new twist on sediment

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INTERNATIONAL PARTNERSHIP made possible the construction of these curved divide walls at the Superior-Courtland Dam and canals. Far-off India helped solve the problem of diverting and keeping the canal clean. *Photo by R. Boyce, Region 7.*

FROM THE BUREAU'S RESEARCH LABORATORIES in Denver comes the good news of the latest successful effort to curb one of the water users' stealthiest enemies—sediment.

The new development is based on the laboratory-tested technique called curve principle of diversion. It has been adapted in the design of the headworks for the Superior and Courtland Canals which start at the Superior-Courtland Diversion Dam. The dam is a brand new feature of the Missouri River Basin project on the Republican River near Guide Rock, Nebr.

Here is the background on the research development of the curve principle and its application—the new twist on sediment.

When the preliminary designs for the Superior-Courtland Diversion Dam were being studied, engineering brows were furrowed in concern over the large concentration of sediment that will be carried by the Republican River to the dam. This load of river-bed material could then be drawn into the headworks of the Superior and Courtland Canals which flank the upstream side of the diversion structure. From available data on the river's sediment concentration, the engineers learned that the bed load averaged about two-tenths of 1 percent of the water discharge during the years from 1943 to 1946. Applying this percentage to the water requirements for irrigated lands to be served under these canals, they then deduced that should this same sediment-laden water enter the headworks without hindrance, the bed-load material deposited would amount to about 170,000 cubic yards each year.

Definitely a headache for the Bureau's sedimentation specialists and a whopping potential backache for the shovel-wielding irrigation farmer!

The engineers of the Denver hydraulic laboratory were then consulted and asked to assist in recommending a design which would reduce the amount of coarse sediment transported through the headworks of the canals.

The hydraulic research engineers reasoned that the best plan of attack was to keep the sediment in the Republican River and out of the Superior and Courtland Canals—which at first appears as a truism, but which in actual practice was easier said than done. True, the famed desilting works at the Imperial Diversion Dam on the Colorado River operate successfully in keeping sediment out of the All-American Canal, but the cost of constructing a similar desilting scheme for the Superior-Courtland diversion was prohibitive.

In their review of existing works the engineers' attention turned abroad to the several successful sediment control schemes for diversion dams developed by the Government of India. These con-

trol schemes consist of divide walls which split the stream of water, allowing clear water to run into the canal headworks and diverting the sediment-laden water downstream. Although the Indian rivers and divide walls are much larger than the Superior-Courtland diversion, the principles evolved and practiced applied substantially to the Republican River undertaking. Accordingly, from these studies of the Indian Government's developments came the specific approach to the hydraulic model studies on the Superior-Courtland Dam.

A model of the diversion dam one-fifteenth in size to the full-size structure was constructed in the laboratory, and experiments were begun on models of various types of divide walls. The goal constantly before the engineers was to develop a method of diverting as much of the sediment downstream and at the same time arrive at a solution which would be within reasonable cost limits to the project.

To keep the model as large as possible and thereby assure the greatest similarity between the model and prototype (full-size structure), one-half of the model diversion dam was tested at one time. The right half of the dam, which includes the Courtland headworks and sluiceway, was tested first. Experiments were then conducted on the left half, comprising the Superior headworks and sluiceway.

Sediment was fed in the model basin constructed upstream from the diversion dam, at a rate which would duplicate the concentration of sand in the water of the Republican River. An electric vibrator type of apparatus was used to allow an even flow of sand to be dispersed in the water from the supply hopper. A system of sampling the discharge of water and sediment in both the headworks and sluiceways was also perfected so that the rate and volume of sediment entering the headworks of the canals could be detected immediately. The apparatus devised indicated the concentration of sediment in each of the samples taken from the headworks and the sluiceway. Comparison of these concentrations for each scheme soon revealed the particular arrangement which would allow the least amount of sediment to enter the headworks.

First tests conducted were those on the headworks and sluiceways without the addition of divide walls. Then various modifications were tried out on the model and were subject to exhaustive study. Without the divide walls, the tests disclosed that a higher concentration of sand entered the headworks of the canals than the concentration going through the sluiceways and into the river below. Conversely, by adding the divide walls, the concentration of sediment entering the sluiceways was much greater than in the headworks.

These tests clearly showed the advantage of di-

RECEDING FLOOD on Republican River (below) shows curved steel sheet piling wall at Superior headworks. Right, silt bed in model of Courtland Canal. Below, E. J. Carlson (center) adjusting sluice gate on model of Courtland headworks, O. S. Hanson (right) regulating sand feed into dam as R. S. Brown (left) checks sediment samples. *Two photos at right by G. F. Breitung, Branch of Design & Construction, Denver, Colo. Photo below by R. Boyce, Bureau of Reclamation.*

vide walls in diverting coarse sediment from the canals' headworks. From this clear-cut picture of sediment action, the laboratory hydraulicians constructed models of two curved divide walls. One wall extended upstream between the dam and the Superior headworks; the other was placed athwart the Courtland headworks. Thus the curve principle of sediment division was evolved and adapted.

