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HYDRAULIC LABORATORY
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TRAVEL TO SACRAMENTO, CALIFORNIA, TO OBSERVE FIELD CONDITIONS AT OROVILLE DAMSITE AND TO PRESENT LABORATORY TEST DATA TO THE CALIFORNIA DEPARTMENT OF WATER RESOURCES AND ITS BOARD OF CONSULTANTS

W. P. SIMMONS, ENGINEER

Form DFC-11
(12-61)
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293 Schroeder

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July 26, 1963

Travel Report #2635

72-642

To: Chief Engineer

Through: Chief Research Scientist
Chief, Hydraulics Branch

From: W. P. Simmons, Engineer

Subject: Travel to Sacramento, California, to observe field conditions at Oroville damsite and to present laboratory test data to the California Department of Water Resources and its Board of Consultants
(Travel Authorization No. 32654, June 19, 1963)

GPO 852320

Travel

I left Denver on June 25 and arrived in Sacramento, California, in the early morning of June 26. After completing my assignment I departed from Sacramento in midafternoon June 28, and arrived in Denver the same evening.

Purpose

The trip was made at the request of the Department of Water Resources so the most recently obtained laboratory test data on the penstock intake control structures and the spillway could be discussed at the meeting of the Board of Consultants and the Department of Water Resources on June 26, 27, and 28. Following the discussions, plans and priorities for future model studies were to be formulated.

Pertinent Correspondence

June 17 letter to you from Mr. G. W. Dukleth, Engineer-representative, State of California.

June 20 letter to Mr. Dukleth from Acting Chief Engineer, Parmakian.

TR 2635

TR 2635

Personnel Contacted

Department of Water Resources

H. G. Dewey, Jr., Division Engineer, Division of Design and Construction
D. P. Thayer, Chief, Dams and Plants Design Branch
G. W. Dukleth, Engineer-representative, Denver-California
E. W. Stroppini, Chief, Dams Section
L. O. Transtrum, Dams Section
T. W. Troost, Chief, Mechanical-Electrical Section
R. Rutherford, Mechanical Section
A. J. Bunas, Chief, Structural Section
A. L. O'Neill, Chief, Engineering Geology Branch

Oroville Dam Consulting Board

R. A. Hill, Chairman, Leeds, Hill and Jewett, Los Angeles
Benjamin Torpen, Pacific Power and Light, Portland
Roger Rhodes, Bechtel Corporation, San Francisco
Thomas Lang, Bechtel Corporation, San Francisco
P. C. Rutledge, Moran, Proctor, Mueser and Rutledge, New York

Special Consultant

J. D. Jacobs, Jacobs Associates, San Francisco

Agenda

The agenda of activities is presented as an attachment hereto.

Field Trip

On Wednesday morning, June 25, the consulting board convened with members of the California design staff at the field office in the town of Oroville. A briefing on construction progress was held and then the group was taken on an inspection tour of the fish barrier dam near Oroville, and of the Oroville damsite about 6 miles upstream. At Oroville Dam, inspections were made of the foundations, concreting procedures, tunnelling, materials handling facilities, and river diversion preparations. Also, the location where the downstream end of the spillway will be located was observed and photographed.

Technical Sessions

On Thursday the Board was in session with the Department engineers. During the morning session, I presented the results of our model studies on the initial design spillway structure which consisted of a depressed center section containing five gate-controlled flood outlets with gate-controlled, overfall spillway sections on each side (Figure 1).

The principal hydraulic problem was that of bringing the flows from the flanking spillway sections inward to the center and into the 150-foot-wide chute without causing severe overtopping of the sidewalls and without requiring extensive areas of concrete paving. The exploratory model studies showed the possibility of accomplishing this, but the results were not entirely satisfactory.

Mr. Hill, Chairman of the Board, then presented a new design proposal wherein the overfall section is placed directly above the sluices (Figure 2). This proposal eliminates many of the problems found with the old flanking design and was favorably received by the Department.

In the afternoon I presented the results of exploratory model studies on the initial design penstock intake control structures (Figure 3). The Board and the designers felt that the overall inlet losses of 0.65 times the velocity head in the penstock were nominal, but were concerned about the turbulence on the semi-cylindrical shutter gates that are close to the trashrack beams, and the vortices that developed above the gates. A point of particular interest was whether or not air would be admitted by the vortices and carried into the penstocks and power units.

