

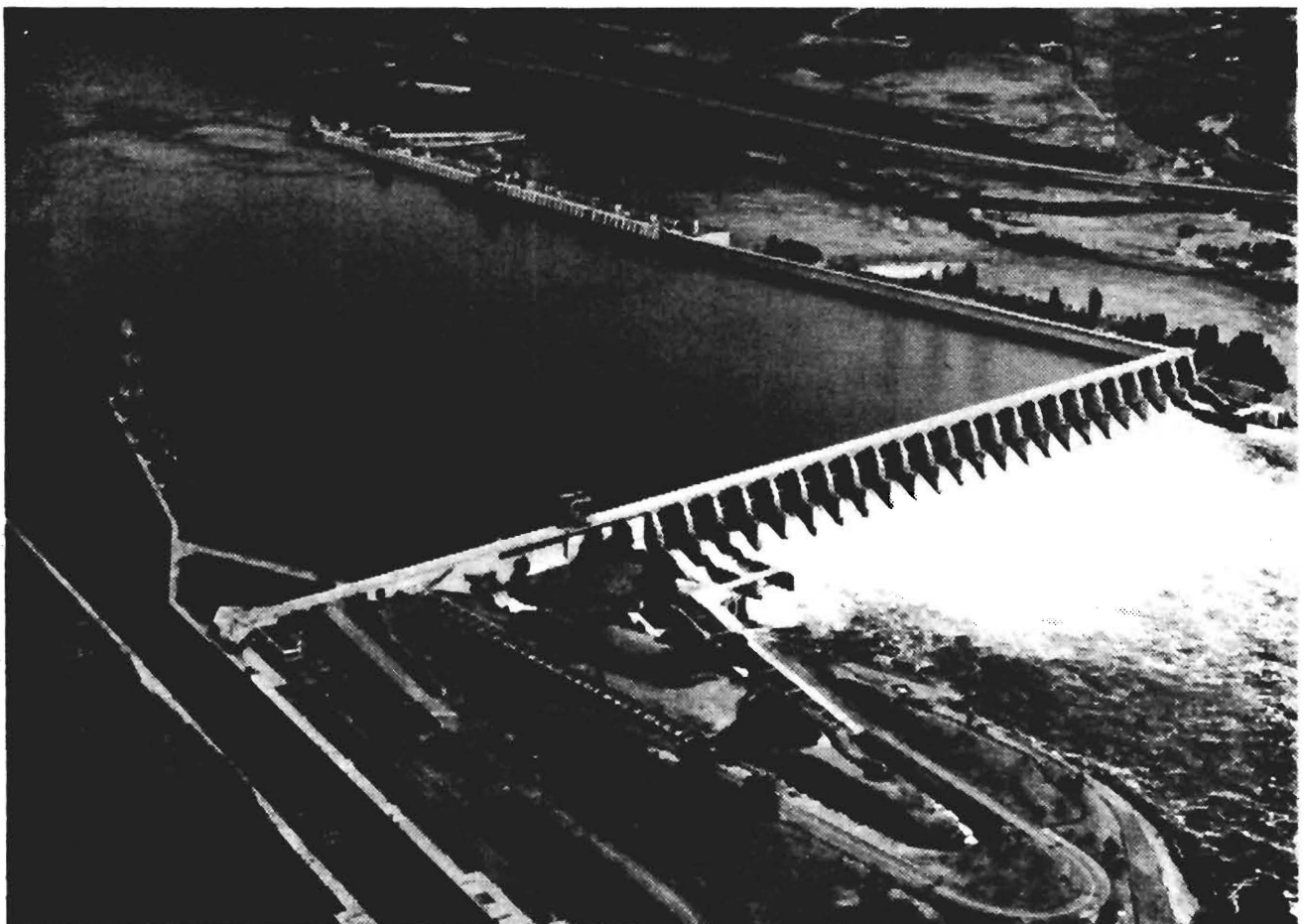


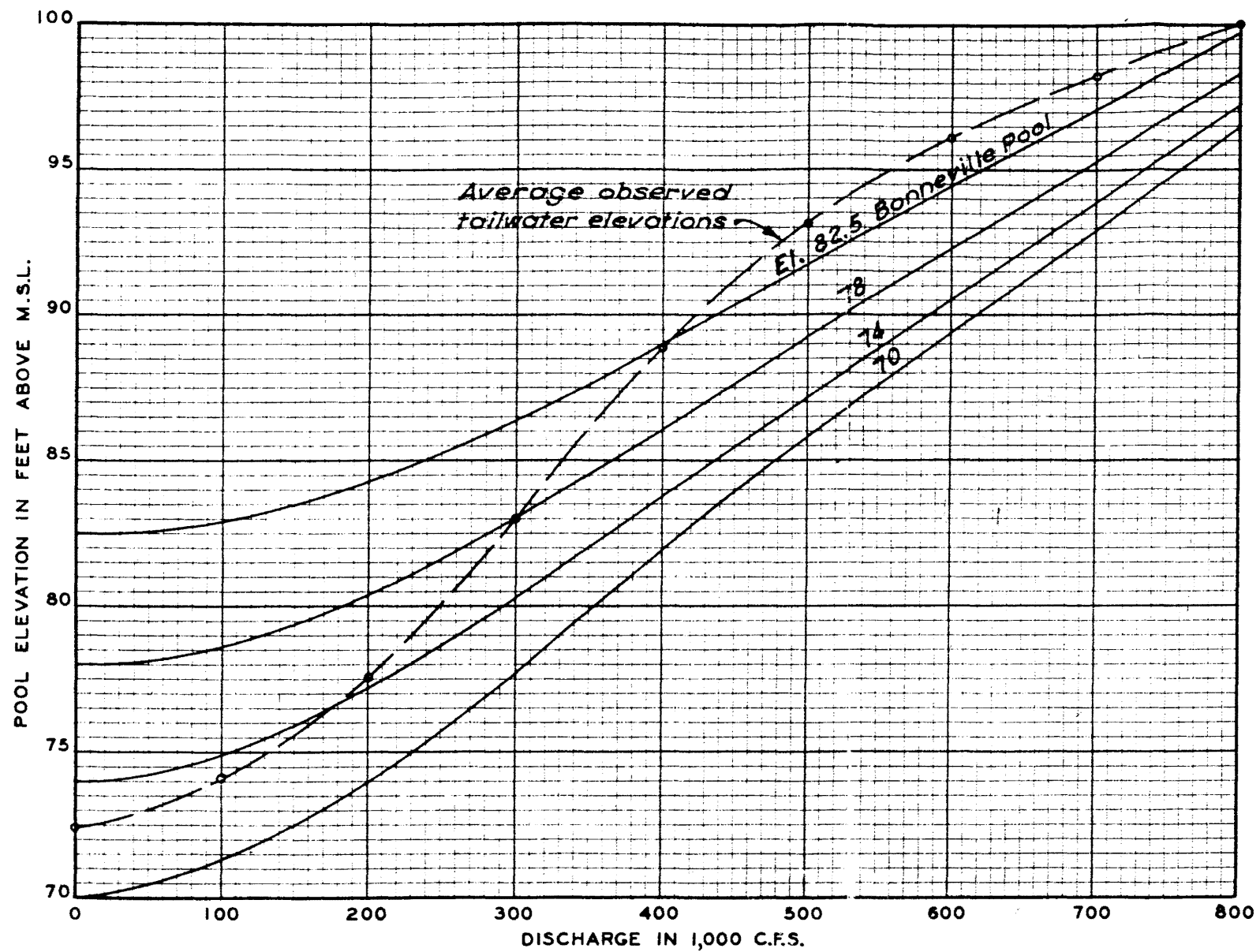
US Army Corps
of Engineers
Portland District

Redacted for Public Version

Water Control Manual for The Dalles Lock and Dam - Lake Celilo

Oregon and Washington





Note:

Curves are based on model data and represent average tailwater elevations at the tailwater gage opposite Unit No. 8 for:

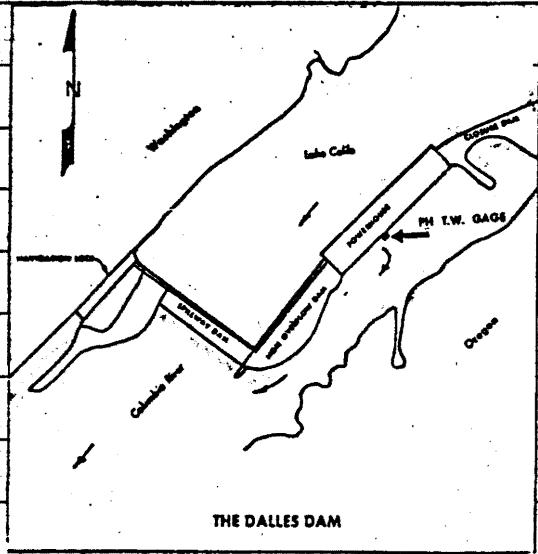
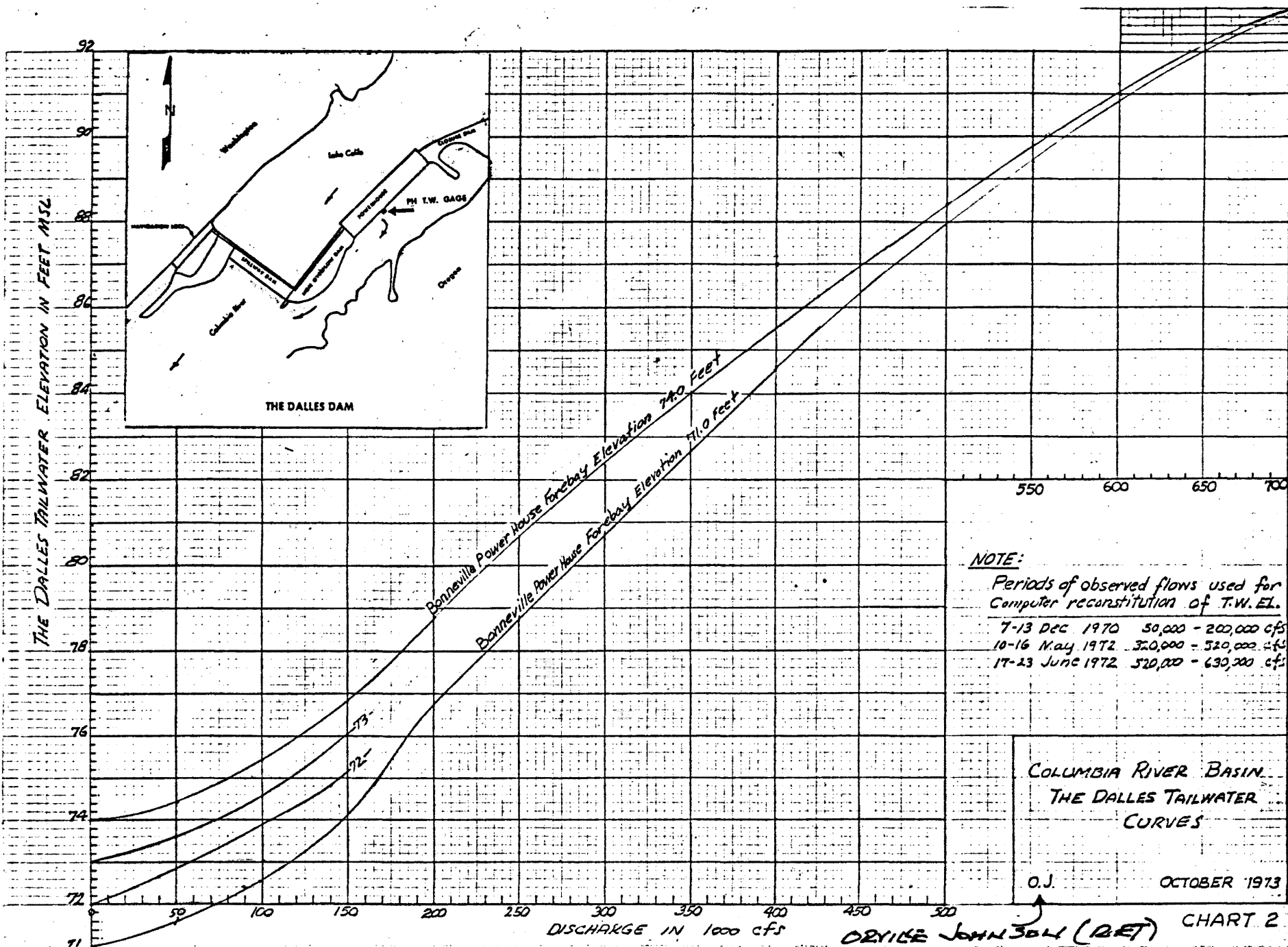
- (1) Bonneville Dam pool elevations as indicated.*
- (2) Uniform discharge from 14 units in The Dalles powerhouse.*
- (3) Steady flow conditions.*

THE DALLES DAM
 TAILWATER RATING CURVES
 (OPPOSITE UNIT NO. 8)
 DECEMBER 1960

TAILWATER RATING CURVES
COLUMBIA & SNAKE RIVERS
Grand Coulee to Bonneville

U. S. Army Corps of Engineers
North Pacific Division

March 1974



NOTICE TO USERS OF THIS MANUAL

Regulations specify that this Water Control Manual be published in looseleaf form, and only those sections, or parts thereof, requiring changes will be revised and printed. Therefore, this copy should be preserved in good condition so that inserts can be made to keep this manual current.

