FIRST OBSERVATIONS OF HYDRAULIC MODEL STUDIES OF A TRAVELING SCREEN IN AN ICE HARBOR TURBINE INTAKE

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March 3, 1969

INTRODUCTION

Hydraulic model studies of the traveling screen are now underway at the Albrook Hydraulic Laboratory, Washington State University, Pullman, Washington. The studies, employing a 1-to-12-scale model of an Ice Harbor turbine intake and gatewell, are being conducted by Dr. August Mueller under the direction of Dr. John Orsborn.

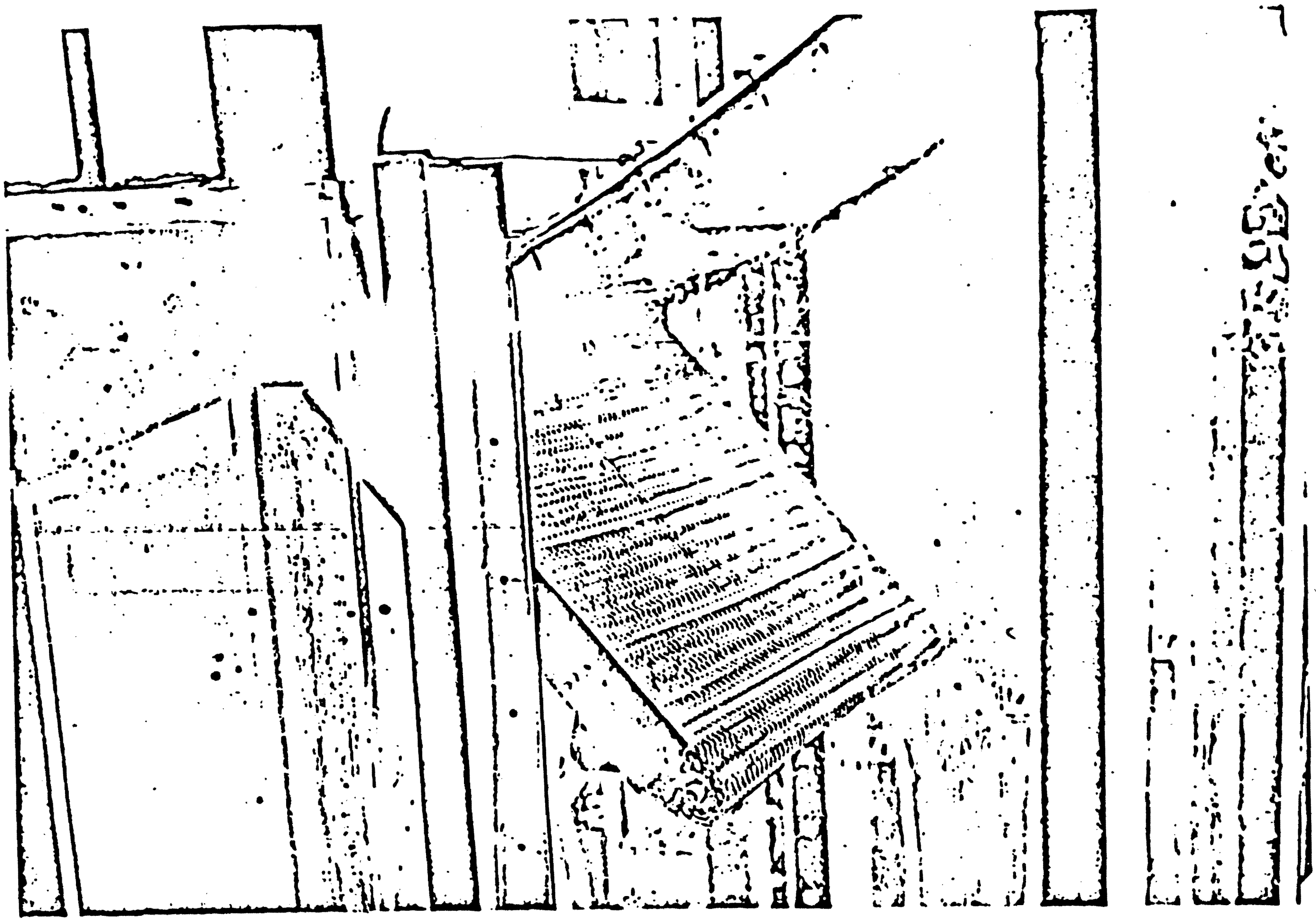
Messrs. Richard Duncan and Winn Farr of the Bureau were on hand at the Laboratory Wednesday, February 26, to observe some of the first tests, and Clifford Long viewed tests March 5. This is a letter report of these first observations. It should be clearly understood that these observations are preliminary because much testing remains to be accomplished. However, there appears to be no particular reason for suspecting that subsequent tests will change significantly the basic information provided here.

MODEL

The model turbine intake and gatewell is constructed on a 1-to-12 scale. One side is of plexiglass to facilitate observations.