Mr. Hill then submitted a new design proposal which uses flat shutter gates located well below the trashrack structures. The gates are connected together with loose pins which act like very loose couplers on railroad cars (Figure 4). In operation, a cable pulls the uppermost gate uphill. This gate moves away from the subsequent one, leaving an opening. When the withdrawal reaches full length of the coupling pins, the next gate would begin to open, producing an opening at a lower level. In this manner the entire string of gates could be moved. After considerable discussion, this general design was tentatively accepted.

On Friday an hour session was held with the Board. It was concluded that the proposed new spillway and the new penstock control structures would be seriously investigated analytically and by model studies, and adopted if found satisfactory. The remainder of the morning and part of the afternoon were spent in discussions with the designers about drawings needed for rebuilding the models, and technical points about areas on the structures where hydraulic problems might be avoided.

Summary

I traveled to Sacramento, California, to present to the Board of Consultants and the California Department of Water Resources engineers

the results of recent model studies on the spillway and the penstock intake control structures. New design proposals that appear to overcome the major problems found by the models in the spillway and intake structures were proposed by Mr. Raymond Hill. These designs are being studied in detail by the Department, and will be evaluated by hydraulic models after revised drawings have been received.

W. P. Simmons

Copy to: 290
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W. P. Simmons

AUG 2 1963

NOTED:
John Parmakian
Associate Chief Engineer

DEPARTMENT OF WATER RESOURCES
DIVISION OF DESIGN AND CONSTRUCTION
Sacramento, California

OROVILLE DAM CONSULTING BOARD MEETING
June 26, 27, and 28, 1963

AGENDA

Wednesday, June 26, 1963 (Field trip to Oroville Dam)

8:00 a.m.	1.	Leave El Dorado Hotel. Assemble at Oroville office on Oliver Street for progress report on construction.
10:00 a.m.		a. Diversion Tunnel No. 1.
10:10 a.m.		b. Diversion Tunnel No. 2.
10:15 a.m.		c. Core Block.
10:20 a.m.		d. Grout Program.
10:30 a.m.		e. Materials Haul Route.
10:35 a.m.		f. Contractor's diversion and embankment placement plan for Oroville Dam.
11:00 a.m.		g. General discussion of construction.
11:30 a.m.	2.	Inspection of Interim Fish Facilities.
12:00 Noon	3.	Lunch.
1:15 p.m.	4.	Inspection of Oroville Dam.
		a. Stripping operations and foundation preparations.
		b. Foundation for core block and Zone 1 materials.
		c. Downstream portals of Diversion Tunnel Nos. 1 and 2.
		d. Administration Building and Housing Area.
		e. Haul Road and Borrow Area.
4:00 p.m.	5.	Return to Sacramento--El Dorado Hotel.

AGENDA

(Continued)

Thursday, June 27, 1963

9:00 a.m. 6. General discussion of construction.

a. Diversion Tunnel No. 1.

b. Diversion Tunnel No. 2.

c. Core Block.

d. Grout Program.

e. Contractor's Diversion and Embankment.

10:00 a.m. 7. Problems of Rock Reinforcement and Tunnel Supports. (O'Neill)

10:30 a.m. 8. Oroville Spillway.

a. Status of model studies. (Transtrum and Simmons)

b. Crest gate operating criteria and mechanism. (Transtrum)

12:00 Noon 9. Lunch.

1:30 p.m. 10. Oro Power Plant Intake Structure.

a. Status of model study. (Troost and Simmons)

b. Structural features. (Bunas)

c. Operating mechanism. (Troost)

3:00 p.m. 11. General discussion.

4:30 p.m. 12. Return to El Dorado Hotel.

Friday, June 28, 1963

9:00 a.m. 13. General discussion with staff.