EMERGENCY REGULATION ASSISTANCE PROCEDURES

In the event that unusual conditions arise during non-duty hours, contact can be made by telephone to the Reservoir Control Center, North Western Division (A.C. 503 808-3945). If Reservoir Control Center is unmanned, assistance can be achieved by contacting, in the order listed, one of the persons assigned on the Columbia Basin Teletype (CBTT) to be on call during non-duty hours, or one of the following persons:

1. Chief of Reservoir Control Center
(Phone: 503-808-3945)
2. Reservoir Regulation Unit
(Phone: 503-808-3942)
3. Chief, Reservoir Regulation and Water Quality Section, Portland District
(Phone: 503-808-4886 Pager: 299-0512)

WATER CONTROL MANUAL STATUS SHEET

PROJECT: THE DALLES LOCK AND DAM

CHAPTER	STATUS	PLANNED ACTION
I. INTRODUCTION	*** 2 *** *** **	Update and revise RRMAN Section I. Introduction; add additional material
II. DESCRIPTION	*** 2 *** *** ** *** **	Update and revise RRMAN Section III, Basin Description, and Section V, Description Of The Project Features; add additional materials
III. HISTORY	*** 2 *** *** ** *** **	Update and Revise RRMAN Section II, Project History
IV. WATERSHED CHARACTERISTICS	*** 2 *** *** ** *** **	Update and revise RRMAN Section III, Basin Description
V. DATA COLLECTION	*** 2 *** *** ** *** **	Update and revise RRMAN Section IV, Hydrology And Meteorology; add additional material
VI. HYDROLOGIC FORECASTS	*** 4 *** *** ** *** **	Update and revise RRMAN Section IV, Hydrology And Meteorology; add additional material
VII. WATER CONTROL PLAN	*** 2 *** *** ** *** **	Update and revise RRMAN Section VI, Plan Of Operation; add additional material
VIII.EFFECT OF WATER CONTROL PLAN	*** 4 *** *** ** *** **	Compile a new chapter using existing records and additional material
IX. WATER CONTROL MANAGEMENT	*** 4 *** *** ** *** **	Compile a new chapter using existing records and additional material
SUPPORTING INFORMATION (photo, pertinent data, tables, graphs, etc)	*** 4 *** *** ** *** ** *** **	Selected tables, charts, and graphs require update and revision

STATUS CODES:

- 1 - approved, up to date
- 2 - approved, needs revision
- 3 - preliminary draft
- 4 - incomplete and/or outdated

NOTE: RRMAN=Reservoir Regulation Manual

*Ben
VG WSP*

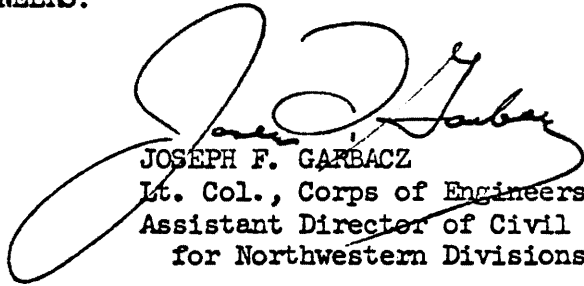
ENGCW-EY (9 Aug 61) 2nd Ind
SUBJECT: Reservoir Regulation Manual, The Dalles Dam, Washington and Oregon

Hq, DA, Office of the Chief of Engineers, Washington, D. C., 21 Sep 61 *OM*

TO: Division Engineer, U. S. Army Engineer Division, North Pacific, Portland, Oregon

The subject reservoir regulation manual is approved.

FOR THE CHIEF OF ENGINEERS:


JOSEPH F. GARBACZ
Lt. Col., Corps of Engineers
Assistant Director of Civil Works
for Northwestern Divisions


1 Incl
wd

NPDGH (9 Aug 61) 3rd Ind
U. S. Army Engr Div, North Pacific, Portland, Ore. 26 Sep 61

TO: District Engineer, US Army Engr Dist, Portland, Ore.

Forwarded.

FOR THE ACTING DIVISION ENGINEER:


JOHN F. KIMBEL
Lt. Colonel, Corps of Engineers
Acting Deputy Division Engineer

VG-OM

W.C.

Co. 1000

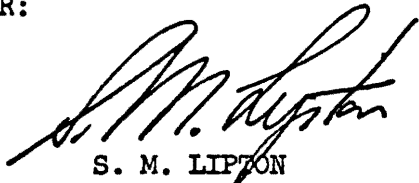
NPDGH (9 Aug 61) 1st Ind
SUBJECT: Reservoir Regulation Manual, The Dalles Dam, Washington and Oregon.

U. S. Army Engr Div, North Pacific, Portland, Ore. 15 Aug 61

TO: Chief of Engineers, DA, Washington, D. C.

Forwarded for your information and approval.

FOR THE DIVISION ENGINEER:



S. M. LIPTON
Colonel, Corps of Engineers
Deputy Division Engineer

1 Incl
n/c - 6 cys w/d

U. S. ARMY ENGINEER DISTRICT. PORTLAND
CORPS OF ENGINEERS
628 PITTOCK BLOCK
PORTLAND 5. OREGON

NPPGW-2

9 August 1961

SUBJECT: Reservoir Regulation Manual, The Dalles Dam,
Washington & Oregon

Ex 0

CK *K* *EP*
Brooks

TO: Division Engineer
U. S. Army Engineer Division, North Pacific
Portland, Oregon

Wilcox *ad*

Ingram *FC*

Pedersen *ad*
adt/424

1. Inclosed are 8 copies of The Dalles Reservoir Regulation
Manual.

2. Authority and preparation of this manual has been in
accordance with the provision of paragraph 6 of ER 1110-2-240, dated
8 December 1958, and paragraphs 6.01-6.03 of EM 1110-2-3600, dated
25 May 1959.

8 Incl
as

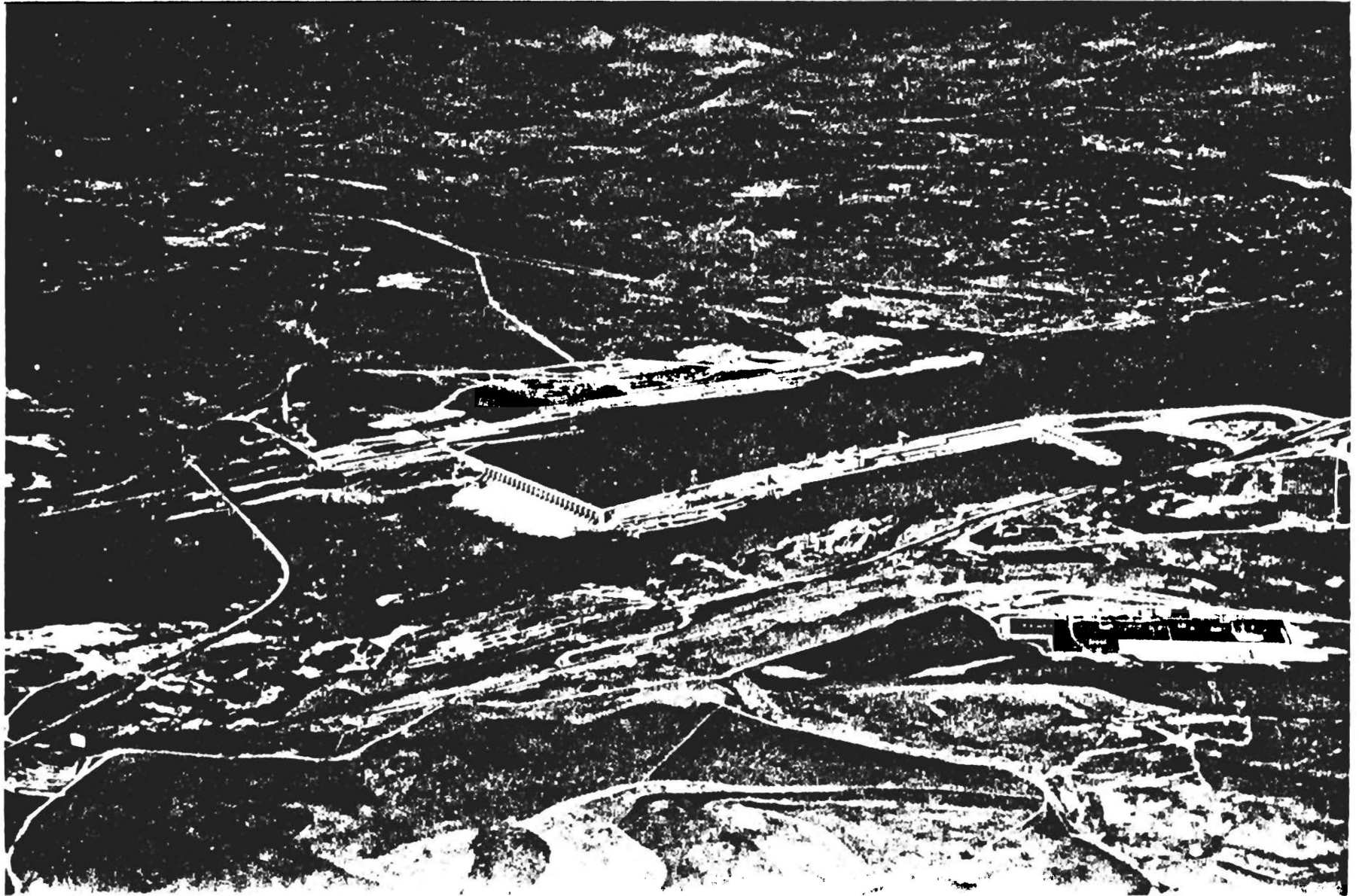
JOHN F. HAMIL
LT COL CORP S OF ENGINEERS
DEPUTY DISTRICT ENGINEER
FOR: *John F. Hamel*
STERLING K. EISIMINGER
Colonel, Corps of Engineers
District Engineer

280/110 (Pedersen's Manual) 9 Aug 61

THE DALLES DAM
COLUMBIA RIVER, WASHINGTON AND OREGON

RESERVOIR REGULATION MANUAL

Prepared by
U. S. Army Engineer District, Portland
Corps of Engineers
July 1961



THE DALLES DAM

TABLE OF CONTENTS

<u>Paragraph</u>		<u>Page</u>
<u>ILLUSTRATION</u>		
	The Dalles Dam, From Oregon Side	Frontispiece
PERTINENT DATA		
		v
SECTION I - INTRODUCTION		
1-01.	Authority	1
1-02.	Purpose and scope	1
1-04.	Revisions to manual	2
SECTION II - PROJECT HISTORY		
2-01.	Authorization and purpose	3
2-02.	Early history	3
2-06.	Significant construction dates	5
2-07.	Major construction contracts and costs	5
2-08.	Navigation	7
2-10.	In-service dates - navigation locks and power units	8
SECTION III - BASIN DESCRIPTION		
3-01.	Project location	10
3-02.	Drainage area	10
3-03.	Stream system	10
3-05.	Topography	11
3-08.	Natural resources and industry	12
3-10.	Population	13
SECTION IV - HYDROLOGY AND METEOROLOGY		
4-01.	General	14
4-02.	Temperature	14
4-03.	Precipitation	14
4-04.	Snow	15
4-05.	Streamflow characteristics	16
4-08.	Stream gaging stations	16
4-13.	Runoff	18
4-15.	Floods	19
4-18.	Flood frequencies	20
4-19.	Sedimentation	21
4-25.	Water temperatures	23

