Denver 2, Colorado, January 28, 1944.

MEMORANDUM TO CHIEF DESIGNING ENGINEER:
(Fred Locher through J. E. Warnock)

Subject: Hydraulic model studies on the Lovelock Diversion Dam, Humbolt Project, Nevada.

1. The Lovelock Diversion Dam will be 11.5 feet high and 250 feet wide, protected at the upstream and downstream extremities by riprap and concrete paving. In the first design, a 4:1 slope on the downstream face terminated at a stilling pool 27 feet in length. The pool with a row of dentates, as shown in figure 1, design 1, was protected against scour by a 12-inch sill and a 3-foot blanket of riprap extending 40 feet downstream from the structure.

2. The river flow will vary from a few second-feet to 5,000 second-feet during floods. The resulting tailwater elevation could not be determined accurately; therefore, it was necessary to determine if a suitable hydraulic jump would form on the 4:1 slope apron with a reasonable range of tailwater levels. In addition, there were unanswered questions concerning the amount of riprap, the nature of the scour that would occur with the expected cross-channel flow below the pool during low flows, (a result of the downstream topography) and the most effective baffles for stilling of the overpour. These questions could be answered satisfactorily with a hydraulic model, so in accordance with instructions, a 1:16 sectional model, figure 1, design 1, was constructed in the hydraulic laboratory.

3. Tests with this model showed that with a discharge of 5,000 second-feet, a satisfactory jump formed with the tailwater at elevation 4006.0. However, the jump "swept out" with the tailwater level at elevation 4005.16. With the tailwater at elevation 4008.0, the jump was replaced by a diving sheet which dissipated itself in the pool and did not cause any undue scour.

4. As a remedy for the unsatisfactory performance of the pool at low tailwater elevations, various arrangements of baffles were installed to help dissipate the kinetic energy of the flow. The first arrangement consisted of placing type 1 baffles between the existing type 2 baffles. This improved conditions in the pool. However, it appeared that a steeper slope on the upstream face of the type 1 baffles would cause more energy dissipation. This was found to be true when the type 3 baffles were installed in place of the type 1 baffles, but it was also discovered that the type 3 baffles alone were just as efficient as the combination. The most satisfactory arrangement was obtained by placing the type 2 baffles, figure 1, design 1, in combination with another row of baffles of similar shape on the stilling pool floor with the small face normal to the 4:1 slope - an arrangement similar to that shown in design 2. This arrangement dissipated sufficient energy that even with the downstream sill removed, the pool did not "sweep out" with the tailwater at 4004.0.

5. As it was not possible to maintain a jump on the 4:1 downstream slope, it was considered advisable to change this slope to 3:1, thereby saving a considerable length of slope paving. In view of the results obtained from previous tests, the baffle arrangement as shown on figure 1, design 2, was selected. Tests with this model indicated satisfactory flow conditions for the range of tailwater elevations and discharges. In addition, there was no apparent displacement of the riprap downstream from the pool.

6. A simulation of the cross-channel flow below the pool indicated that some scour of the river bed immediately downstream from the riprap could be expected, but it is believed that ample protection would be provided by the 3-foot blanket of riprap placed as shown in figure 1, design 2.