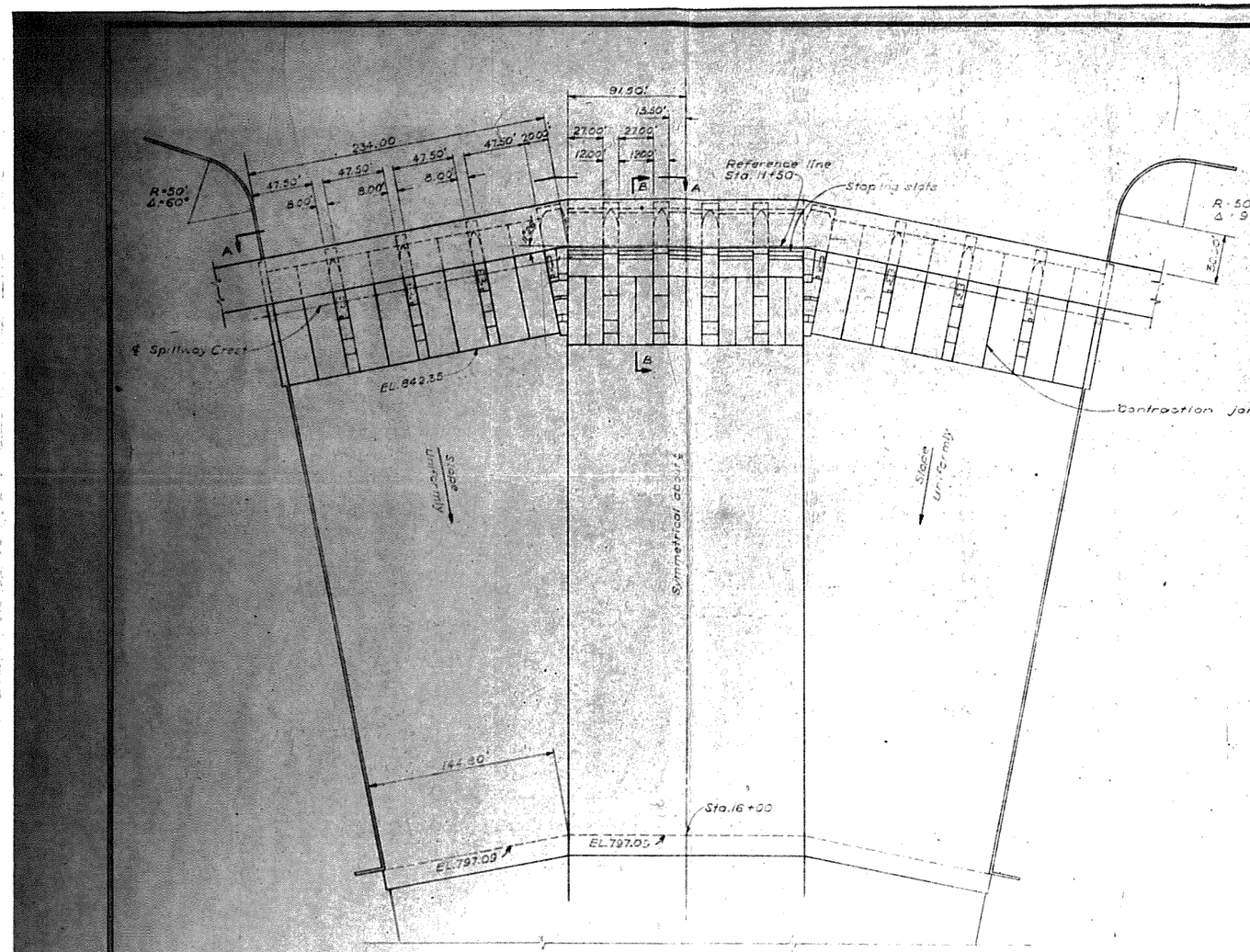
10:00 a.m. 14. Executive session and report.

12:00 Noon 15. Lunch.

1:30 p.m. 16. Executive session and report.

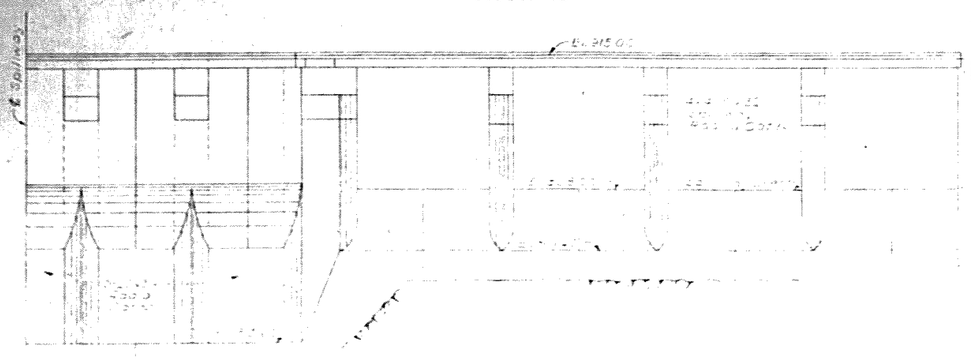
4:00 p.m. 17. Oral presentation of report by the Board.