TABLE OF CONTENTS (cont'd)

<u>Paragraph</u>		<u>Page</u>
SECTION V - DESCRIPTION OF PROJECT FEATURES		
FEATURES OF THE DAM		
5-01.	General	24
5-02.	Powerhouse	24
5-05.	Spillway	26
5-08.	Navigation lock	27
5-10.	Fish facilities	28
5-17.	Nonoverflow sections	29
FEATURES OF THE RESERVOIR		
5-22.	General	32
5-23.	Storage	32
5-24.	Backwater profiles	32
5-27.	Levee	33
5-28.	Tailwater and downstream gages	34
5-29.	Reservoir gages	34
5-30.	Inflow stations	35
5-32.	Freeboard	35
5-33.	Travel time	36
SECTION VI - PLAN OF OPERATION		
6-01.	Organization and responsibilities	37
6-06.	Coordination	39
6-09.	Agency liaison	40
6-14.	Standard operating procedure	41
6-18.	Power - general	43
6-19.	Power plant operation	43
6-20.	Turbines	44
6-24.	Generators	46
6-27.	Transformers	47
6-30.	Station service units	48
6-31.	Metering of generation	48
6-32.	Switchboards	49
6-37.	Circuit breakers	50
6-39.	Switching equipment	50
6-41.	Selection of units for meeting power demand	51
6-42.	Load frequency control	51
6-44.	Navigation	51
6-46.	Recreation	52
6-48.	Reporting network	53
6-52.	Communication	54
6-53.	River forecasting	55

TABLE OF CONTENTS (cont'd)

<u>Paragraph</u>		<u>Page</u>
SECTION VI - PLAN OF OPERATION (cont'd)		
6-57.	Inflow determination	56
6-60.	Outflow determination	57
6-65.	Pool gages	58
6-68.	Tailwater gages	59
6-69.	Fish ladder gages	59
6-70.	Weather instrumentation	60
6-72.	Reports	60
6-73.	Forms	60
6-74.	Power studies	63
6-75.	Emergency	63
6-77.	Public notices	64

<u>No.</u>	TABLES
1.	Climatological Summary - The Dalles, Oregon
2.	Monthly and Annual Precipitation - The Dalles, Oregon (3 sheets)
3.	Columbia River Traffic in Tons
4.	Temperature and Precipitation - Columbia Basin
5.	Snow Course Data - Columbia Basin
6.	Spillway Rating Table - 1 Bay
7.	Gages (2 sheets)
8.	Rating Table, Columbia River below McNary Dam (4 sheets)
9.	Rating Table, Umatilla River near Umatilla, Oregon
10.	Rating Table, John Day River at Service Creek
11.	Rating Table, Deschutes River at Moody

CHARTS	
1.	Frequency Curve - Columbia River at The Dalles
2.	Operation Curves - Main Units
3.	Operation Curves - Fishwater Units
4.	Spillway Discharge Rating Curves - 23 Bays
5.	Discharge Rating Curve - North Fish Ladder
6.	Discharge Rating Curve - North Fishway Auxiliary Water Tainter Gate
7.	Discharge Rating Curve - East Fish Ladder
8.	Storage Capacity Curves - The Dalles Reservoir
9.	Functional Chart
10.	Organizational Chart - The Dalles Project
11.	Organizational Chart - Portland District
12.	Organizational Chart - North Pacific Division
13.	Organizational Chart - Bonneville Power Administration
14.	Tailwater Rating Curves - Opposite Unit No. 8

TABLE OF CONTENTS (cont'd)

No.

PLATES

1. Basin Map - Columbia River and Tributaries
2. The Dalles Dam - General Plan and Sections
3. Daily Discharge Hydrograph, Columbia River at The Dalles
(Sheet 1 of 5)
4. Daily Discharge Hydrograph, Columbia River at The Dalles
(Sheet 2 of 5)
5. Daily Discharge Hydrograph, Columbia River at The Dalles
(Sheet 3 of 5)
6. Daily Discharge Hydrograph, Columbia River at The Dalles
(Sheet 4 of 5)
7. Daily Discharge Hydrograph, Columbia River at The Dalles
(Sheet 5 of 5)
8. Summary Hydrographs, Columbia River at The Dalles
9. Maximum Annual and Minimum Daily Discharges, Columbia
River at The Dalles
10. Gage and Levee Locations
11. Backwater Profiles
12. Backwater Profiles
13. Main One Line Diagram

APPENDIXES

- A. Memorandum of Agreement between the Corps of Engineers
and the Bonneville Power Administration for Operation
of The Dalles Dam Project
- B. Provisions Governing the Use, Administration and Naviga-
tion of The Dalles Dam Navigation Lock and Approach
Channels
- C. Public Notice, For Radio Transmitter Silence,
Bonneville Dam Area
- D. Public Notice, Closure of Columbia River Locks
- E. Public Notice, Bonneville Dam Reservoir Drawdown
- F. Public Notice, Operation of The Dalles and Bonneville
Dam Reservoirs
- G. Standard Forms
 1. NPD RF 12
 2. NPD RF 55 (Rev.)
 3. NPP 56a
 4. RCS NPPGW-52
 5. NPD RF 252
 6. NPP 252 (Rev.)
 7. Federal Power Commission
No. 4

THE DALLES PROJECT

PERTINENT DATA
(July 1961)

1. LOCATION OF PROJECT: On Columbia River, 3 miles above The Dalles,
Oregon.
2. AUTHORITY: Public Law 516, 81st Congress, 2nd Session, 17 May 1950.
3. PURPOSE: Power and inland navigation.
4. COST: Total as of 1 July 1960 \$248,000,000
5. SIGNIFICANT DATES:

Project authorization	17 May 1950
Initial appropriation for construction	2 November 1951
Construction began	18 February 1952
Dam closure	9 March 1957
Navigation lock in service	17 March 1957
Power on line (fishwater unit)	13 May 1957
Passage of first fish	17 March 1957
Completion of fish passage facilities	(not completed)
6. PROPERTY ADJUSTMENTS:

Area acquired	6639 acres
Access roads built	1 mile
Relocations:	
State highways	16 miles
County and other roads	2 miles
Railroads	38 miles
Power line	8 miles
Telephone and telegraph	58 miles

THE DALLES PROJECT

PERTINENT DATA (Cont'd)
(July 1961)

7. THE DAM:

Powerhouse, length	2089 feet
Spillway, total length	1467 feet
Navigation lock, overall width	200 feet
Closure section, length	2017 feet
Concrete nonoverflow sections:	
Navigation lock to spillway, length	574 feet
Spillway to powerhouse, length	1527 feet
Powerhouse to closure, length	452 feet
Earth embankments, length	<u>409 feet</u>
Total length of dam	8735 feet
Maximum height of concrete sections	200 feet
Maximum height of closure section	295 feet
Deck elevation (m.s.l.)	185 feet

Note: Distances are measured along construction base line
in all cases.

8. PROJECT BASIN

A. Columbia River above The Dalles, Oregon

<u>1.</u> Drainage area, total	237,000 sq mi
Canada area (yields 40% of runoff)	39,500 sq mi
USA area (yields 60% of runoff)	197,500 sq mi

THE DALLES PROJECT

PERTINENT DATA (Cont'd)
(July 1961)

8. PROJECT BASIN (Cont'd)

2. Climate

Temperature

Basin extremes -60° F to 117° F

Frost-free days in basin 100 to 200/yr

Precipitation

Basin average 24 in./yr

B. Columbia River in the Dalles Project Area

1. Climate

Temperature

Normal 54° F

Maximum of record 115° F

Minimum of record -30° F

Frost-free days, (avg) 288/yr

Overcast days, (avg) 78/yr

Precipitation

The Dalles area average 15 in./yr

2. Streamflow

Normal ann. R.O.

142,000,000 ac.-ft.; 195,500 cfs

Max. wat. year R.O. (1894)

227,000,000 ac.-ft.; 313,300 cfs

Min. wat. year R.O. (1926)

85,500,000 ac.-ft.; 118,000 cfs

Maximum flow of record (1894 flood) 1,240,000 cfs

Max. recent flow (1948 flood) 1,010,000 cfs

Min. flow of record (Jan. 1937) 35,000 cfs

100-year flood 1,190,000 cfs

1894 flood - controlled with

existing or under-construction

storage as of July 1960 1,030,000 cfs

THE DALLES PROJECT

PERTINENT DATA (Cont'd)
(July 1961)

9. RESERVOIR:

Item	Water Surface		Volume ac.-ft.
	Forebay elev-ft(m.s.l.)	Area acres	
Minimum power pool	155.0	10,350	280,000
Normal power pool	160.0	11,200	332,500
Spillway design flood (2,290,000)	182.3	14,000	Not avail.
1894 flood (1,240,000)	160.0	11,200	463,100
1948 flood (1,010,000)	160.0	11,200	429,500
Average flood (600,000)	160.0	11,200	372,400

Freeboard above design flood level (185 - 182.3) = 2.7 feet

10. SPILLWAY:

Type	Ogee, concrete gravity, gate controlled
Maximum width at base	240 feet
Height	68 feet
Number of bays	23
Overall length, including piers	1370 feet
Clear waterway length	1150 feet
Elevation of gate seal (m.s.l.)	119.50 feet
Crest elevation (m.s.l.)	121.00 feet
Elevation, deck (m.s.l.)	185.00 feet
Elevation of maximum gate opening (m.s.l.)	169.00 feet

THE DALLES PROJECT

PERTINENT DATA (Cont'd)
(July 1961)

10. SPILLWAY (Cont'd)

Type of gate	Tainter, (47-foot radius)
Height of gate	42.5 feet
Gate hoist	Cable lift
Gate control	Electric motor, push button
Design flood (maximum spillway capacity at pool elevation 182.3)	2,290,000 cfs
Head	61.3 feet
Maximum spillway capacity at pool elev. 160	1,050,000 cfs
Head	39.0 feet

11. STILLING BASIN

Type	Horizontal
Length	170 feet
Floor elevation (m.s.l.)	55 feet
Baffles	
Type	"Bluestone"
Rows	1
Size (height x width x length)	9 feet x 10.5 feet x 18 feet

12. NAVIGATION LOCK:

Type	Single lift
Normal lift	87.5 feet
Maximum list	90.5 feet
Inside clearance	86 feet x 675 feet

THE DALLES PROJECT

PERTINENT DATA (Cont'd)
(July 1961)

11. NAVIGATION LOCK (Cont'd)

Minimum depth over lower sill (at T.W. El. 69.5)	15 feet
Depth over upper sill (at normal pool elev. 160)	20 feet
Upstream lock-gate (Tainter-type) height	22 feet
Downstream lock-gate height	107.5 feet
Emergency accessories (Upstr. and downstr.)	Stop logs
Filling system:	Wall culverts with flood laterals & ports

Operating Data

Head (ft)	Filling time (min)	Emptying time (min)
90.5	12.2	14.7
83.6	11.9	14.2
62.8	10.7	12.2

Maximum wall height (foundation to top of guard wall, elev. 168.0)	146 feet
Length of upstream lock approach channel	1060 feet
Length of downstream lock approach channel	1170 feet

THE DALLES PROJECT

PERTINENT DATA (Cont'd)
(July 1961)

12. FISH PASSAGE FACILITIES:

LADDERS -

Item	North	East
Length	1761 feet	1801 feet
Width	24 feet	30 feet
Number of weirs	90	90
Weir height	6 feet	6 feet
Orifices (2 in each weir)	1'-11" x 1'-00"	2'-01" x 2'-02"
Slope	1 on 16	1 on 16
Top of ladder, invert elevation (m.s.l.)	147 feet	147 feet
Bottom of ladder, invert elevation (m.s.l.)	60 feet	60 feet
Number of entrance gates	3	3
Width of entrance gates	15 feet	8 feet - 8 inches
Fishway flow (from forebay)	150 cfs	175 cfs
Auxiliary attraction water supply	490-2050 cfs	5000 cfs

FISHLOCK -

Diameter	28 feet
Locking height, ave.	78 feet
Approach width	10 feet

THE DALLES PROJECT

PERTINENT DATA (Cont'd)
(July 1961)

12. FISH PASSAGE FACILITIES (Cont'd)

POWERHOUSE FISH COLLECTION SYSTEM -

Length	2064 feet
Width	17.5 feet
Fish entrances	
Number equipped with gates	56
Number normally operated	25
Size, (height by width)	2 feet x 6 feet
Floor elevation (m.s.l.)	63.5 feet