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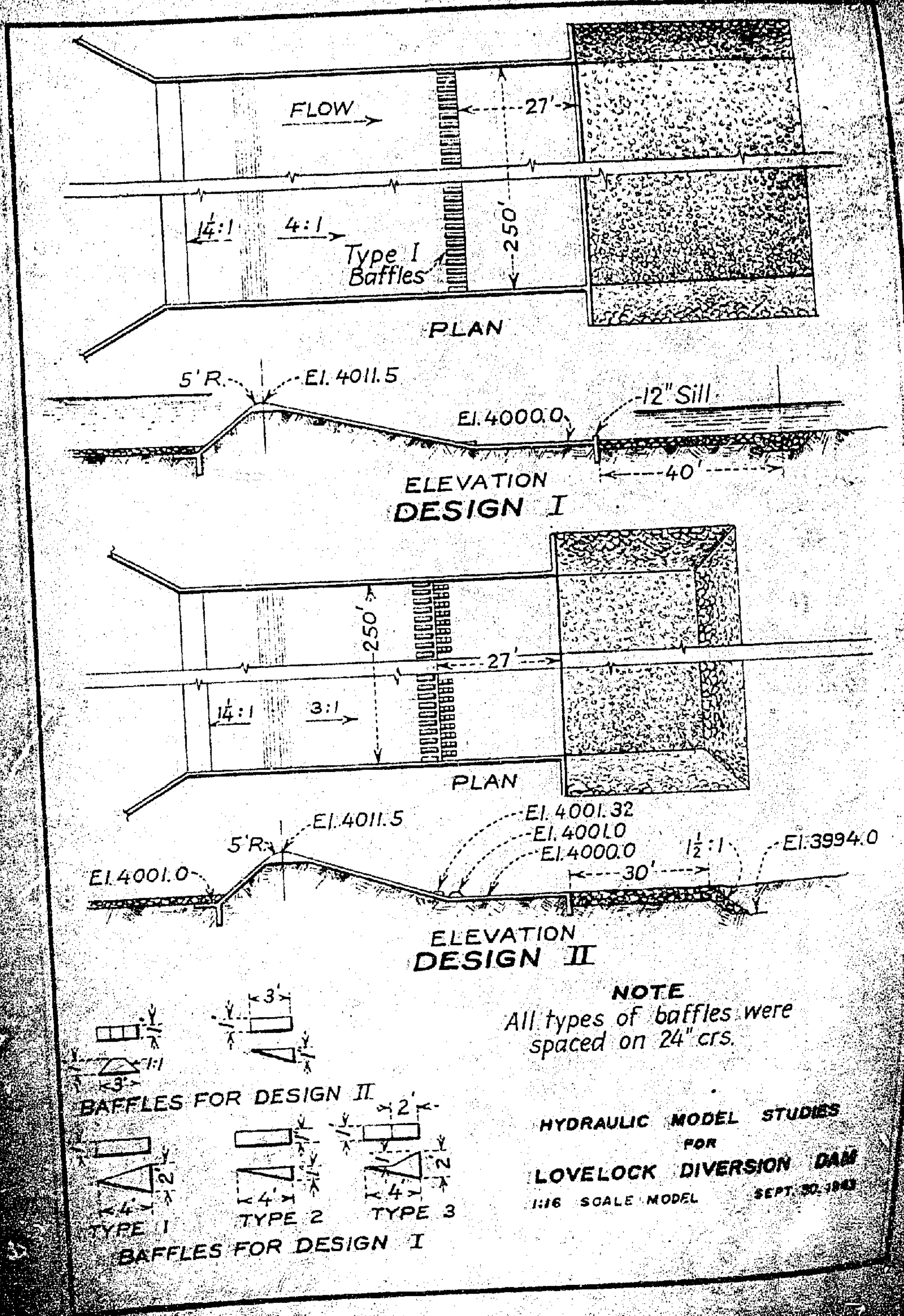
Fred Locher

FIGURE


FLOW
27'
250'
14:1
4:1
Type I Baffles
PLAN
5'R.
El. 4011.5
-12" Sill
El. 4000.0
40'
ELEVATION
DESIGN I
250'
27'
14:1
3:1
PLAN
El. 4011.5
5'R.
El. 4001.32
El. 4001.0
El. 4000.0
1½:1
El. 3994.0
El. 4001.0
30'
ELEVATION
DESIGN II
NOTE
All types of baffles were spaced on 24" crs.
3'
1:1
3'
BAFFLES FOR DESIGN II
2'
2
4'
4'
4'
TYPE 1
TYPE 2
TYPE 3
BAFFLES FOR DESIGN I
HYDRAULIC MODEL STUDIES
FOR
LOVELOCK DIVERSION DAM
1:16 SCALE MODEL
SEPT. 30, 1943