

1916 History

SILT SURVEY

The field work for the Silt Survey of Roosevelt Reservoir was completed the last of 1916, and the report worked up in the office in the early part of 1917. Three maps were made in connection with this survey, Nos. 514-31A, 519-31A and 520-31A, copies of which are on file in the Washington, Denver and Project offices. The Silt Survey was written by O. J. Schieber, Assistant Engineer, and is given below:-

The following is a report of the silt deposits in Roosevelt Reservoir as shown by survey completed December 31st, 1916.

A survey to determine the amount of silt deposited in the Roosevelt Reservoir was made during the winter of 1914-1915. Since that time, two wet seasons with large floods have come and gone. The first survey did not show any definite or dependable results, due most probably to errors in the original topography of the Reservoir site.

With the expectation that another survey would show some definite results when compared to the first one, authority was obtained for the making of a second survey during the summer and fall of 1916. Accordingly, a survey party was sent to Roosevelt during the latter part of July. This party was to do the engineering work that was necessary for the construction work at the Dam and to put in the rest of the time on the silt survey. This party consisted of O. J. Schieber, assistant engineer, R. H. Jessop, instrumentman, O. Kitchen, rodman, and O. Berg, chainman. The old Reclamation Service launch was repaired and put in service. Active work was started on the lake, August 8th, first locating monuments and checking the triangulation of the previous survey.

The monuments of the first silt survey were all concrete blocks and were placed approximately on the 235 foot contour. The high water of January, 1916, which stood from one and a half to two feet above these monuments, was accompanied by severe wave action and as a result about 40 of these monuments were found to be washed out, or not found at all.

The replacing of these monuments at higher elevations and on original sounding lines required that the original locations of the monuments be determined by intersection from two monuments which were still in place. This re-established the old sounding line and then it was only necessary to put in the new monuments at higher elevation on this same line.

The washed-out monuments were finally all replaced and the necessary angles turned to tie these new monuments to the triangulation system. The old triangulation system was then checked at several places for azimuth and distance. A traverse with long courses was run from Roosevelt up each arm of the Reservoir. This showed an error of five minutes on the Tonto end in a distance of eight miles and an error of six minutes in a distance of ten miles on the Salt arm. Distances between triangulation stations were checked at Roosevelt and at both ends and found to check very closely with the triangulated distances.

Observations were made on both the Sun and Polaris to check the meridian used on the original silt survey. Those observations checked against each other and showed courses of the survey to be 25 minutes in error. Records of that survey showed that the wrong latitude was used in making their solar observations, which would account for the larger part of their error.

In order to make the survey comparable with the first one, it was necessary to take the soundings along the same lines. The same general method was used in making the soundings. Two transits were used, one to keep the launch in line and the other set up on some adjacent monument to turn the intersection angle.

Two men were used on the water, one to run the launch, and the other to operate the sounding tape. Care was taken to entirely stop the motion of the boat before lowering the sounding weight, so that the tape would be plumb when it touched the bottom and was read. Soundings were not taken when the wind or waves were strong enough to carry the boat off the line and give erroneous intersection or an inclined tape. A fifteen pound sounding weight was used on the end of a 300 foot steel tape. The sounding tape was operated with a reel bolted to the front end of the boat. Intersection angles locating soundings were taken on this reel.

The previous survey was taken at a much lower elevation of the lake. The sections taken at that time began and ended at the edge of the water. Sufficient soundings and levels were taken this time to give complete cross sections. Soundings were taken from 100 to 500 feet apart, depending on the topography of the bottom. The elevation of the lake was obtained each day from the hydrographer at Roosevelt and the soundings were then referenced to the lake elevation.

The triangulation system was extended up both ends of the lake so as to include the 225-foot contour. The previous survey section ended at contour 180. Six new cross-sections were taken on the Tonto end and seven on the Salt end. Most of these were taken with level and tape as they were above the lake elevation.