POWERHOUSE TRANSPORTATION CHANNEL -

Length	2373 feet
Width	18.5 feet
Floor elevation (m.s.l.)	63.5 feet

~~33~~ POWERHOUSE:

July 1961

GENERAL

Outside dimensions, including service bay	239 feet by 1462 feet
Service bay dimensions	86 feet by 75 feet inside diameter
Foundation dimensions	239 feet by 2150 feet
Generating capacity (without overload)	
Fish units - 2 ea. at 13,500 kw	27,000 kw
Main units - 14 ea. at 78,000 kw (initial)	1,092,000 kw
Main units - 8 ea. at 78,000 kw (future)	624,000 kw
Total	1,743,000 kw
Service units - 2 ea. at 3,000 kw (for Project use only)	6,000 kw
Hoisting Equipment (available to all turbines and generators)	2 - 370 ton bridge cranes
Control Room	
Location	Station Service Bay
Floor area	86 feet x 46 feet
Elevation (m.s.l.)	157.50 feet

POWER INTAKE FACILITIES

	MAIN UNITS	FISHWATER UNITS	STATION SERVICE
Number of openings for each unit	3 each with 1 bay	2 each with 1 bay	2 each with 1 bay
Trash rack dimensions (for each opening)	25 feet wide by 94 feet high	18 feet wide by 94 feet high	25 feet wide by 107 feet high
Gates, number and size	3 - 22½ feet by 45 feet	2 - 16 feet by 18 feet	1 - 8 feet by 8 feet
Type	Wheel	Wheel	Vertical lift
Hoist	Hydraulic	Hydraulic	Hydraulic
Elevation of sill (m.s.l.)	44.7 ft.	53.5 ft.	62.5 ft.
Penstock, number and size	None	None	2 ea. - 8 ft diam

HYDRAULIC TURBINES

MAIN UNITS

FISHWATER UNITS

STATION SERVICE

	14	2	
Number	14	2	
Manufacturer	Baldwin-Lima-Hamilton	Allis Chalmers	Pelton
Type	Kaplan automatic adjustable 6-blade propeller	Kaplan automatic adjustable 6-blade propeller	Francis
Rated capacity	123,800 hp at 81 feet	18,800 hp at 74 ft	4,500 hp at 81 ft
Best efficiency head	81.0 feet	74 feet	81.0 feet
Maximum head	90.5 feet	88 feet	90.5 feet
Minimum head	60 feet	55 feet	60 feet
Rated speed	85.7 rpm	200 rpm	277 rpm
Max runaway speed	171 rpm	430 rpm	554 rpm
Specific speed at rating	124	126.2	76.5
Diameter of runner	280 inches	120 inches	61 inches (throat)
Spacing center to center of turbines	86 feet	39.5 feet	26.5 feet
Governors, type	Flyball	Flyball	Flyball

APX

DRAFT TUBES

Type and opening	Elbow type with rectangular opening	Elbow type with rectangular opening	Elbow type with rectangular opening
Horizontal length (turbine to downstream face)	98 feet - 6 inches	51 feet - 0 inches	68 feet - 0 inches
Vertical distance (distributor to draft tube floor)	70 feet - 8 inches	35 feet - 6 inches	50 feet - 9 inches
Outlet opening, net area of each	884 square feet	460 square feet	341 square feet

13. POWERHOUSE (Cont'd)

July 1961

GENERATORS	MAIN UNITS	FISHWATER UNITS	STATION SERVICE
Number (initial installation)	14	2	2
Manufacturer	General Electric	Westinghouse	Electric Machinery Mfg. Co.
Type	Water-wheel driven	Water-wheel driven	Water-wheel driven
Installation	Vertical	Vertical	Vertical
Speed, rpm	85.7	200	277
Cycles	60	60	60
Poles	84	36	26
Rating, kw and kva			
Nameplate, 60° C rise	78,000 kw 82,105 kva	13,500 kw 14,210 kva	3,000 kw 3,750 kva
Guaranteed 15% overload	89,700 kw 94,420 kva	15,252 kw 16,350 kva	3,450 kw 4,320 kva
Power factor	0.95	0.95	0.80
Voltage regulator, number	14	2	2
Generator, floor elev.(m.s.l.)	111.50 ft.	90.00 ft.	90.00 ft.
Diameter, rotor	398 inches	186 inches	107 inches
Diameter, stator	482 inches	240 inches	182 inches

TRANSFORMERS

Number	3-115 kv and 18- 230 kv	3
Type	two-winding, type FOW	Oil immersed
Manufacturer	Ferranti, Ltd., England	Central Transformer Corp.
Phase	Single phase	Single phase
Cooling	Oil cooled	Forced air cooled
Rating (55° C rise)	3 @ 13.2/115 kv, 63,000 kva 18 @ 13.2/230 kv, 63,000 kva	13.2/115 kv, 8720 kva self-cooled or 10,900 kva forced- air-cooled

AX

~~13.~~ POWERHOUSE (Cont'd)

July 1961

CIRCUIT BREAKERS

MAIN UNITS

FISHWATER UNITS

STATION SERVICE

Number (initial installation)

14

2

Type

Air blast station
type

Solenoid-operated

Capacity

14.4 kv, 4000 amp.,
1500 mva I.C.

13.8 kv, 1200 amp.,
500 mva I.C.

THE DALLES RESERVOIR REGULATION MANUAL

SECTION I - INTRODUCTION

1-01. Authority. - Authority and preparation of this manual has been in accordance with the provision of paragraph 6 of ER 1110-2-240, dated 8 December 1958, and paragraphs 6-01 - 6-03 of EM 1110-2-3600, dated 25 May 1959.

1-02. Purpose and scope. - The purpose of this manual is to document the plan of reservoir regulation and to provide a reference source for higher authority and for personnel who will be responsible for the regulation of The Dalles Reservoir.

1-03. Material presented in the manual includes a concise description of the basin, history of the conditions leading to the authorization of the project, and a discussion of the project in relation to the coordinated plan of basin development. It likewise contains background information necessary for understanding the objectives of the project and the necessary information and instructions to implement the regulation of the reservoir. Such items as organization for reservoir regulation, method of regulation, regulation schedules, hydrologic networks, forecasting procedures, liaison and working agreements with other projects and agencies, public relations, and pertinent data, are given full coverage in the manual.

1-04. Revisions to manual. - Changes and revisions to this manual will be made by the Engineering Division of the Portland District. Changes will be made for the purpose of improving reservoir regulation

techniques, or when developments occur which necessitate revision of the information and data presented in this manual. Any changes in the reservoir regulation plan that affect the authorized functions of the reservoir, or otherwise constitute major changes in the approved regulation plan, will be submitted through the North Pacific Division to the Office, Chief of Engineers, for prior approval. Whenever revisions are made, new pages containing the revised material will be printed and issued to each person or office having a copy of this manual. Revised pages will show the date of revision.

SECTION II - PROJECT HISTORY

2-01. Authorization and purpose. - The Dalles project was authorized by the Flood Control Act approved May 17, 1950 (Public Law 516, 81st Congress, 2d Session) on the basis of the report published as House Document 531, 81st Congress, 2d Session, to provide improved inland navigation facilities on the Columbia River and for generating hydroelectric power to meet the needs of the rapidly growing industries of the Pacific Northwest. In addition, the reservoir will provide incidental irrigation and recreation benefits. The project was not designated for flood control use.

2-02. Early history. - The U. S. Reclamation Service (now Bureau of Reclamation), in cooperation with the State of Oregon, made an investigation of The Dalles-Celilo power site in 1914-1915. The proposed plan of development consisted of a dam at the head of 5-Mile Rapids with a normal pool elevation of 151 feet and a canal about 1.5 miles long, leading to a proposed powerhouse at Big Eddy.

2-03. Under the provisions of House Document No. 308, Sixty-ninth Congress, first Session, the U. S. Corps of Engineers investigated The Dalles dam site during 1928-1931. Their plan of development was proposed in House Document No. 103, Seventy-third Congress, first Session and consisted of two dams; namely, The Dalles Dam, with a normal pool elevation of 330 feet, and Warrendale Dam, now Bonneville Dam, with a pool elevation of 54 feet. House Document No. 704, Seventy-fifth Congress, third Session, 1937, proposed a dam at the foot of 5-Mile Rapids with reservoir

pool elevation of 150 feet msl, a double-lift navigation lock with each chamber 12 x 56 x 360 feet, and a power plant with a capacity of 517,000 kw.

2-04. Bonneville Dam, located at river mile 145, was completed with two power units in 1937. This was the first Federally constructed dam on Columbia River. Eight additional units were added, bringing the total power installation to 518,400 kilowatts by 1943. The dam is provided with a single-lift ship lock 76 feet wide and 500 feet long. Depth over the lower lock sill is 24 feet at adopted low water. More than 95 percent of the time, however, the depth is 27 feet or greater. The City of The Dalles is the upper limit of the 27-foot, deep-draft channel. Upstream from The Dalles, John Day Dam is under construction at the head of The Dalles pool, and McNary Dam has been completed. The navigation lock at The Dalles has a width of 86 feet and a clear length of 675 feet. John Day Dam, McNary Dam and the lower Snake River dams will all have the same size locks. The depth over both the upper and lower sills at The Dalles navigation lock is 15 feet at minimum power pool. A general plan and typical sections of The Dalles project are shown on plate 2.

2-05. The completion of The Dalles project constitutes another step forward in the orderly development of the Columbia River Basin. Its operation will provide needed power for industry and improved inland navigation for the region. A more complete discussion of the Columbia River Basin development is found in Volume 1, Water Resource Development, Columbia River Basin, dated June 1958. (Review of House Document 531, 81st Congress, 2nd Session.)

2-06. Significant construction dates. - Construction work on The Dalles project was initiated on 18 February 1952, by a contract which called for the construction of a cofferdam enclosing the entire powerhouse area and the excavation of a major part of the powerhouse area. Construction of the spillway and appurtenances was started in November 1952. Concrete placing in the spillway section and in the draft tubes of the powerhouse was commenced in December 1953. In June 1953, construction of the substructure of the first 14 main units for generating power was started. Similar work on the excavation and construction of the substructure for the remaining 8 main units was started in January 1954. In January 1954, grading operations and construction of bridges on the relocated UPRR and U.S. Highway No. 30 on the Oregon shore were initiated; similar work on the SP&S RR on the Washington shore was begun in February 1955. Dam closure operations were initiated in October 1955. In 1956, construction was in progress simultaneously under seven continuing prime contracts.

2-07. Major construction contracts and costs. - The following table shows a list of the major contractors on The Dalles project, their contracts, dates of award and completion, and cost:

MAJOR CONSTRUCTION CONTRACTS ON THE DALLES PROJECT

Contract Item	Contractor	Awarded	Construction		Payment Made
			Began	Completed	
Cofferdam and powerhouse excavation	S. A. Healey Co.	Jan 24, '52	Feb 18, '52	Jan 13, '54	\$ 5,368,653
Spillway dam and appurtenances	Atkinson-Ostrander Company	Oct 8, '52	Oct 29, '52	Sep 25, '56	\$14,636,655
Powerhouse substructure, Phase I	The Dalles Powerhouse Constructors	Jun 10, '53	Jul 11, '53	Jan 12, '56	\$31,031,842
Powerhouse substructure, Phase III	Atkinson-Ostrander Company	Dec 30, '53	Jan 21, '54	Jul 1, '56	\$19,304,359
Shoofly on the SP&S RR	G. D. Dennis & Sons	Jun 17, '53	Jun 30, '53	Jan 9, '54	\$ 226,347
Navigation lock facilities	Atkinson-Ostrander Company	Sep 7, '54	Sep 24, '54	Mar 20, '57	\$14,243,421
Powerhouse Superstructure, Phase II	S.J. Montag & Sons	Dec 21, '54	Jan 31, '55	Sep 18, '58	\$14,164,558
Grading and track laying, SP&S RR	Morrison Knutson Co.	Jan 28, '55	Feb 7, '55	Sep 28, '56	\$ 2,650,695
Closure dam	Atkinson-Ostrander Company	Oct 10, '55	Oct 26, '55	Mar 31, '57	\$ 4,947,784

The following tabulation shows a breakdown of the estimated construction costs as of 1 July 1960:

<u>Project Feature</u>	<u>Construction Cost</u>
Lands and Damages	\$ 32,100,200
Relocations (highways and railroads)	20,898,500
Reservoir (reservoir clearing)	150,900
Dam, Spillway and Non-overflow Section	24,741,400
Fish Passage Facilities (ladder, elevator, channels)	13,927,700
Fish passage facilities power plant	2,552,600
Project roads and railroads	651,000
Reservoir levees and pumping plants	313,300
Buildings, grounds and utilities	1,421,200
Permanent operating equipment	1,072,100
Navigation locks, guide walls and channel excavation	12,450,500
Power plant (powerhouse, turbines (except fishway turbine))	117,787,600
Recreation facilities	193,000
Preauthorization studies, engr. design, supervision, administration	<u>19,740,000</u>
TOTAL	\$ 248,000,000

2-08. Navigation. - The dam and single-lift navigation lock replaced The Dalles-Celilo canal which was built in 1915. The Dalles-Celilo canal and locks were closed on 2 January 1957 and were subsequently inundated with the construction of the rock closure section upstream

from The Dalles powerhouse. Until The Dalles navigation lock was opened to traffic on 17 March 1957, petroleum products were pumped around the closure section by pipeline. Traffic on other products was temporarily suspended for $2\frac{1}{2}$ months. With the completion of The Dalles project all water-borne vessels passing upstream through the Bonneville lock will operate in slack water to the head of The Dalles pool, a distance of about 75 miles. Completion of The Dalles navigation lock constitutes another step forward in the ultimate plan to provide slack water as far upstream as Richland, Washington, on Columbia River and Lewiston, Idaho, on Snake River. These points are 339 and 464 miles, respectively, from the Pacific Ocean, and 248 and 374 miles, respectively, upstream from Portland, Oregon.