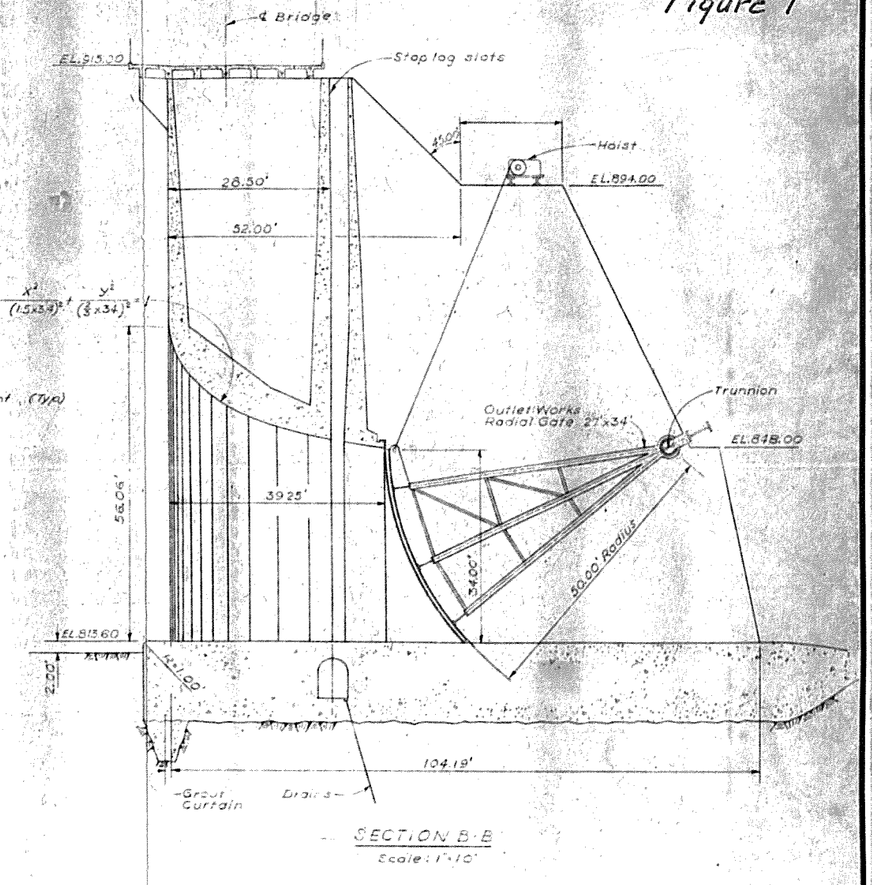
Figure 1



PLAN OF SPILLWAY AND FLOOD CONTROL OUTLETS

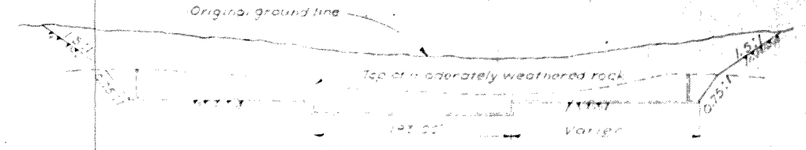
Scale: 1"=40'





SECTION B-B

Scale: 1"=10'



SPILLWAY TRANSITION CHANNEL

TYPICAL SECTION

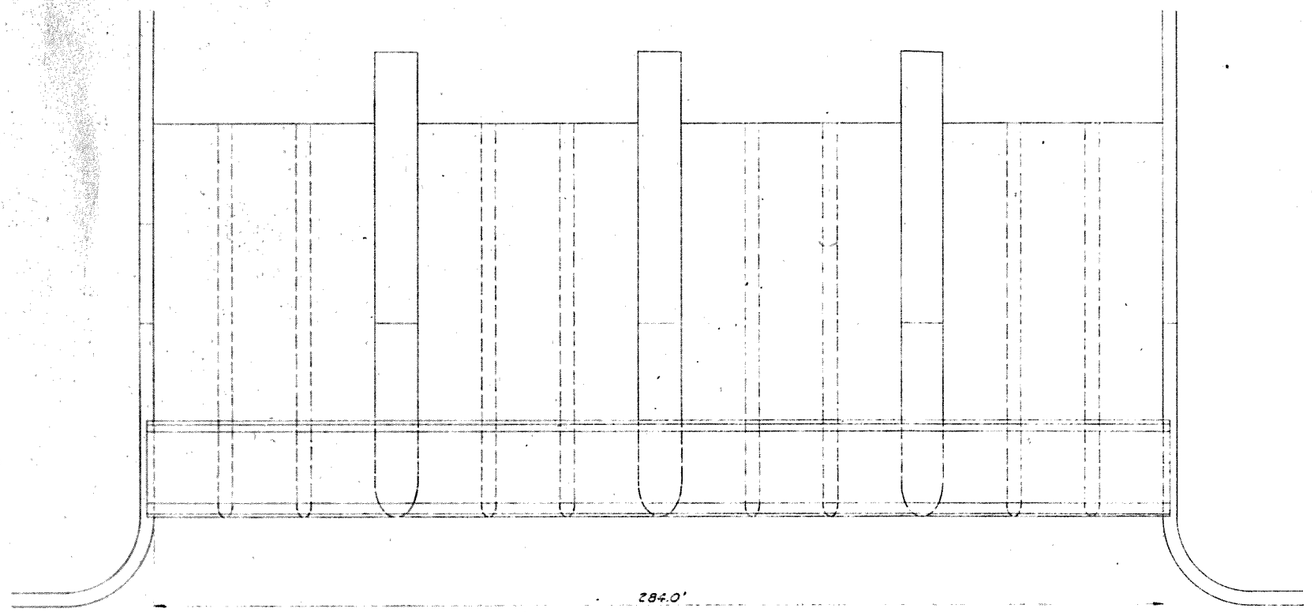
Scale: 1"=5'

