,202	0.22	0.10	0.15	0.07	1.31	0.14	11
34	11	2,658.8	6,886.3	1,645.8	4,262.6	111,381	137,388	0.19	0.09	0.22	0.10	0.46	0.17	24
	6	4,872.0	12,618.5	3,014.9	7,808.6	203,940	251,560	0.15	0.07	0.22	0.10	0.52	0.17	35
35	45	1.3	3.4	1.3	3.4	69	85	2.89	1.38	0.94	0.45	3.17	1.76	12
	1	41.0	106.2	41.0	106.2	1,652	2,038	0.43	0.20	0.43	0.20	1.08	1.08	33
36	19	55.5	143.7	50.7	131.3	1,200	1,480	2.27	1.08	0.14	0.07	2.00	0.57	12
	4	261.4	677.0	238.8	618.5	5,550	6,846	0.38	0.18	0.12	0.06	0.91	0.53	28
37	25	1.5	3.9	1.5	3.9	33	41	0.56	0.27	0.22	0.10	1.78	0.99	11
	2	11.1	28.7	11.1	28.7	125	154	0.07	0.03	0.06	0.03	1.05	0.58	19
44	10	472.0	1,222.5	471.4	1,220.9	6,520	8,042	0.72	0.34	0.20	0.10	0.60	1.45	10
	4	1,175.3	3,044.0	1,173.9	3,040.4	15,156	18,695	0.39	0.19	0.20	0.10	0.99	1.55	11
45	38	101.1	261.8	99.9	258.7	13,290	16,393	0.91	0.43	0.29	0.14	0.47	0.22	18
	14	269.8	698.8	267.0	691.5	34,579	42,653	1.00	0.48	0.27	0.13	0.46	0.21	18
46	22	807.0	2,090.1	513.3	1,329.4	40,722	50,231	1.05	0.50	0.30	0.14	1.92	0.38	12
	11	1,612.2	4,175.6	1,024.7	2,654.0	81,135	100,080	0.97	0.46	0.30	0.14	0.73	0.38	13
50	49	914.4	2,368.3	685.2	1,774.7	135,393	167,007	1.92	0.91	0.84	0.40	1.18	0.42	13
	8	5,590.6	14,479.7	4,187.1	10,844.6	826,273	1,019,208	1.82	0.87	0.83	0.40	0.79	0.42	18
51	33	446.2	1,155.7	408.7	1,058.5	72,147	88,993	2.34	1.11	0.69	0.33	0.85	0.38	20

TABLE 4. (continued)

River Basin No.	No. of Reservoirs	Total Drainage Area		Net Drainage Area		Original Reservoir Capacity		Average Annual Sediment Accumulation*		Weighted Annual Sediment Accumulation*†		Annual Storage Depletion, %		Period of Record, years
		mi²	km²	mi²	km²	ac ft	10³ m³	ac ft/mi²	10³ m³/km²	ac ft/mi²	10³ m³/km²	Average	Weighted§	
	9	1,628.8	4,218.6	1,491.8	3,863.8	261,969	323,139	1.54	0.73	0.68	0.32	0.71	0.38	14
52	16	2,298.0	5,951.8	2,294.5	5,942.8	81,531	100,568	0.87	0.41	0.15	0.07	1.07	0.42	13
	3	12,245.7	31,716.4	12,227.3	31,668.7	432,834	553,901	0.24	0.11	0.15	0.07	0.85	0.42	17
53	42	844.0	2,186.0	478.8	1,240.1	70,746	87,265	1.23	0.59	0.53	0.25	1.00	0.36	21
	14	2,528.1	6,547.8	1,432.7	3,710.7	211,485	260,867	0.45	0.21	0.53	0.25	0.71	0.36	20
57	15	3,850.6	9,973.1	1,882.6	4,875.9	206,839	255,136	1.11	0.53	0.37	0.18	3.40	0.41	13
	4	14,437.5	37,393.1	7,057.5	18,278.9	775,587	956,687	0.27	0.13	0.37	0.18	0.34	0.41	25
58	14	2,539.5	6,577.3	1,423.6	3,687.1	18,685	23,048	0.52	0.25	0.14	0.07	3.55	1.01	18
	6	5,924.5	15,344.5	3,320.8	8,600.9	43,584	53,761	0.18	0.09	0.14	0.07	1.05	1.01	27
60	36	878.5	2,275.3	693.8	1,796.9	91,706	113,119	0.26	0.12	0.32	0.15	2.69	0.24	16
	8	3,948.1	10,225.6	3,117.3	8,073.8	412,600	508,942	0.29	0.14	0.32	0.15	1.33	0.24	18
66	11	823.7	2,133.4	456.6	1,182.6	33,626	41,478	0.52	0.25	0.21	0.10	1.70	0.29	32
	8	1,129.9	2,926.4	625.1	1,619.0	45,764	56,450	0.26	0.12	0.20	0.10	2.13	0.28	27
70	38	128.5	332.8	91.5	237.0	18,160	22,400	1.77	0.84	0.66	0.31	1.30	0.32	23
	24	201.5	521.9	143.0	370.4	27,343	33,728	1.39	0.66	0.62	0.30	0.94	0.31	24
71	38	153.8	398.3	153.3	397.0	51,057	62,979	0.23	0.11	0.16	0.08	1.08	0.05	22
	13	447.4	1,158.8	445.9	1,154.9	148,972	183,757	0.24	0.11	0.16	0.08	0.47	0.05	28
72	25	50.2	130.0	49.8	129.0	9,787	12,072	0.58	0.28	0.65	0.31	3.19	0.33	18
	7	174.5	452.0	172.9	447.8	34,120	42,087	0.74	0.35	0.66	0.31	0.39	0.34	29
74	17	71.5	185.2	71.0	183.9	13,856	17,091	0.16	0.08	0.16	0.08	0.92	0.09	13
	6	201.0	520.6	199.5	516.7	39,214	48,370	0.18	0.09	0.16	0.08	0.09	0.08	21
76	14	125.8	325.8	125.8	325.8	694	856	1.32	0.63	0.36	0.17	2.19	6.52	8
	1	1,760.0	4,558.4	1,760.0	4,558.4	9,688	11,950	0.36	0.17	0.36	0.17	6.54	6.54	12
78	15	366.0	947.9	319.2	826.7	21,986	27,120	0.11	0.05	0.12	0.06	0.72	0.18	18
	5	1,006.8	2,607.6	956.6	2,477.6	65,919	81,311	0.10	0.05	0.12	0.06	1.18	0.18	30