2-09. Table 3 shows the increase in river traffic between Bonneville and The Dalles since 1930. Barge traffic upstream from The Dalles Dam is expected to average a total of about 9,186,000 tons annually during the 50-year period, 1975-2025. (Source: Review of H.D. 531, 81st Congress, 2nd Session.)

2-10. In-service dates - navigation lock and power units. - Following the dam closure, water in The Dalles Reservoir was raised to minimum power pool, elevation 155 feet, on 16 March 1957, and to normal power pool, elevation 160, on 16 July 1957 when the new lift span of the reconstructed Oregon Trunk Railway Bridge at Celilo was placed in operation. The navigation lock was opened to river traffic on 17 March 1957. "On-line" dates for the fishwater generator units No. 1 and No. 2 (each of 13,500 kw), were 13 May and 3 June 1957, respectively. Dates that each of the initial 14 main units have gone into service are:

<u>Unit</u>	<u>Date</u>
1	September 25, 1957
2	October 31, 1957
3	January 17, 1958
4	April 24, 1958
5	September 11, 1958
6	October 24, 1958
7	January 16, 1959
8	April 16, 1959
9	August 28, 1959
10	October 10, 1959 (Dedication of the project)
11	January 26, 1960
12	April 5, 1960
13	July 22, 1960
14	October 28, 1960

Each of the main generating units is rated at 78,000 kw.

SECTION III - BASIN DESCRIPTION

3-01. Project location. - The Dalles Dam is located on the Columbia River at the head of Bonneville Reservoir, 192.5 miles upstream from the mouth of the river and 3 miles east of The Dalles, Oregon. Portland, the largest population and industrial center on the Columbia River, is 97 river miles below The Dalles Dam. The Oregon-Washington state boundary lies along the main Columbia River channel, dividing the project between the two states. All of the project except the rockfill closure dam is in the State of Washington. Plate 1 is a map of the Columbia River Basin, showing the geographical location of The Dalles project.

3-02. Drainage area. - The Dalles Reservoir has a tributary drainage area of 237,000 square miles, an area equal to nearly 8 percent of the continental United States. Of the basin total, 17 percent, or 39,500 square miles, is in Canada and contributes 40 percent of the average annual runoff of the Columbia River at The Dalles. The drainage area above The Dalles Dam is bounded by the Rocky Mountain Range on the east and the Cascade Range on the west. The watershed extends from 41 degrees to 53 degrees N latitude and from 110 degrees to 124 degrees W longitude. All of Idaho, most of Washington and Oregon, and parts of Montana, Wyoming, Utah, and Nevada are within the watershed of the Columbia River.

3-03. Stream system. - The Columbia River originates in Canada's Columbia Lake at elevation 2,650 feet and flows a distance in excess of 1,000 miles before entering The Dalles Reservoir. From Columbia Lake, the river flows in a northerly course before abruptly turning south at Mica, Canada.

From Mica, the river flows for 680 miles in a southerly direction until it reaches Pasco, Washington, at the mouth of Snake River. From this point, the river takes a westerly course to The Dalles Dam and on to the Pacific Ocean. Generally, the channels of the main stem and its major tributaries are in relatively deep narrow canyons, but there are some reaches along the tributaries and below The Dalles Reservoir where lands adjacent to the streams are subject to overflow and flooding. Stream gradients are relatively steep. The natural profile of the main stem of Columbia River falls 2,600 feet from its origin to The Dalles, and 50 feet from The Dalles to its mouth.

3-04. The principal tributary streams above The Dalles project and their drainage areas are given in the following table, in upstream order:

<u>Stream</u>	<u>Drainage area, sq. mi.</u>
Columbia River at The Dalles	237,000
Deschutes River	10,500
John Day River	7,840
Snake River	109,000
Yakima River	5,970
Okanogan River	8,415
Spokane River	6,640
Kettle River	4,160
Pend Oreille River	25,200
Kootenai River	19,300

3-05. Topography. - The topography of the basin is characterized by numerous mountain ranges, gorges, vast rolling plateaus and broad valleys. Rugged sections of the basin in northern Canada, northern and central Idaho, and western Montana, contribute the major portion of the streamflow at The Dalles project. The Rockies and Cascade Ranges are

the two principal mountain systems that bound the basin on the east, north, and west. Their slopes are generally steep and they have peaks ranging from 4,000 to 14,000 feet in elevation. Numerous large lakes comprising a total area of about 2,500 square miles exist in the basin as the result of glacial activity. Over 60 percent of the basin is above 4,000 feet elevation and 14 percent is above 7,000 feet elevation. These high elevations are barriers to the moisture-laden winds moving in off the Pacific Ocean and have a definite influence on the climate and flora of the basin.

3-06. The plains area, known as Inland Empire or Columbia Plateau, is a gently sloping area of 100,000 square miles in the central portion of the basin. It extends from central Oregon through central and eastern Washington into British Columbia. Another similar area is the Snake River plains which occupies most of southern Idaho. These regions are relatively arid and contribute little to the flow of Columbia River.

3-07. Forest lands constitute the largest single segment of the area in the Columbia Basin, 44 percent. A large portion of these lands are government-owned and managed. Open range lands which are situated between the agricultural lands in the valleys and the forested areas in the mountains constitute 24 percent of the basin's area. Crop lands and agricultural lands comprise 22 percent of the area. A substantial portion of the crop lands are under irrigation.

3-08. Natural resources and industry. - The principal natural resources of the Columbia Basin, in order of importance are: Agricultural land, forests, mineral deposits, fish, and water supply. Great progress has been made in the development and utilization of agricultural resources.

Approximately 25 percent of the cropped land above The Dalles is irrigated. Expansion of irrigated land will continue as the demands of the region and world markets increase, and the water supply is made available. The Dalles project contributes only to incidental irrigation. See House Document 531 for details on development of the agricultural resources of the entire Columbia Basin.

3-09. The development of the region is related to its natural resources, hydroelectric power potential, and inland navigation facilities of the Columbia River. While farm products, fish industry, forests, and mines still constitute a large portion of the area's economy, the trend is toward diversification and increased manufacture of finished products from its own mineral and forest resources. In recent years, the area has attracted electrometallurgical and electrochemical industries because of the availability of low cost power in the Columbia River Basin. The abundance of high-quality water and power brought two of the Atomic Energy Commission's installations into the area. With adequate flood control, and the continuing development of water power and inland waterway facilities, the area will continue to be in a position to offer attractive advantages to industries.

3-10. Population. - Between 1940 and 1950, the rate of population growth in the Pacific Northwest has been more than twice the national average. Between 1950 and 1960, the rate has been greater than the national average but to a lesser degree than during the 1940 to 1950 period. The war-time population gain has been retained, and post-war industrial expansion has attracted more workers. Today, the manufacturing industry employs more than 20 percent of the region's labor force.

SECTION IV - HYDROLOGY AND METEOROLOGY

4-01. General. - Because of the large variations in latitude, longitude and topography, the Columbia River Basin above The Dalles experiences extremes in climate. Both maritime and continental air masses affect the area, resulting in wide variations in temperature and precipitation. Located in the belt of prevailing westerlies, the basin experiences its greatest precipitation where topographic barriers intercept the moisture-bearing winds from the Pacific Ocean, with lowest amounts occurring at low elevations on the leeward sides of the prominent barriers.

4-02. Temperature. - Daytime temperatures during the summer months are generally warm, due to the predominance of continental air masses.

Winter temperatures vary widely, being generally moderate under maritime influences, but extremely cold during short periods when polar continental air invades the area. Extremes of 117 degrees F. and minus 60 degrees F. have been recorded, but periods of extremely hot and cold temperatures are generally of short duration. Maximum summer temperatures are generally in the 80's and winter minimums are between 10 and 20. Frost-free periods range from over 200 days in the valleys to less than 100 days at the high elevations. More detailed description of the climate can be found in Water Resource Development - Columbia River Basin, dated June 1958 (Review of H. D. 531, 81st Congress, 2nd Session).

4-03. Precipitation. - The normal annual precipitation over the drainage area above The Dalles Dam is about 24 inches. The average annual precipitation in the basin ranges from 6 inches in portions of the

plains area of eastern Washington and southern Idaho to over 100 inches in the mountainous regions. Generally, the precipitation increases with elevation and decreases in an easterly direction away from the influence of the Pacific Ocean. The greatest storm activity is during the winter months. In the central and eastern portions of the basin, the maximum precipitation generally occurs in May and June in the form of rain when there is still some snow at the higher elevations. Except for occasional thunder showers and hail storms, the summers are mostly storm-free. Table 4 summarizes temperatures, precipitation and snowfall for a number of representative stations above The Dalles. Similar statistics in tables 1 and 2 for The Dalles, Oregon, represent the local climate in the vicinity of The Dalles project.

4-04. Snow. - Since most of the precipitation over the basin above The Dalles Dam occurs during the winter months when low temperatures predominate, a large percentage is in the form of snow. At high elevations snow may occur as early as September, accumulating to a maximum depth in April or May. The months of greatest snowfall are December and January. Records show that the average annual snowfall at Glacier, British Columbia, elevation 4,100 feet, and at Snoqualmie Pass, Washington, elevation 7,780 feet, is 400 inches. There are a few peaks in the Kootenai and Upper Columbia Basins where glacier activity exists. Snow depths and water equivalent records for a number of representative snow courses are shown in table 5.

4-05. Streamflow characteristics. - Discharge hydrographs on plates 3 to 7, together with the summary hydrographs and the flow-duration

curve on plate 8, illustrate the flow characteristics of Columbia River at The Dalles project. The river begins to rise early in March, reaches flood stage in May, and usually peaks in June. The flood hydrograph is characterized by a prolonged high-water period with a relatively flat flood crest. The period of annual high water lasts from 60 to 120 days at The Dalles, Oregon.

4-06. High flows in the Columbia River are primarily the result of snowmelt, and fluctuate in late spring and early summer with the changes in basin temperature. The relatively slow recession of flows after the peak is due to the continued runoff from melting snow and to the storage effect of the large natural lakes in the upper Columbia Basin.

4-07. Occasionally, rainfall augments the streamflow and adds significantly to the rate and volume of runoff. At times the combination of rain and snowmelt from low levels in southern and western regions will cause the Columbia River at The Dalles project to rise during the winter, but such rises rarely exceed 200,000 second-feet, the approximate mean annual flow.

4-08. Stream gaging stations. - The only gaging station operated on the lower Columbia River was flooded out with the filling of The Dalles Reservoir in 1957. This station had a continuous record of daily discharges dating back to 1878, the longest of any station in the Columbia River Basin. The station did not, however, exist at one location during this 79-year period. The early record was compiled from staff gage readings observed at Umatilla, Cascade Locks, and The Dalles. In 1903

the station was moved to Celilo and it remained at this location until flooded out by The Dalles Dam. Maximum annual discharges have been estimated as far back as 1858 from staff gage readings observed at Cascade Locks. The discharge records compiled for the Columbia River near The Dalles were rated good by the U. S. Geological Survey who operated the station.