The screen of the traveling screen is of standard, or full-scale, size (Figure 1). At present, the screen and frame are about 30 percent open. The frame is constructed so that its length may be varied to simulate a prototype from 15 to 25 feet in length. For the tests reported here, the

Figure 1

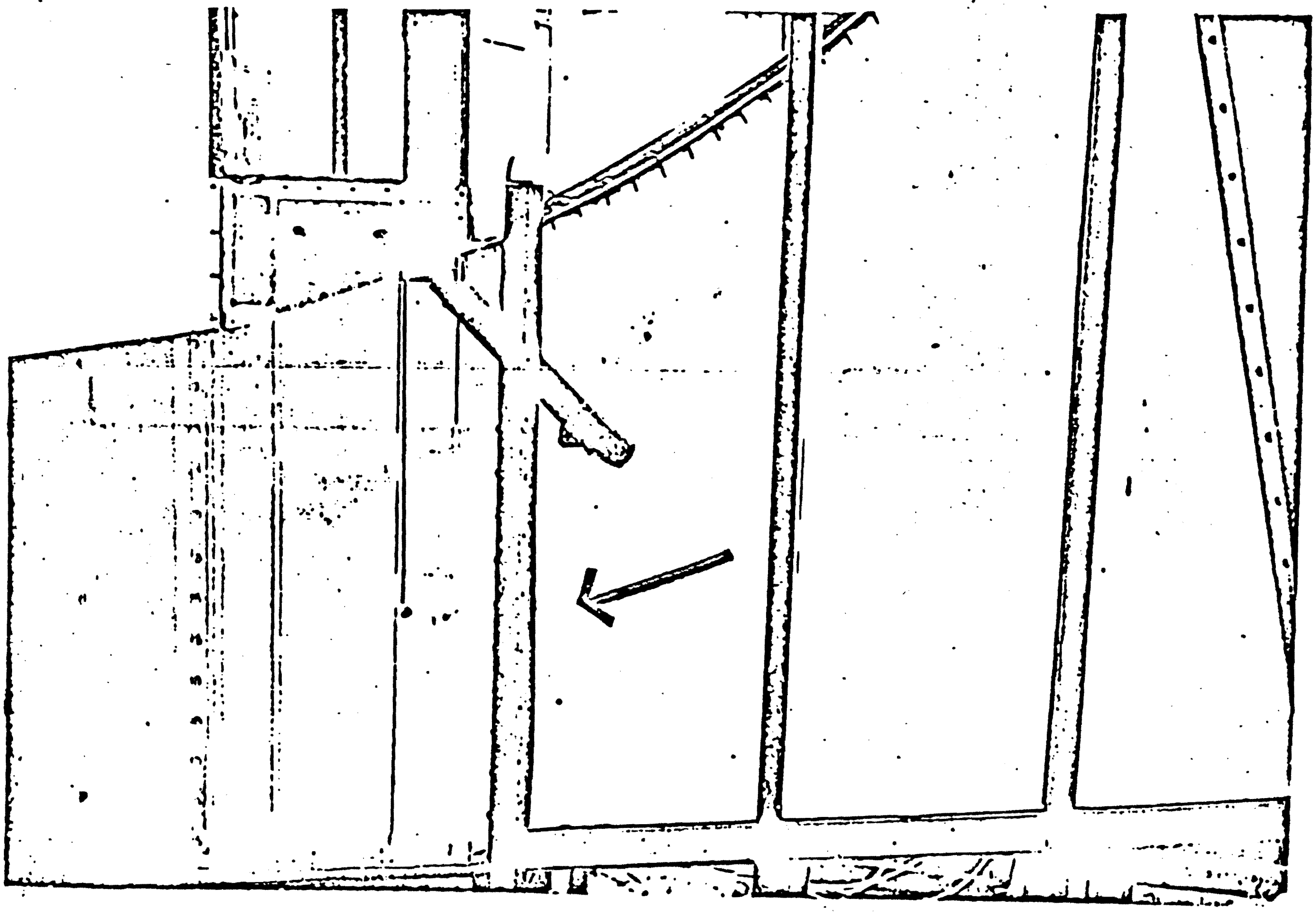


screen length was set to simulate 17 feet, and the screen was not traveled. Water velocities simulated 5.8 feet per second in the prototype.