STATE OF CALIFORNIA
THE RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
DIVISION OF DESIGN AND CONSTRUCTION

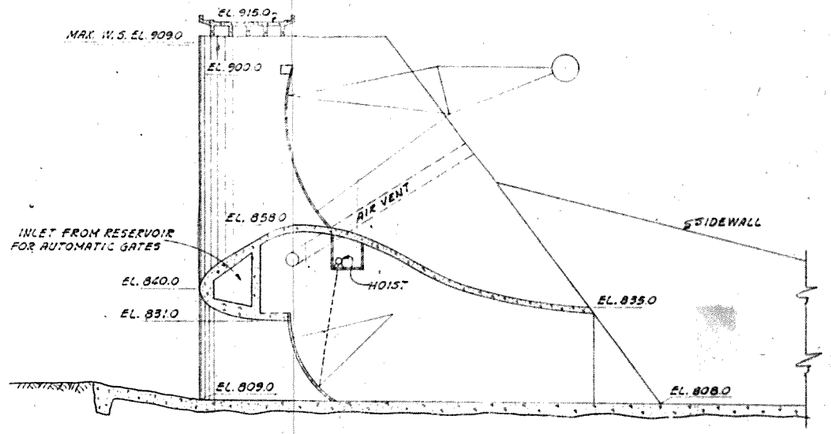
STATE WATER FACILITIES
OROVILLE DIVISION
OROVILLE DAM
SPILLWAY
PROPOSED ARRANGEMENT
PLAN, ELEVATION AND OUTLET WORKS DETAILS

SUBMITTED		APPROVED	DATE
APPROVAL RECOMMENDED		DIVISION ENGINEER REG. C.E. NO. 8800	
APPROVAL RECOMMENDED		DRAWING NO. 410-EM-8	SHEET NO.