4-09. The loss of The Dalles gaging station presents a problem as to how to determine the flow in the Columbia River. The Columbia River is soon to become a slack-water reservoir all the way from tide-water at Bonneville Dam to well above the mouth of Snake River.

4-10. Several possibilities for measuring the flow of the lower Columbia River are being investigated. One is to utilize recorder gages at Court Street in The Dalles and at Hood River. The stages and water surface slope between these two gages are being correlated to discharges measured from the Hood River bridge. The results are fairly reliable for high flows but the correlation is not sensitive enough for low flows when the slope between stations is very flat. It is not a satisfactory arrangement.

4-11. Another possibility is to establish an acoustic flow meter at The Dalles. This is a new idea in stream metering and not fully developed. By sending ultrasonic waves back and forth across the river on a 45-degree angle the difference in time between the two transmissions can be attributed to the velocity of the river through which the sound beam is being sent and can be correlated to the measured flow in the river. It may be several years before this type of gage

is perfected but it offers the best possibilities for measuring the flow in Columbia River below The Dalles Dam, which is subject to wide daily fluctuations.

4-12. At the present time, the recorder gage below McNary Dam on Columbia River and recorder gages on the lower Umatilla, John Day, and Deschutes Rivers are being utilized to derive the inflow to The Dalles Reservoir. Three recorder gages have been installed in The Dalles pool. These stations are located at Celilo, Miller, and Rufus and are equipped to transmit pool elevations to The Dalles powerhouse when the individual stations are interrogated. This information is used to evaluate the effect of reservoir storage on the flows as they pass through The Dalles pool. Pool and tailwater gages at the project will be discussed in Section V.

4-13. Runoff. - The average annual discharge of Columbia River at The Dalles project is 195,500 c.f.s. or 141,500,000 acre-feet per year for the observed 79-year period, 1878-1957. Including the estimated values for the years prior to 1878, the 100-year average flow is 206,000 c.f.s. or 149,000,000 acre-feet per year. Plates 3 to 7 show for each year the total runoff, the minimum, maximum, and average daily flow. Between 1860 and 1900, the annual runoff was generally above normal; from 1920 to 1945 it was below normal; and since 1945 it has been about normal.

4-14. It is noted that 40 percent of the runoff at The Dalles Dam originates in Canada from an area equal to only 17 percent of the entire drainage area above The Dalles. Mean annual runoffs of the main stem and principal tributaries are shown in the following table which was summarized from U. S. Geological Survey Water Supply Paper for 1957, and from Water Supply Bulletin No. 6 of the State of Washington:

AREAS AND RUNOFFS OF THE COLUMBIA RIVER
AND PRINCIPAL TRIBUTARIES

Gaging station	: Drainage	: Period	: Number	: Mean annual runoff		
	: area,	: of	: of	: Million	:	:
	: sq. mi.	: record	: years	: C.f.s.	: ac.-ft.	: Inches
Columbia River at The Dalles ^{1/}	237,000	1878-1957	79	195,500	141.5	11.2
Deschutes River at Moody (mouth)	10,500	1906-1957	52	5,843	4.2	7.6
John Day River at McDonald Ferry	7,840	1905-1957	52	2,009	1.5	3.5
Snake River at Clarkston	103,200	1910-1957	48	49,699	36.0	6.5
Yakima River at Kiona	5,600	1897-1957	60	3,812	2.8	9.2
Okanogan River near Tonasket	7,270	1929-1957	28	2,948	2.1	5.5
Spokane River at Long Lake	5,920	1939-1957	18	8,010	5.8	18.4
Kettle River near Laurier	3,800	1929-1957	28	2,852	2.1	10.2
Pend Oreille River below Z Canyon	25,200	1912-1957	45	26,570	19.2	14.3
Columbia River at Birchbank	34,000	1913-1957	44	70,290	50.9	28.1

^{1/} Discontinued

4-15. Floods. - In lower Columbia River, high water occurs nearly every year in late spring and early summer and has exceeded flood stage at Vancouver 83 times in the last 100 years. Flood stage is 16 feet on the Vancouver gage, which corresponds to a flow of 450,000 second-feet at The Dalles. The average of the annual peak flows at The Dalles for

the period of record is approximately 600,000 second-feet. Major flood on the lower Columbia River is 750,000 second-feet which corresponds to 26 feet on the Vancouver gage. In the past 100 years, 750,000 second-feet has been exceeded 20 times at The Dalles. In the future the recurrence of major floods will be less frequent because of upstream storage regulation. It is estimated that existing upstream storage and storage under construction will reduce major floods approximately 3 feet at Vancouver. This is equivalent to reducing a 750,000 second-foot flood to 600,000 second-feet and an 1894 flood from 1,240,000 second-feet to 1,030,000 second-feet.

4-16. The larger floods of record occurred in June 1894 and May 1948. The 1894 flood had a maximum discharge of 1,240,000 second-feet at The Dalles and the 1948 flood had a maximum discharge of 1,010,000 second-feet. Thirty-eight persons lost their lives in this latter flood and property damage amounted to over 100 million dollars.

4-17. Occasionally there is a short-duration winter flood on the lower Columbia River. These maximum flows seldom exceed 250,000 second-feet, being well below the maximum flows experienced in the spring. Plate 9 shows the maximum and minimum flows for the Columbia River at The Dalles for each year of record.

4-18. Flood frequencies. - Frequency curves for natural and regulated maximum annual discharges at The Dalles, shown on chart 1, indicate that the flood stage at Vancouver may be expected to be equaled or exceeded in 84 and 72 percent of the years, respectively. The following information is abstracted from these frequency curves.

Flood frequency in years	Annual peak discharge, c.f.s.		Stage at Vancouver in feet	
	Natural	Regulated ¹	Natural	Regulated ¹
2	590,000	510,000	21.8	19.1
5	760,000	645,000	26.3	23.5
10	870,000	735,000	28.6	25.7
25	1,000,000	840,000	31.1	28.0
50	1,100,000	920,000	33.0	29.6
100	1,190,000	990,000	34.6	30.9

¹/ Regulated with existing reservoirs and reservoirs under construction. (1960)

4-19. Sedimentation. - In the past 50 years, the measurement of suspended sediment in the lower Columbia River has been undertaken on several occasions. The earliest record of suspended sediment measurements was in 1910 through 1912 when the Corps of Engineers, in cooperation with the U. S. Geological Survey, made measurements of suspended sediment at Cascade Locks. The results indicated the average concentration to be 40 ppm.

4-20. In 1942 and 1943 the water flowing over Bonneville spillway was sampled and tested for suspended sediment. The results of this investigation showed the average annual concentration of suspended sediment to be 76 ppm.

4-21. During the high water of 1948 fourteen water samples were taken at Bonneville Dam with a bucket-type sampler. The sediment concentration varied from 1,070 ppm near the peak of the 1948 flood to 70 ppm near the end of the high-water period in July. The type of sampler used had deficiencies and the results must be considered very preliminary. The results did show the variation in concentration that can be expected during periods of flooding as compared to the concentration experienced during winter low flows.

4-22. In 1949, 1950, and 1951, suspended sediment samples were taken of the Columbia River at Vancouver with modern-type samplers. During this period the maximum concentration observed was 410 ppm. The weighed average concentration was determined to be 90 ppm for the period studied. This concentration corresponds to an average annual suspended sediment load of 14,500,000 cubic yards. Even though the concentration is a relatively small percentage of the streamflow the large volume of water makes the annual sediment load a very significant figure which is reflected in the amount of dredging that is required on the lower river each year.

4-23. A one-year program of sampling the Columbia River for suspended sediment at Vancouver and Hood River was initiated in 1959. Results of this program, conducted as a part of the lower Columbia River dredging investigation, are not available at this time.

4-24. Silting of The Dalles Reservoir is not considered a problem for several reasons. First, there is a system of upstream reservoirs that will catch most of the heavier sediment before it reaches The Dalles Reservoir; and second, the finer materials that pass through these upstream reservoirs will be carried on through The Dalles pool. High velocities during the larger floods will have a flushing action on much of the suspended materials deposited in the pool. This has been experienced at Bonneville Reservoir and therefore a very low catchment rate is forecast for The Dalles Reservoir. There could be some silting at the mouths of the smaller streams flowing into The Dalles pool but this would be a local problem and would not result in a significant loss of storage in The Dalles Reservoir. After John Day Dam is in

operation the sediment load that might be caught in The Dalles pool should be even smaller.

4-25. Water temperatures. - Temperature of the Columbia River at Bonneville Dam and at The Dalles has been observed simultaneously over a period of 16 years, 1944-1959. These observations show a good correlation between stations as well as a well-defined water temperature pattern for the year. During the winter, December through March, the river temperatures are generally below 48 degrees F. Occasionally, during extreme cold weather, the water temperature will drop to near 32 degrees F. for periods as long as 2 weeks. In the spring, the river starts to warm and reaches about 58 degrees F. by the end of June. During July, August, and September, the river experiences its highest temperatures. August is normally the month with the highest water temperature, about 68 degrees for an average maximum. During October and November the water temperatures recede to their winter-time level. The maximum daily water temperature observed at either Bonneville Dam or The Dalles during the period 1944-1959, was 72 degrees F. and the minimum was 31 degrees F. The minimum temperature was observed during a period when temperatures over the exterior basin were much below zero degrees F.

SECTION V - DESCRIPTION OF PROJECT FEATURES

FEATURES OF THE DAM

5-01. General. - The Dalles Dam consists of a powerhouse, a concrete spillway, a navigation lock, concrete nonoverflow sections, an earth-fill embankment on the Washington shore, a rock-fill embankment on the Oregon shore, and fish passage and appurtenant facilities. The dam is 8,735 feet in length, including embankments. Maximum height of any concrete section from foundation to top of deck, elevation 185 feet m.s.l., is 200 feet; the maximum height of the earth- and rock-fill embankments is 295 feet. Normal pool at the dam is 160 feet above mean sea level, minimum pool is elevation 155 feet, and maximum pool elevation, which would occur during a spillway design flood, is 182.3 feet. Free-board is 2.7 feet above maximum pool for both concrete and embankment sections. Extreme tailwater elevations are 69.5 feet for a flow of about 35,000 second-feet and 132.0 feet for the spillway design discharge of 2,290,000 second-feet. Head differential between normal pool and minimum tailwater is 90.5 feet, and 50.3 feet between maximum pool and maximum tailwater. Various features of the project are described in the following paragraphs. Plate 2, a general plan of the dam, shows relative locations of principal features and typical sections of the structure. Pertinent data on various features of the dam are summarized on the project data sheets following the table of contents.

5-02. Powerhouse. - The powerhouse, located on the Oregon side of the spillway and parallel to the stream channel, has an overall length

of 2,089 feet and a maximum width of 239 feet. This structure will ultimately house 22 main power units, 2 fishwater units, station service units, an assembly bay and a control room. See plate 2. The assembly bay and the two fishwater units are located at the west end of the powerhouse. The control room and station service units are located between main power units No. 8 and 9. Fourteen of the main power units have been installed, with a total rated capacity of 1,092,000 kilowatts at an 81-foot head. Ultimately, 8 additional units will be added in the space provided in the east end of the powerhouse. The main power units are Kaplan-type turbines, 280 inches in diameter and spaced 86 feet on centers. The individual turbines are equipped with a 6-blade propeller that adjusts automatically and rotates at 85.7 revolutions per minute, developing 123,800 horsepower at the design head of 81 feet. At full generation each turbine discharges 12,430 second-feet of water. Chart 2 shows the megawatts generated per unit for any combination of discharge and gross head.

5-03. Station service generators of 3,000-kilowatt rated capacity are driven by Pelton Francis-type turbines and only provide power needed at the project. At rated capacity each station service unit discharges 624 second-feet at a gross head of 81 feet. No partial generation curves are shown for these units.

5-04. The fishwater generators have a generating capacity of 13,500 kilowatts each, and are driven by Kaplan propeller-type turbines with 6 automatic adjustable blades. Each turbine discharges 2,400 second-feet at generator rated capacity of 13,500 kilowatts and with 74 feet of effective head. Chart 3 shows the megawatts generated per unit for any combination of discharge and effective head.