The making of the survey extended from August 8th to December 31st. This was due mostly to the fact that nearly one-half of the party's time was spent on construction work at Roosevelt Dam. The boat also gave considerable trouble, at one time delaying the work for a whole month due to a broken crank-shaft.

Additional work was also required as about 40 monuments had to be replaced and ten or twelve new ones established. This practically doubled the amount of work contemplated when the survey was started. Bad weather on the lake also delayed the soundings several days at a time. However, no time was lost, as men used the time in the office figuring triangulation work when not engaged in the out-door survey.

In checking over the computations, the original triangulation was found to be in error in a few cases which made it necessary to figure the entire triangulation. A new drawing, #514-31A, was made showing the corrected triangulation system with the location of the replaced monuments and the extensions at both ends of the lake. The dotted lines on this drawing show the lines on which soundings were made.

On drawing #520-31A, are plotted cross-sections showing the reservoir bottom along the lines on which the soundings were made. The full line shows the original bottom as determined from the original plane table topography taken in 1901. The short dash line shows the bottom as indicated by soundings of the 1914 survey. On many of the sections, the original bottom showed higher than on either the 1914 or 1916 survey. The 1916 survey is indicated by the dot-dash line. In cases like this, the difference between the 1914 and the 1916 sections was taken as a basis for estimating the amount of silt prior to 1914 and the original section was then shown a corresponding distance below the 1914 section.

The 1914 survey did not extend above the 180 foot contour, so above this elevation, at both ends of the lake, sections show silt accumulations based on present survey and original topography. This shows a total of eight to twelve feet of silt on the Tonto end and from twelve to twenty-two feet of silt on the Salt end. On the main body of the reservoir between sections 26-37a and 77-68, 1914 and 1916 sections show an average depth of deposit of about two feet uniformly distributed over the bottom. In the narrow portion of the land next to the Dam, six to eight feet of silt has been deposited since 1914. Compared with the original section, a total of 22 to 28 feet of silt is shown to have been deposited there. Most of this probably occurred during the construction of the Dam when this section of the Reservoir acted as a stilling basin for a long period.

Drawing #519-31A is colored to show the distribution of total silt to date. This shows the greatest deposits at both ends of the lake and in the narrow neck next to the Dam. Heavy deposits are also shown along the old Tonto and Salt channels. These were probably filled up as the lake filled, the rivers depositing their silt at the entrance into the lake.

On the same drawing as the cross-sections, tables are made showing the end areas for the 1914 and 1916 sections, with the corresponding silt volumes between adjoining sounding lines. On drawing #520-31A a table is also given showing a summary of the silt for both surveys for the entire reservoir.

The 1914 survey showed 14,000 acre-feet of silt in the report made at that time. All the data of the 1914 survey was refigured and replotted in conjunction with the 1916 survey. After replotting the original sections from the old topography and correcting where this was evidently wrong, the 1914 soundings now show a silt deposit of 26,740 acre feet. Over the same area as the 1914 survey, the 1916 survey shows an increase of 19,230 acre feet. On the ends of the reservoir not shown by the 1914 survey, the 1916 survey shows a total of 16,080 acre feet. This makes a grand total of 62,050 acre feet of silt deposited in the reservoir to the date of this last survey.

Taking 1911 as the beginning of storage at Roosevelt and using the total silt deposit of 62,050 acre feet, this gives an average deposit of 10,340 acre feet per year. Using 1,367,000 acre feet as the capacity of the Reservoir, the average yearly deposit figures .755 of one per cent of the total capacity. At this rate, it would take 132 years to completely fill the reservoir. The 1916 survey shows an increase of 35,310 acre-feet of silt over the 1914 volume. For two unusually wet years, this shows an annual deposit of 17,655 acre feet, or 1.29 percent per year and would make the total life of the Reservoir 77 years. However, in view of the fact that the original topography is not reliable and that the two years for which we have good data are exceptional years, it is difficult to draw any definite conclusions as to the probable life of the Reservoir. Another survey six or eight years from now will be necessary before any definite estimates can be made.

WALTER WARD