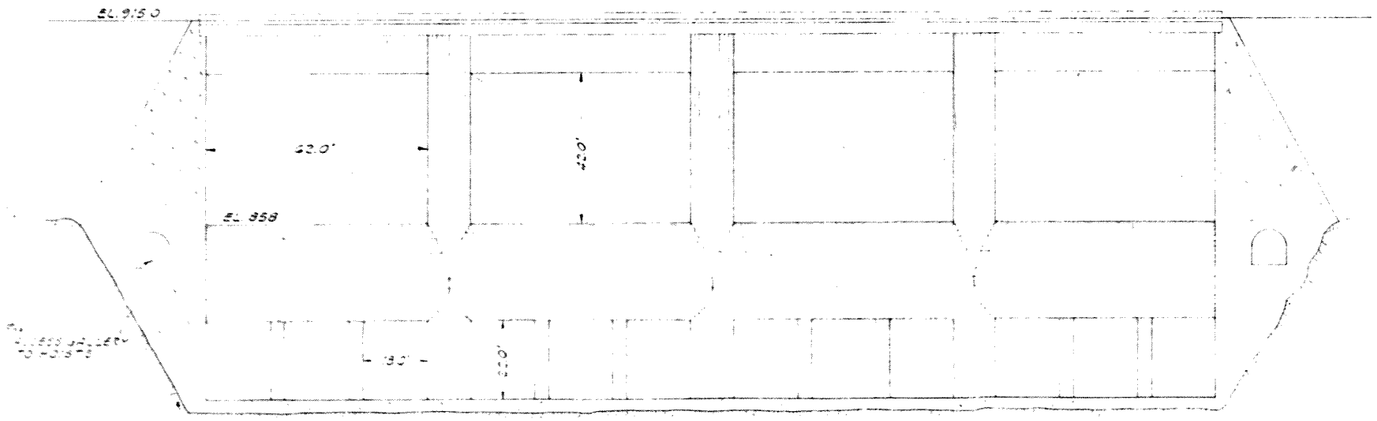
Figure 2



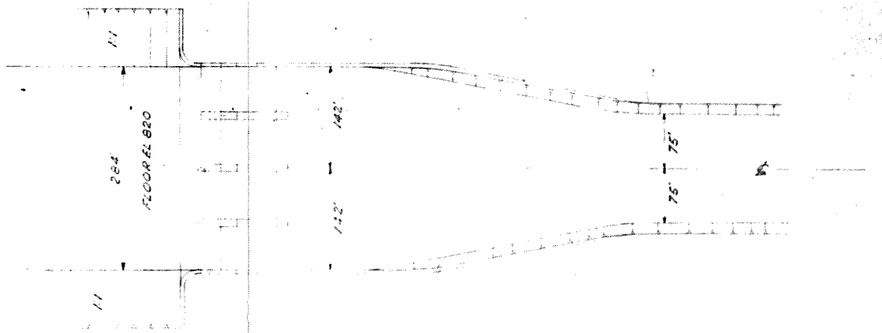
PLAN
SCALE: 1" = 20'



SECTION
SCALE 1" = 20'



ELEVATION
SCALE 1"=20'



GENERAL PLAN
SCALE 1"= 100'

STATE OF CALIFORNIA DEPARTMENT OF WATER RESOURCES		
OROVILLE DAM DOUBLE-DECK SPILLWAY SUGGESTED DESIGN		
LEEDS, HILL AND JEWETT, INC. CONSULTING ENGINEERS		
DESIGNED DRAWN CHECKED	APPROVED	