Stated simply, the principle is based on this fact: If water is twisted or channeled around a curve, the sediment moving on or near the bed tends to move to the inside of the curve and is diverted back into the river below the dam.

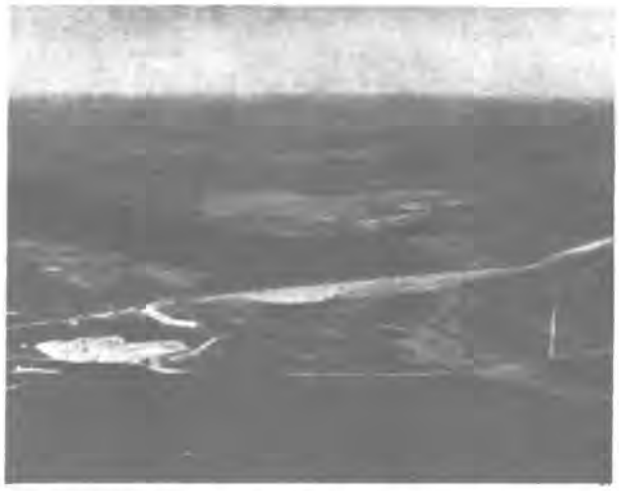
On the basis of this laboratory work, two curved walls of steel sheet piling were subsequently driven upstream from the Superior-Courtland Diversion Dam. The wall protecting the Superior Canal headworks is about 50 feet long; the wall for the Courtland Canal headworks is over 100 feet long. Both walls are topped by a continuous concrete cap 10 inches thick.

By installation of these comparatively minor additions to the diversion structure the relatively sediment-free portion of the stream flow is channelled into the canals. Water carrying about two-thirds of the sediment is twisted away from the headworks and is carried away into the river.

The research engineers look upon the curved walls as a step forward in licking the knotty sediment problem on Reclamation projects. In the past, water users have grudgingly accepted sediment as a necessary evil. However, the curve diversion walls appear as the most promising of several solutions in minimizing the influx of this elusive element into irrigation facilities.

To the water users who will benefit by the new Superior-Courtland Diversion Dam, the curved guide walls may be the answer to the endless cost and effort in dredging thousands of yards of sediment that choke canals and laterals. THE END.

FIRST KANSAS DAM COMPLETED UNDER MISSOURI RIVER BASIN PLAN



CEDAR BLUFF DAM, on the Smoky River in Kansas, begun on April 1, 1949, is to be dedicated June 10, 1951. This multiple-purpose dam, combining flood control and irrigation features, will work in conjunction with Kanopolis Dam, also on the Smoky Hill River near Salida, Kans. An irrigation district is now in the process of being formed on the irrigable land just below Cedar Bluff Dam. It is the first dam to be completed in Kansas under the Missouri River Basin project plan, and is one of several dams proposed for control of flood waters in the Kansas River Basin. Other dams in the Kansas River Basin now completed, or near completion, include Bonny Dam in Colorado, Medicine Creek, Trenton and Enders Dams in Nebraska (all built by the Bureau of Reclamation), and Harlan County Dam, near Republican City, Nebr., being built by the Corps of Engineers. Among the dignitaries to attend the dedication are Congressman Wint Smith of Kansas, President of the National Reclamation Association Harry Polk, and Commissioner of Reclamation Michael W. Straus. *Photo by N. T. Novitt, Region 7 photographer.*

Work Started on Big Thompson Weatherproof Power Lines

During the next 14 months the Trans-Electric Co. of Louisville, Ky., will be constructing one of the country's toughest power transmission lines, on the 59-mile route over the Continental Divide between Gunnison and Salida, Colo., as part of the Colorado-Big Thompson project.

The contractors, who received the award in late March and were to start work within a month, will string the 115-kilovolt, aluminum, steel-reinforced cable over some of the most rugged terrain in the United States. The line will begin at a point about 5 miles west of the city of Salida, and the contractors will use as many as 1,000 wood poles, from 50 to 75 feet high to support the aluminum lines. A 24-mile stretch crosses Monarch Pass (11,312 feet high) and while constructing this portion of the line the crews will be working at altitudes of 8,500 feet and higher. Four miles of this section will get special bracing, designed to hold up under 1¼ inches of ice, 60-mile-an-hour gales, and 20°-below-zero temperatures. When the line is completed it will carry low-cost Colorado-Big Thompson project electricity to the city of Gunnison, REA cooperatives, and other preference customers in the area through wheeling arrangements with the Public Service Co. of Colorado. ●

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