DISRUPTION OF FLOWS IN INTAKE

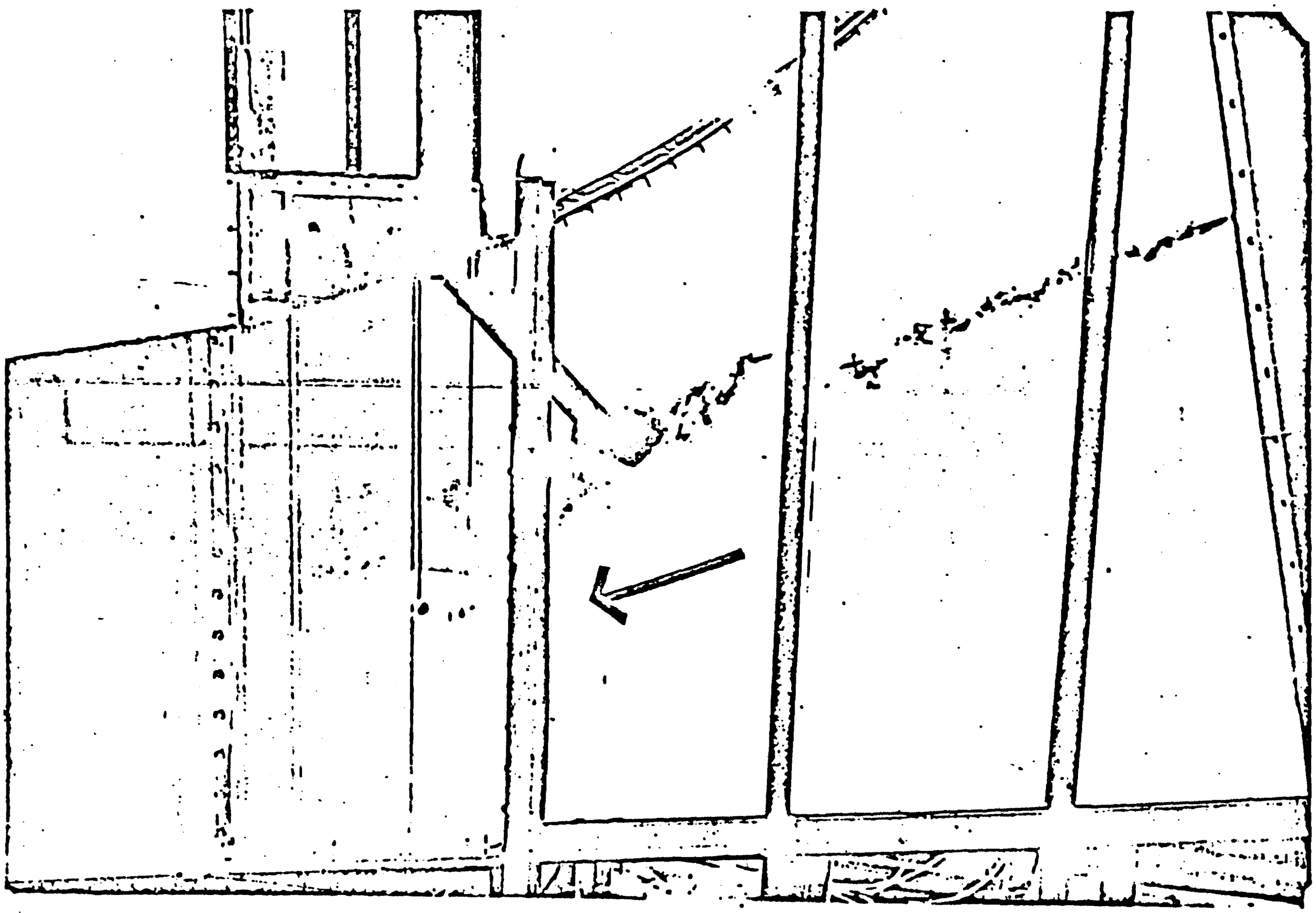
Figures 2 and 3 show the flow pattern upstream of the traveling screen. Observation of the dye stream indicates very little if any deflection of the flow approaching the

Figure 2



screen. Apparently the water mass intercepted by the screen merely slows up, rather than a portion of the flow being deflected down to pass under the screen. The velocity of the water mass below the screen increases "proportionately."

Figure 3



FLOW PATTERNS IN GATEWELL

Clear pictures are not yet available showing flow patterns in the gatewell. Briefly, dye streams show that a major part of the flow entering the gatewell passes well up into the gatewell, bends over against the downstream wall, and then passes down behind the stored gate to exit from the opening on the downstream side of the stored gate.

The presence of the traveling screen in the intake appears to increase flows entering the gatewell, but the basic flow pattern within the gatewell remains about the same.

IMPLICATIONS

One of the questions leading up to these studies concerned the degree to which flows upstream of the traveling screen would deflect downward to pass under the screen. Fish in the deflected water mass might be carried with this water and fail to be guided.

These preliminary results imply that losses of fish due to this cause will be negligible.

Another question concerned the passage of guided fish from the gatewell back into the intake due to increased flows (and velocities) passing into and back out of the gatewell. First, the percentage increase in such flows due to the presence of the screen, although unmeasured as yet, does not "appear" to be as great as originally feared. Second, the pattern of flow probably carries fish well up into the gatewell, making it more likely that the fish will separate themselves from the flow and continue to ascend toward the surface of the gatewell. Third, it appears that the area between the top of the stored gate and the downstream wall of the gatewell can be screened to guarantee against the loss of fish without undue fear of clogging by debris; i.e., debris that high in the gatewill probably will be buoyant and will continue to rise to the surface rather than be carried back down with the current to impinge on the screen.