Figure 3

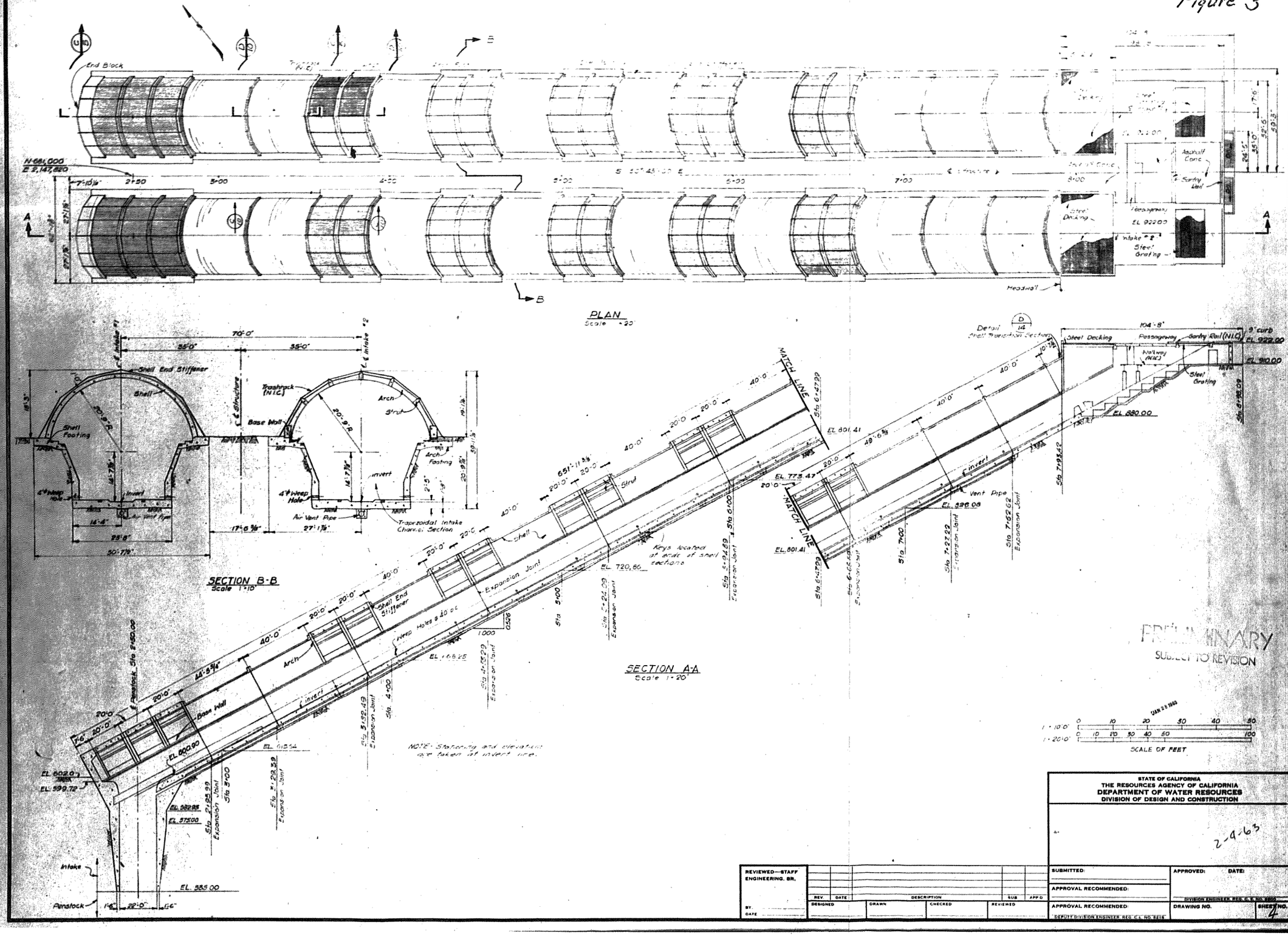
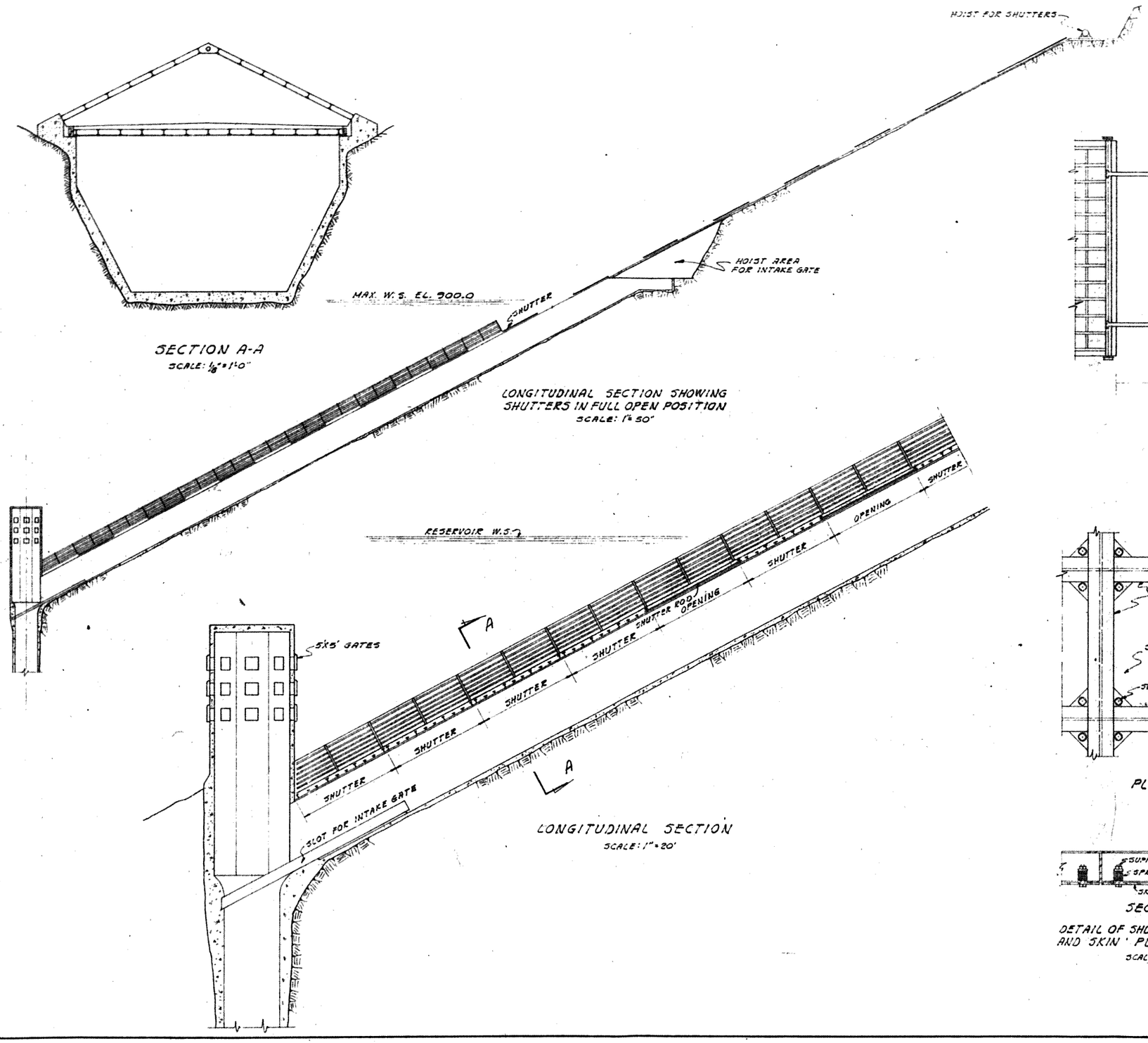

