MISSOURI RIVER

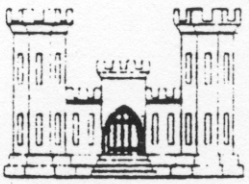
CHANNEL REGIME STUDIES

PREPARED BY

U. S. ARMY ENGINEER DISTRICT, OMAHA

CORPS OF ENGINEERS

OMAHA, NEBRASKA



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U. S. ARMY ENGINEER DIVISION, MISSOURI RIVER
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M.R.D. Sediment Series

NO. 13B

Water and Air Temperature Relationship.

48. Comparisons of the mean daily air temperatures and water temperatures were made to determine the time lag between air and water temperature changes at Omaha. Changes in the water temperature appear to lag changes in air temperature by about three days.

Effects of Wind on River Stage.

49. An attempt was made to determine the effects of wind on river stage by comparing the stage shift occurring at the time of a discharge measurement with the wind velocity and direction. No correlation was noted using this method. It is planned to compare the stage recorder chart data with the wind velocity and direction data to see if a correlation exists.

IV SUMMARY

50. This report presents the data collected during the 1966, 1967, and 1968 study periods. The principal results and tentative conclusions based on the three years of record are as follows:

a. The water surface of the Missouri River at Omaha lowers, with no reduction in discharge, from 1 to 2 feet between the months of September and November. The mean daily discharge of the river remains relatively constant through this period due to control imposed by the upstream system of dams. The shift in stage appears to be very closely tied with a steady decrease in the water temperature of about 30°F during the period. The shift appears to be taking place in that reach of the river above the confluence of the Platte River, and is not confined within the reach limits of this special study. The average drop in stage approaches two feet, and is quite consistent throughout the Missouri River from Sioux City to Omaha, a distance of over 100 miles.

b. The three years of record obtained on the special 7 mile study reach of the Missouri River indicate the following:

1. The discharge varied between 31,000 and 34,000 cfs except for occasional short-duration rises.

2. The average velocity of the flow in the reach increased from 4.5 fps in August to 5.0 fps in November.

3. Mannings resistance coefficient "n" decreased from 0.020 in August to 0.015 in November.

4. The average channel dimensions in the reach do not appear to be going through any gross changes such as a general degradation of the bed or erosion of the banks. Minor changes or shifts in the locations and orientation of bars and sand waves at given locations within the reach may be occurring as the shift takes place.

5. A downward shift in the water surface does not necessarily result in a corresponding decrease in "unobstructed or useable" water depth over the dunes. The 1966 data indicates a tendency for the average depth over the dunes to increase as the bed becomes smoother, while the 1967 and 1968 data indicate that the depth over the dunes remains about constant as the shift occurs. This analysis is based only on the longitudinal sounding data obtained along the channel centerline.

6. The proportion of the bed completely void of dune formations increases from near zero in August to near 80 percent in late October and November. An evaluation of the portion of the bed containing dunes revealed that in 1966 the dunes gradually increased in length and decreased in amplitude through the fall period, resulting in a net reduction in dune steepness. This analysis suggests that when the channel bed changes from dunes to a flat bed, it is not necessarily a gradual lengthening and flattening process, but may alter its effective roughness by changing the dune steepness, which can be accomplished by changing the dune length, dune height, or in some cases, both factors.

7. A general coarsening of the material in suspension is evident as the smoothening of the bed occurs. A slight coarsening of the bed material may also be occurring.

8. An increase in the total amount of material in suspension also occurs. The largest increase appears to be taking place in the 0.105 to 0.149 mm particle size range.

9. As the bed smooths out, the slope of the velocity profile in the vertical, "N", tends to increase through the fall months. This trend, coupled with a general increase in the amount of material in suspension, indicates that less turbulence or mixing of the flow may be taking place within the vertical. Computations of the Von Karman "k" value show a wide range of values, thus making it difficult to correlate the various hydraulic and sediment parameters.

c. The analysis to date indicates that the observed shift is the result of a change in overall channel resistance and not the result of a general lowering of the bed profile, or other change in channel dimensions. This change in resistance is primarily a result of a transformation of the bed from one composed of dunes and a high degree of turbulence, to one where the bed is virtually void of dunes. The above phenomena are closely associated with the observed changes in water temperature, which apparently serve as the triggering mechanism. Separating the effects of the various parameters known to influence the resistance to flow in alluvial channels remains as one of the major objectives of this study.

V. FUTURE SURVEYS

51. Additional observations are planned during the 1969 season. Emphasis will be placed on obtaining additional suspended sediment samples and corresponding velocity distribution data at a common location in the reach. Information on the bed form present along the flow streamline