CITY AND COUNTY OF DENVER

Board of Water Commissioners

CITY AND COUNTY BUILDING
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March 29, 1951

Mr. D. D. Gross, Chief Engineer
Denver Municipal Waterworks
Denver, Colorado

Dear Sir:

The plans and specifications for Reservoir 22 Dam, to be constructed on South Boulder Creek between Pine Cliff and Elderado Springs, were formally approved by yourself, by the State Engineer, and by myself on March 23, 1951. The plans for the reservoir and dam are shown on Sheets 1 to 22, inclusive, filed in Drawer 45. Sheet 1 bears the Water Board's Certificate of Authority, signed by George R. Morrison, President, and E. L. Mosley, Secretary. Mr. Hinderlider, as State Engineer, placed his signature of approval on each of the 22 drawings.

One of the major problems involved in the design of Reservoir 22 Dam has been the determination of a suitable cross section that will not only be adequate to carry the loads for the initial stage of construction but will also fit into future plans and future construction programs required in order to secure increased storage capacity.

Present plans for the Reservoir 22 Project contemplate a second stage of construction which will increase the height of the dam by 40 feet, permitting storage to elevation 7320, and an ultimate stage of construction which will increase the height of the dam by an additional 80 feet, permitting storage to elevation 7400. The cross section adopted for the present construction and the cross sections tentatively adopted for the second and ultimate stages of construction are shown on Sheet 11.

In the design for the initial development, the slope at the downstream face of the dam has been made relatively steep and the necessary thicknesses of concrete at the different elevations below 7200 have been secured by providing a batter of 0.15 at the upstream face, beginning at elevation 7200. With this design, additional thicknesses of dam needed for the second and ultimate developments can be secured by adding concrete at the downstream face, keeping the upstream face vertical above elevation 7200 and increasing the downstream slope to about 0.70 and 0.73 respectively.

It is believed that the design adopted for the present development will permit the construction of the second and ultimate stages without the draining of the reservoir. In fact, it is believed that the construction work required during the second and ultimate developments can be carried on successfully without lowering the water surface more than a normal amount, probably not more than may be expected to take place annually during average reservoir operation. A lowering of the water surface for construction purposes should not be necessary except at the time of final grouting of the joints.

Preliminary analyses of stress and stability conditions at a few elevations in the second and ultimate stages of development were made during the work on the present plans as shown on Sheets 1 to 22. These analyses constituted the basis for the opinions expressed in the preceding paragraphs. More complete analyses, similar to those shown on Sheet 7, will be needed when work is begun on detailed plans for future developments.

The plans for the Reservoir 22 Dam shown on Sheets 1 to 22 represent a large amount of detailed design work. This work included some redeterminations of certain controlling factors, a few changes in basic assumptions,

and numerous revisions in the locations and dimensions of certain items, some of major importance.

The plans for the first stage construction as now drawn, although adequate and satisfactory for advertising purposes, cannot be considered as complete and final in all respects. Further revisions of some items undoubtedly will become desirable as the work progresses, especially as foundation and tunnel excavations provide more definite information on the nature and sufficiency of the rock formations. In addition, more detailed designs and dimensions of some features of the work probably will be needed by the contractor when he begins actual construction, as provided for in the specifications.

In considering the additional design work that may be necessary during the construction of the first development, it seems proper to point out certain features that probably should receive further attention. These are briefly discussed in the following paragraphs, under items 1, 2, and 3.

1. Power Conduit through Dam. The power conduit through the dam, now shown in block F, see Sheet 15, probably should be shifted horizontally to a location farther from the slope of the canyon. Loose materials moving down the abutment slope, or floating debris along the edge of the reservoir, may cause trouble at the trash rack, despite the small baffle wall provided along the shore edge of the intake.

It is believed that a location farther from the abutment wall will be desirable, even though the conduit may have to be carried on concrete pedestals from the valve house at the downstream face of the dam to a location on the canyon slope. Drawing 15 carries a note saying that the location of the conduit may be shifted.

2. Trash Rack at Power Conduit. If the power conduit is relocated in a block farther from the canyon wall, the trash rack at the upstream end of the conduit should be redesigned to permit direct flow of reservoir water into the conduit, without making the right angle turn now required in the present design.

The amount of concrete in the trash rack construction is very small, probably less than about 10 cubic yards, so that no appreciable item of cost will be involved if the structure is redesigned.

3. Trash Rack Structure at Tunnel Inlet. It is believed that further consideration should be given to the design of the trash rack structure at the upstream end of the diversion and discharge tunnel, now shown on Sheet 21. The present design is based on a velocity of about 1 foot per second through the openings between the trash rack bars.

A velocity as low as 1 foot per second is desirable when the reservoir water surface is only a few feet above the intake. However, when the water surface is more than 100 feet above the intake, as it will be nearly all the time at Reservoir 22, a higher velocity is not only permissible but also desirable, especially since the velocity must be further increased to about 24 feet per second by the time the tunnel section is reached. For high head operation, velocities as high as 10 feet per second have been permitted and found satisfactory at trash rack panels.

The present design of the trash rack structure probably should be replaced by a design based on a velocity of about 4 feet per second through the trash rack panels. Such a design would have about the same general dimensions as the design originally submitted by Mr. Lowe, but would be provided with somewhat heavier trash rack bars, spaced somewhat farther apart.

As work on the construction of the first stage development progresses, new data and additional information, particularly on rock conditions, may require reconsideration of additional features of the plans.

In connection with the specifications for the concrete to be used in the construction of the dam, it seems desirable to point out that the contractor must submit plans showing his proposed concrete mixing plant to the Board for approval prior to the installation of the plant.

It is believed that the contractors plans should include the installation of an accurate recorder for making continuous visible records, on a single chart, of the amounts of the separate concrete ingredients and of the consistency of the concrete. It is believed that the installation of such a recording instrument will not only permit better inspection and control of the concrete mixing operations by the representatives of the Board but will also assist the contractor in his mixing operations and in the securing of better concrete of more uniform consistency for all parts of the work.

In conclusion, permit me to say that it has been a pleasure as well as a privilege to work with you and your engineers on the Reservoir 22 Project.

Yours very truly,

Ivan E. Houk

Ivan E. Houk
Consulting Engineer

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