PLAN
Scale 1"=20'
SECTION B-B
Scale 1"=10'
SECTION A-A
Scale 1"=20'
End Block
Headwall
Shell End Stiffener
Shell
Shell Footing
Trashrack (N.I.C.)
Base Wall
Arch
Strut
Arch Footing
Invert
Air Vent Pipe
Trapezoidal Intake Channel Section
Weep Holes
Expansion Joint
Keys located at ends of shell sections
MATCH LINE
Steel Decking
Passageway
Gantry Rail (N.I.C.)
Steel Grating
Vent Pipe
Intake
Penstock
NOTE: Stationing and elevations are taken at invert line.
PRELIMINARY
SUBJECT TO REVISION
SCALE OF FEET
STATE OF CALIFORNIA
THE RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
DIVISION OF DESIGN AND CONSTRUCTION
2-4-63
REVIEWED—STAFF ENGINEERING, BR.
SUBMITTED:
APPROVED:
DATE:
APPROVAL RECOMMENDED:
DIVISION ENGINEER, REG. C.E. NO. 5800
DRAWING NO.
SHEET NO. 4
DEPUTY DIVISION ENGINEER, REG. C.E. NO. 5818

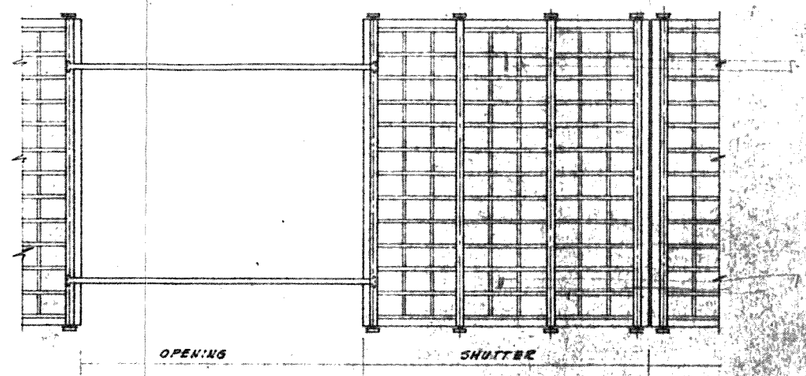
Figure 4

SECTION A-A
SCALE: 1/8" = 1'-0"

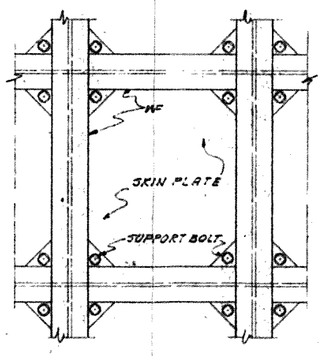


LONGITUDINAL SECTION SHOWING SHUTTERS IN FULL OPEN POSITION
SCALE: 1" = 50'

LONGITUDINAL SECTION
SCALE: 1" = 20'



TYPICAL SHUTTER
SCALE: 1" = 10'



PLAN

SECTION

DETAIL OF SHUTTER FRAMING AND SKIN PLATE CONNECTION
SCALE 3/4" = 1'-0"

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

OROVILLE DAM
POWER PLANT INTAKES
SUGGESTED SHUTTER DESIGN

LEEDS, HILL AND JEWETT, INC. CONSULTING ENGINEERS

DESIGNED DRAWN CHECKED	APPROVED	