5-05. Spillway. - The spillway has a total length of 1,467 feet which comprises 23 gate-controlled bays, each 50 feet in width. Piers 10 feet in width separate the bays. Elevation of the crest of the ogee section is 121 feet. The spillway has a maximum height of 120 feet with a 28-foot roadway at elevation 185 feet. Spillway discharges are controlled by 50-foot by 42.5-foot tainter gates. Each tainter gate is operated by two hoist units placed at deck level. Operation of the gates is by manual control of each hoist unit through pushbutton stations located near each hoist. The gate seal is on the reservoir side of the spillway crest at elevation 119.50 feet.

5-06. The design capacity of the spillway is 2,290,000 second-feet with a corresponding pool elevation of 182.3 feet. At normal pool elevation 160 feet, the spillway will pass a maximum discharge of 1,050,000 second-feet. Table 6 shows discharge ratings at partial gate openings for individual bays. Chart 4 depicts the combined free flow capacity of the 23 bays. Pool elevations used to determine spillway discharges are those observed at the navigation lock forebay gage and recorded on a chart in the navigation lock control building.

5-07. Energy of the water discharging through the spillway is dissipated by a hydraulic jump in a horizontal apron-type stilling basin equipped with baffles. The stilling basin floor, elevation 55 feet, m.s.l., is 170 feet in length. One row of Bluestone-type baffles is used to assist in dissipating the energy. The stilling basin has been designed to contain the jump for all discharges up to 2,290,000 second-feet. Normal tailwater elevation is 75 feet and maximum tailwater elevation is 132 feet. Plate 2 shows a cross section of the spillway dam.

5-08. Navigation lock. - The single lift navigation lock is located on the Washington shore. The lock has a clear width of 86 feet, a length of 675 feet, and a maximum lift of 90.5 feet. Minimum water depth over lower and upper sills is 15 feet. Normal depth over sills is 20 feet. The lock has gates 107.5 feet in height at the lower end and 22 feet in height at the upper end. It is filled and emptied through wall culverts with floor laterals and ports. Filling and emptying of the lock chamber is controlled by tainter valves. Maximum filling time is about 12 minutes and emptying time about 15 minutes. Total lockage time is expected to be about 30 minutes. Provision is made for stoplogs at the upstream and downstream ends of the lock chamber for use in emergencies. When flow in the river reaches 800,000 second-feet, the navigation lock will be closed to river traffic. Guard walls extend 1,060 feet upstream and 1,170 feet downstream to protect the 250-foot wide approach channels. Lock control facilities are located in control booths on the south or river side of the lock near each gate. In addition a lock control building is located on the river side of the lock near the upper gate.

5-09. Pool elevations recorded at the navigation lock forebay gage located in the north nonoverflow dam are transmitted electrically and recorded on a chart in the navigation lock control building. Two staff gages are located on the north guide wall of the lock chamber and a tailwater gage on the north guide wall of the downstream lock approach channel. Each individual lockage requires 5,448,000 cubic feet of water or about 125 acre-feet. This is equivalent to a flow of

7,500 c.f.s. over a period of 12 minutes, the time normally required to fill the navigation lock.

5-10. Fish facilities. - The fish-passing facilities at The Dalles Dam consists of the north fish ladder and auxiliary water supply system, south fish channel, powerhouse collection system and transportation channel, two fishwater power units, east fish ladder and fish lock located in the east nonoverflow dam. Total discharge through these fish facilities will vary between 5,930 and 7,380 second-feet.

5-11. The north fish ladder, located between the navigation lock and spillway dam, is 1,761 feet long, 24 feet wide, and has a slope of 1 on 16. Normal flow in the ladder is 150 second-feet which is regulated by a telescoping weir located in the upstream end of the ladder. See chart 5 for the north fish ladder rating curve. The auxiliary water supply system consisting of an intake structure, a 20-foot by 17-foot tainter gate, and a 20-foot trapesoidal channel, supplies water to the lower end of the north fish ladder. Discharges in the auxiliary water system will vary from 600 to 2,050 second-feet depending on height of tailwater. See chart 6 for tainter gate rating curve. Fish-counting facilities and a flow regulating weir are located in the exit structure.

5-12. The south fish channel which is 1,653 feet long and 16 feet wide, extends from the south end of the spillway to the west end of the powerhouse. There it connects with the transportation channel, 2,373 feet long and 18.5 feet wide, which traverses the entire length of the powerhouse.

5-13. The powerhouse collection system consists of a channel 2,064 feet long and 17.5 feet wide, containing numerous submerged orifices through which water is released to the powerhouse tailrace. Water is supplied to this channel from the east fish ladder and fishwater units.

5-14. The two fishwater power units, located in the west end of the powerhouse, are used for supplying auxiliary water to the south fish channel, east fish ladders, powerhouse collection system and transportation channel via conduits and diffusers. Chart 3, operation curves for the fishwater units, shows the generation in megawatts per unit for various discharges and effective heads. Each turbine will discharge 2,400 second-feet at generator rated capacity of 13,500 kilowatts and effective head of 74 feet. Maximum turbine capacity is 2,500 second-feet.

5-15. The east fish ladder is 1,801 feet long, 30 feet wide, and has a slope of 1 on 16. Normal flow in the ladder is 180 second-feet, which is regulated by a telescoping weir at the upstream end of the fish ladder. Fish-counting facilities and a flow regulating weir are located in the exit structure. See chart 7 for fish ladder rating curve.

5-16. The fish lock is 28 feet in diameter and is an auxiliary fish-handling facility to supplement the ladders during periods when the ladders are partially shut down or during periods when ladders might become overcrowded. Water for the operation of the fish lock and approach ladder is supplied from the forebay by conduits. The

approach fish ladder is 20 feet wide and the normal discharge is 120 second-feet. The fish lockage discharge amounts to 50,000 cubic feet or about 1 acre-foot per lockage.

5-17. Nonoverflow sections. - There are three nonoverflow gravity sections. One is located between the navigation lock and north end of spillway. Another extends from the south end of spillway to the west end of powerhouse, and the third section extends from the east end of powerhouse to the Oregon shore embankment.

5-18. The section between the lock and spillway is 574 feet long and contains the north fish ladder exit structure, auxiliary water supply intake structure, and stilling well for the navigation lock forebay gage. The float well is formed in the nonoverflow section with the chamber for housing the telemetering equipment reached through an opening in the deck slab.

5-19. The nonoverflow section between the spillway and west end of the powerhouse is 1,527 feet in length. At the powerhouse end of this section are the gate repair pit and storage facilities, and a portion of the ice and trash sluice which traverses the powerhouse from forebay to tailwater.

5-20. The concrete nonoverflow section between the east end of the powerhouse and the Oregon shore is 452 feet in length. This section of the dam contains the east fish ladder exit structure and the gravity fish lock.

5-21. The Oregon shore embankment consists mainly of quarry-run rock with an upstream blanket section varying in coarseness from

quarry-run rock to sandy gravel. The embankment has a maximum height of 295 feet, crest width of 30 feet, crest elevation of 185 feet, and a length of 2,017 feet. The upstream slopes vary from 1 on 2 above elevation 90, to 1 on 2.3 below elevation 90. The downstream slope is 1 on 1.5. This section of the dam has a freeboard of 2.7 feet above maximum design pool elevation. The seepage loss through the newly completed embankment is estimated to be about 100 second-feet. Silting of the upstream slope, however, is expected to gradually decrease the seepage. The Washington shore embankment is an earth-fill dike. The dike has a maximum height of 10 feet, a top width of 30 feet, crest elevation of 185 feet, and is 400 feet in length. The side slopes of the dike are 1 on 3.

FEATURES OF THE RESERVOIR

5-22. General. - The Dalles Reservoir is ²¹~~44~~ miles in length and forms a pool with an average width of about 4,000 feet and a maximum depth of about 90 feet near the dam. The reservoir has a surface area of 11,200 acres at normal pool, elevation 160. Reservoir storage, backwater profiles, levees, gages, freeboard, and travel time are discussed in the following paragraphs. See plate 10 for a map of the reservoir.

5-23. Storage. - Reservoir regulation at The Dalles project for power generation will be confined to the use of storage between elevations 155 and 160 for daily peaking purposes. Total storage at elevation 155, during low flow conditions, is 280,000 acre-feet, and 332,500 acre-feet at pool elevation 160, a difference of 52,500 acre-feet. The pool will be approximately level for its entire length during periods of low flows. As the discharge increases, a slope develops in the pool, particularly at the upper end. Total storage in the reservoir becomes a function of discharge as well as pool elevation at the dam for the higher flows. Chart 8 depicts the storage elevation relationship for a full range of discharges.

5-24. Backwater profiles. - The Dalles Dam will form a pool extending beyond the John Day Dam site, and the water surface in this reach will have very little slope during low flow periods. As the flow in the Columbia River increases, the slope becomes greater and the backwater effect for a flood the magnitude of the 1894 flood will extend 44 miles above The Dalles Dam, which is 21 miles above the John Day Dam site. Plates 11 and 12 show water surface profiles for both natural and backwater conditions for several discharges.

5-25. Plate 11 shows the natural water surface profile and the controlled backwater for the 1894 flood. This flood is significant in that it is the largest of historical record and was adopted as the design flood for relocating utilities, highways, and railroads. On this same plate are the water surface profiles for the 1948 flood and ordinary high water. The 1948 flood is the largest of the more recent floods and has a recurrence expectancy of once in 25 years. Ordinary high water corresponds to a flow of 425,000 second-feet and its significance is in that it was the basis for negotiating for real estate. Lands below ordinary high water are considered part of the river channel and not private property. The above profiles are supplemented by backwater profiles for five discharges between 530,000 second-feet and 1,050,000 second-feet. These profiles are shown on plate 12.

5-26. Backwater from The Dalles Dam is quite pronounced in the lower 2 miles of the Deschutes River, the only significant stream that will flow into The Dalles Reservoir after completion of the John Day Dam. Before John Day Dam is completed, backwater from The Dalles Dam will be evident in the lower reach of the John Day River.

5-27. Levee. - A levee about 1.3 miles in length was built along The Dalles Reservoir at Celilo to protect the Union Pacific Railroad and U. S. Highway 30. At this location the railroad and highway pass under the Oregon Trunk Railroad bridge. At the low point of the underpass the subgrade of the Union Pacific Railroad is about 3.5 feet below the 1894 controlled backwater profile. The top of the levee was constructed to provide 7.5 feet of freeboard above the 1894 controlled backwater profile. Drainage back of the levee, either surface runoff or seepage,

is collected in an open ditch and removed by two pumping plants. Location of levee and pumping plants is shown on plate 10.

5-28. Tailwater and downstream gages. - A tailwater gage is located at the station service bay between main units 8 and 9. Tailwater elevations at this gage are recorded automatically on a chart in the powerhouse control room. Staff gages are located at all fish ladder entrances and in the navigation lock approach channel. A recorder and staff gage, identified as the Court Street gage, is located on the dock at The Dalles. This gage, in conjunction with the gage at the Hood River bridge, 19.3 miles downstream, is used in determining the water surface slope between the two points. The slope in conjunction with the Hood River gage reading is used to compute the flow in the Columbia River below The Dalles Dam. Discharge records for this station are published in Water Supply Papers of the U. S. Geological Survey. Gage locations are shown on plate 10 and listed in table 7.

5-29. Reservoir gages. - To obtain more effective regulation of the reservoir for power and navigation, automatic stage recording gages have been installed in the reservoir. One gage is installed in the north nonoverflow section between the spillway dam and navigation lock. Pool elevations at this gage record automatically on a chart in the navigation lock control building. This gage is identified as the navigation lock forebay gage. At the powerhouse, the forebay gage is located in the pool opposite the station service bay. Pool elevations at this gage are recorded automatically on a chart in the powerhouse control room. In the reservoir upstream from the dam, automatic stage transmitting equipment

and water stage recorders are located at Celilo, Miller, and Rufus, river miles 200.6, 204.0, and 213.2, respectively. Pool elevations at these locations are transmitted and recorded automatically on a chart in the powerhouse control room.