Second-line entry for each river basin is for reservoirs with drainage areas of >25.9 km² (>10 mi²).
*Sediment accumulation rates are based on net drainage area (sediment-contributing area).
†Area weighted.
§Capacity weighted.

million m^3 (>5000 acre-feet) that were completed or under construction as of January 1963. By applying a mean annual storage loss rate of 0.19% (computed from Table 1) for structures of this size, one can estimate an annual storage loss of 841 million m^3 (682,000 acre-feet) in these reservoirs.

The *Soil Conservation Service* [1970] reported 5282 multiple-purpose reservoirs with a total capacity of 5.49 billion m^3 (4.45 million acre-feet) and 9751 floodwater-retarding structures with a total capacity of 5.66 billion m^3 (4.59 million acre-feet) constructed under its various soil and water conservation programs through June 1969. In addition, 1.7 million farm ponds were reported as being on the land. Most of these multiple-purpose and floodwater-retarding structures range between 123,300 and 6.17 million m^3 (100 and 5000 acre-feet) in capacity. At an average storage depletion rate of 0.6% for reservoirs of this size the annual storage loss would be about 67.8 million m^3 (55,000 acre-feet).

Storage loss in the smaller reservoirs and ponds is more difficult to estimate. If we assume an annual loss rate of 1.25% for 1.7 million small reservoirs and ponds with an average capacity of 12,300 m^3 (10 acre-feet), the annual storage loss would be about 261.5 million m^3 (212,000 acre-feet). This loss, plus that previously computed for the large reservoirs, amounts to nearly 1.2 billion m^3/yr (1 million ac ft/yr), which agrees with earlier estimates [*Glymph and Storey*, 1967].

SUMMARY AND CONCLUSIONS

Sedimentation data are summarized for 1105 reservoirs in the United States. Average annual storage loss rates decreased markedly as reservoir size increased; these rates ranged from 2.7% for small reservoirs and ponds with capacities of <123,300 m^3 (<100 acre-feet) to 0.16% for large reservoirs with capacities of ≥1.23 billion m^3 (≥1,000,000 acre-feet).

Many of the data used in this report were obtained from reservoir sedimentation surveys made many years ago and may not reflect current conditions. If we assume, however, that the data do represent a cross section of the nation's reservoirs, some general conclusions can be made.

1. Overall storage depletion rates of <0.2% annually in the large reservoirs may be well within the design requirements.

2. A median storage loss rate of 1.5% annually for small reservoirs and ponds indicates that the utility of one-half of these will have been seriously impaired when they are half filled with sediment in about 30 years.

3. Storage loss rates in excess of 1% in 14% of the reservoirs with capacities of >1.23 million m^3 (>1000 acre-feet) may not be an acceptable depletion rate for structures of this size.

4. Wide variations in siltation rates, particularly in the smaller reservoirs, indicate that local factors such as land use, vegetative cover, and watershed topography rather than regional or climatic parameters govern individual reservoir sediment deposition rates.

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