



US Army Corps
of Engineers
Omaha District

James River Basin

Sedimentation Conditions at Pipestem Lake, North Dakota 1973-1993

September 1994

M.R.D. Sediment Memoranda

No. 17

SECTION I - INTRODUCTION

PURPOSE

The purpose of this Missouri River Division Sediment Memoranda is to document pertinent data and information relative to aggradation and degradation conditions at Pipestem Reservoir between 1973 and 1993.

SCOPE OF WORK

This report has been prepared in accordance with EM 1110-2-4000, Sedimentation Investigations of Rivers and Reservoirs (dated 15 December, 1989).

Data compiled for this report include historic channel geomorphology and pool elevations.

The report format assembles data and background information in the form of discussions, tables, and plots to identify any significant trends in the geomorphic character of the stream study reach.

DESCRIPTION OF PROJECT

Study Area

Location: Plate I.1 shows the location of Pipestem Dam. Pipestem Reservoir is located three miles northwest of the city of Jamestown, North Dakota, on Pipestem Creek, a tributary of the James River. It is situated in a narrow valley formed by glacial recession. Valley widths average between 1000 and 3000 feet, with the valley bottoms 50 to 100 feet below the plains.

Background: Pipestem Dam was built in 1973 to provide flood protection to the city of Jamestown, in addition to flood protection provided by the Jamestown Dam. Pipestem Dam is a rolled earthfill dam measuring 3500 feet long at the crest and standing 90 feet above the valley floor. A detailed information sheet on the dam and reservoir is shown in Table I-1. Additional project data

can be found in Engineering Form 1787 in Appendix B.

Climatology

The climate of eastern North Dakota is generally semi-arid. Extreme seasonal temperatures are experienced in the Pipestem Creek drainage basin ranging from -22°F to $+99^{\circ}\text{F}$ with a mean annual temperature of 41.5°F . The coldest months are January and February while the warmest months are July and August. Average annual precipitation for the Pipestem Creek drainage basin is 17.5 inches. Average annual runoff for the Pipestem Creek drainage basin (380,160 acres) since closure of Pipestem Dam in 1973 is 0.8 inches (25,521 acre-feet).

SECTION V - SUMMARY OF TREND ANALYSIS

AGGRADATION REACH TREND SUMMARY

A slight aggrading trend is noted in the thalweg and average bed plots for the aggradation reach. Effects of sediment deposition are most notable where tributaries join with the main channel in the segments nearest the dam.

Insignificant changes in surface area are noted since closure of the dam in 1973. Gross storage in the lake decreased by 486 acre-feet between 1973 and 1990 (from 138,397 to 137,911 acre-feet). Most of this loss is experienced in the segment from the dam to about 5,500 feet upstream of the dam, and is probably due to sediments transported in and deposited by tributaries.

SEDIMENT DISTRIBUTION

Design estimations of the distribution of deposits in the upstream reach of the dam (DM No. JP-6) indicated that sediment deposition would reduce the flood control storage by 1,000 ac-ft and the multipurpose storage by 4,000 ac-ft after 100 years of project operation.

Sediment storage in the flood control pool decreased by 316 ac-ft (32%) between 1973 and 1990, a depletion rate of 19 ac-ft per year. According to this measured depletion rate, remaining sediment storage in the flood control zone will be depleted in about 36 years. However, this will have little or no impact on the project's ability to control flood inflow.

Sediment storage below the top of Pipestem Lake's multipurpose pool decreased by 163 ac-ft (4%) between 1973 and 1990. Remaining storage in this zone is projected to be depleted in about 384 years (year 2377) at the observed sediment deposition rate of 10 ac-ft per year.

Actual distribution of sediment deposition indicates that original estimates of sediment distribution in the

multipurpose zone are high, and that estimates of sediment distribution distribution in the flood control zone are a bit low. Gross sediment storage in the reservoir decreased by 479 ac-ft (about 10%) between 1973 and 1990. Remaining sediment storage in the lake will be depleted in about 156 years (year 2146) at the observed gross capacity depletion rate of 29 ac-ft per year.

DEGRADATION REACH TREND SUMMARY

An increase in thalweg elevation of as much as 2.5 feet is seen in portions of the degradation reach. In the reach immediately downstream of the dam and extending downstream a distance of about 5,000 feet, a mild degrading trend is seen. These thalweg changes may reflect the creek's low flow state, with ephemeral pools and intermittent streamflow. Survey error could account for some of the change. The average channel bed has experienced changes of less than a foot, with no clear aggrading or degrading trend seen. No discernable changes were noted in channel cross section areas.

ENG FORM 1787

ENG FORM 1787, "Reservoir Sedimentation Data Summary" is located in Appendix B. The purpose of this form is to provide a means for the uniform documentation of pertinent Pipestem Lake sedimentation data.