5-30. Inflow stations. - Gaging stations are located on the Columbia River below McNary Dam and on the main tributaries at Umatilla, John Day, and the Deschutes Rivers. These stations are used to determine the inflow to The Dalles Reservoir. The station below McNary Dam is used as a tailwater gage and records the discharge from McNary Reservoir. It is located about one-half mile below the dam on the Washington shore, and is equipped with a stage recorder and a telemark by means of which stage reports are received in the McNary powerhouse. The station has been rated for discharge, table 8, and is used in determining the outflow from McNary Dam. When John Day Dam is in operation this station will be affected by backwater from John Day Reservoir. The release from John Day Dam will then be used in determining the inflow to The Dalles Reservoir.

5-31. Stream gaging stations equipped with stage recorders and telemarks are located on the Umatilla River near Umatilla, John Day River at Service Creek, and Deschutes River at Moody. Discharge ratings for the three stations are shown in tables 9 through 11. The discharges at these stations, including the station below McNary, are used at present to determine the inflow to The Dalles Reservoir. When John Day Dam is completed, the release from John Day Dam and the discharge from the Deschutes River will be used to determine the inflow. Location of the gages is shown on plate 10.

5-32. Freeboard. - On the basis of a 75-mile an hour wind, a wave height plus ride-up of 6.8 feet was computed by the modified Stevenson formula for the more critical areas along The Dalles pool. However, after conferring with the railroads in regard to relocating their roadbeds along both shores of the reservoir it was agreed to provide 7.5 feet of freeboard above the backwater of a controlled 1894 flood. The railroads, prior to the construction of The Dalles Dam, had a minimum freeboard of 7.5 feet between their roadbed and the water surface profile of the 1894 flood. Highways and the levee at Celilo were also constructed to the same freeboard criterion as the railroads. At the dam, the freeboard is 2.7 feet above maximum pool and 25 feet above the pool elevation of the controlled 1894 flood.

5-33. Travel time. - Travel time of discharge fluctuations through the 75-mile reach from McNary Dam to the head of The Dalles pool during periods of low flows is about 12 hours, approximately 1 hour through The Dalles pool, and 2 hours through the Bonneville pool. After John Day project is completed, the travel time from McNary to John Day will be approximately 3 hours. At the present time the travel time of discharge fluctuations from McNary to The Dalles dam is about 13 hours, which will be reduced to about 4 hours after the completion of John Day Dam. During periods of high river flows, the travel time of discharge fluctuations will be less than during low flows.

5-34. For discharges less than 600,000 second-feet, the average velocity of water flowing through the reservoir will vary between 1 to 3 miles per hour in the lower half of the reservoir and 3 to 5 miles per

hour in the upper half of the pool. During extreme floods the velocities will range from about 4 miles per hour near the dam to 8 miles per hour at the upper end of the pool.

SECTION VI - PLAN OF OPERATION

6-01. Organization and responsibilities. - Water regulation and power loading at The Dalles project is the responsibility of the Engineering Divisions in the Portland District and North Pacific Division offices. The District office is responsible for the development of all basic operating criteria, procedures, schedules, and rule curves involving water regulation and power loading and for documenting this information into a reservoir regulation manual. This assignment will be accomplished by the Project Planning and Power Section and Hydrology Section of the Engineering Division. The North Pacific Division office will be responsible for the daily liaison with the Bonneville Power Administration in regard to scheduling power generation at The Dalles and in coordinating intradivision power generating activities. Charts 9 through 13 show functional and administrative organizational charts relating to The Dalles project.

6-02. Duties of the Engineering Division personnel assigned to the functional regulation of The Dalles project include the following:

a. Assist the Division office in developing a plan of operation including system power regulation that will produce optimum overall project benefits.

b. Maintain a continuing program of study toward improving the method of operating the reservoir for power, fish, and navigation. Reexamine schedules for their adequacy and effectiveness.

c. Prepare and distribute reservoir regulation manuals and keep the manual up-to-date.

d. Discuss with, and assist the Division office in the day-to-day scheduling of power generation at The Dalles.

e. Prescribe pool operating limitations and supervise their interpretation, including gate regulation.

f. Act as a liaison with fishery interests in regard to the operation of the fish facilities at the dam.

6-03. Physical operation and maintenance of The Dalles project are the responsibility of the Operations Division. Resident responsibility is assigned to the Project Engineer, who reports to the Chief, Operations Division through the Chief, Multiple Purpose Projects Branch. The Project Engineer is responsible for the operation and maintenance of The Dalles project, including the dam, hydroelectric generating facilities, fish facilities, and navigation lock.

6-04. Dam tenders, powerhouse operators, and lock operators are under the supervision of the Chief of Operations, who is responsible to the Project Engineer. The Chief of Operations directly supervises the operation of the dam, reservoir, fish facilities, powerhouse, and navigation lock. Reservoir and power generation instructions are normally issued to one of the powerhouse operators but may be transmitted to the Powerhouse Superintendent, Chief of Operations, or on occasions to the Project Engineer. All instructions pertaining to the regulation of The Dalles pool and power generation shall be logged by the operating attendant receiving the instructions. Date, time, and name of person involved shall be noted in the log.

6-05. Pool, fish, and navigation instructions will normally be issued through the District office. Power generation instructions

shall originate from the North Pacific Division office as requested by Bonneville Power Administration.

6-06. Coordination. - Coordination involves two distinct levels, (1) the general overall planning for the Columbia River Basin, and (2) the actual day-to-day operation of the project. The general basin-wide planning is coordinated through the Columbia Basin Interagency Committee which is made up of representatives from all interested governmental agencies and state governments. This group normally meets once a month to hear and discuss various reports on basin development which may or may not receive the indorsement of the general committee. Several work groups are active in making studies and compiling data for the committee. There is also the International Joint Commission, which deals with problems of an international nature.

6-07. The day-to-day operation of The Dalles project involves the coordination between Portland District office, North Pacific Division office, and Bonneville Power Administration. The District office is responsible for the operation of the project and the formulation of operating procedures and limits. The Division office has the responsibility of coordinating all the Corps of Engineers' projects in the Columbia Basin with the Bonneville Power Administration, which is the government agency responsible for the sale and distribution of power generated at Federal projects in the Columbia Basin. It is imperative that these three offices consult and keep each other informed of actions taken individually in carrying out their responsibilities.

6-08. A formal agreement between the Corps of Engineers and Bonneville Power Administration, which outlines the operating arrangements between the two agencies, is shown in appendix A.

6-09. Agency liaison. - Several organizations other than the Corps of Engineers have a part, directly or indirectly, in the operation and regulation of The Dalles project. The more important groups are listed below:

Bonneville Power Administration	(BPA)
Northwest Power Pool	(NWPP)
U. S. Bureau of Reclamation	(USBR)
Columbia Basin Interagency Committee	(CBIAC)
U. S. Weather Bureau	(USWB)

6-10. Bonneville Power Administration has the responsibility for the sale and distribution of the power generated by The Dalles project. Because of this important responsibility it is vital that the Corps of Engineers and Bonneville Power Administration maintain close liaison with each other. The Northwest Power Pool, an advisory operating group made up of representatives from both Federal and non-Federal power projects, functions as a coordinating body in scheduling power generation at Federal and non-Federal plants on a mutual basis. Both long and short-range load and power capabilities are analyzed.

6-11. Coordination and liaison with the U. S. Bureau of Reclamation is vital to our water regulation problems in the Columbia River Basin. The Bureau has several significant power generating plants and many storage reservoirs that can and have performed significant flood regulation in Columbia River Basin. The operation of their

projects has a bearing on the operation of the Corps of Engineers' projects, including The Dalles.

6-12. The Columbia Basin Interagency Committee is a planning group with representation from all state and governmental groups interested in the development of the water resources of the Columbia River Basin. The group has no direct authority but serves as an advance planning group with prestige to review, advise, and recommend. The group meets approximately once a month and has subcommittees that conduct and report on pertinent studies requested by the parent group.

6-13. The U. S. Weather Bureau has an important function in the operation of the Corps of Engineers' projects in the Columbia River Basin. The River Forecasting Center in Portland provides a river forecasting service, whereas the national facsimile service provides the District office with weather maps and weather forecasts. The Weather Bureau also provides a vast amount of pertinent river and weather information which they collect throughout the Columbia River Basin and transmit by teletype to the District office.

6-14. Standard operating procedure. - Standard operating procedure for The Dalles project will be to maintain pool elevations that will give optimum power generation and navigation benefits with a minimum of obstruction to the movement of anadromous fish. Normal pool at The Dalles Dam is elevation 160, which will only be exceeded when the spillway discharge exceeds 1,050,000 second-feet. At this discharge the spillway becomes free overflowing and the pool rise is a function of the inflow. During periods of low flows, when The Dalles plant is load factoring, the pool will fluctuate as the result of short-term ponding operations.

This fluctuation will not exceed 5 feet. Normally the daily fluctuations will be less than 2 feet.

6-15. When the flow into The Dalles Reservoir is less than the total turbine capacity, maximum power generation can be obtained on a load factor basis by utilizing the storage space between minimum pool 155 and normal pool 160. This 5 feet of drawdown represents a storage capacity of 52,500 acre-feet and serves as a reregulating pool for upstream releases and provides storage space for load factoring at The Dalles. Normally only a fraction of this 5-foot drawdown will be used in any one 24-hour period. When The Dalles pool is to be fluctuated more than ^{1 foot}~~2 feet~~ in any 24-hour period, interested parties on and adjacent to the pool will be notified, as explained in paragraph 6-⁷⁷~~75~~, regarding public notices.

6-16. The initial power installation of 14 units is capable of utilizing a discharge of 211,000 second-feet, which has been equaled or exceeded under natural flow conditions only 32 percent of the time. The remaining 68 percent of the time The Dalles pool would have fluctuated in the course of load factoring the lower Columbia River hydro plants. Ultimately there will be a maximum of 22 units in operation at The Dalles, capable of discharging a maximum of 330,000 second-feet. Load factoring and pool fluctuations will be greater and more frequent when this stage of basin development becomes effective.

6-17. Pumps installed in the Wishram area dewater the leveed area automatically to maintain water levels landward of the levee within

a prescribed range. As an additional precaution, warning signals will alert personnel if water surface exceeds the safe level. Furthermore, as described in the Operations and Maintenance Manual for the levees and pumping plants, the region will be patrolled during critical periods of high flows to insure the satisfactory operation of all pumping and warning facilities.

6-18. Power - general. - The Dalles project is one of the major run-of-the-river power plants on the main stem of Columbia River. Its prime objective, other than to provide slack water for navigation, is to produce an optimum amount of electric energy and peaking consistent with the overall Columbia Basin system operation. Usable storage at the project is limited to the top 5 feet of the reservoir or 52,500 acre-feet. This permits load factoring during periods when the inflow is less than the turbine capacity, which will occur about 70 percent of the time with the initial installation of 14 main units and 2 fish units. These 16 units are capable of utilizing a flow of 216,000 second-feet. When the inflow exceeds 216,000 second-feet for an extended period of time the excess must be passed through the spillway. The operation of The Dalles project is directly related to the operation of both upstream and downstream projects requiring close coordination.

6-19. Power plant operation. - The Dalles powerplant will be operated within the limitations of the equipment in accordance with the general working agreement between the Corps of Engineers and Bonneville Power Administration for scheduling and generating power at The Dalles project. See appendix A. The Dalles Reservoir is not scheduled to be drawn down below elevation 155.0 and the release must be sufficient to

maintain a minimum flow of at least 43,000 c.f.s. below Bonneville Dam. Certain operations, such as voltage schedules, switching orders, transmission line schedules, and communications, may be modified by mutual agreement between the Chief of the Dispatching Section of the Bonneville Power Administration and The Dalles powerplant superintendent. For instance, when it becomes necessary to remove a unit from service, the superintendent will notify the chief Bonneville dispatcher the nature of emergency and the estimated time required to restore normal conditions at The Dalles powerplant. Detailed instructions, manufacturer's recommendations, and equipment limitations for operation of the powerplant are given in The Dalles Project Operation and Maintenance Manual. Only the general characteristics and limitations of the power generating equipment and appurtenances are described here.

6-20. Turbines. - The main turbines are 6-blade Kaplan propeller type. The blades adjust automatically with change in flow through the runner, as well as with change of speed and head. The maximum safe draft is 15,100 c.f.s. for each of the main units and 2,500 c.f.s. for each of the two fishwater units. In addition, there are two project service units which are used for supplying the power needs for all the multipurpose features of The Dalles project. The total head on the main turbines is determined from the water surface elevations of the powerhouse forebay and tailrace. Continuous recordings of these elevations are charted automatically in the control room. The pool gage is located in the reservoir opposite unit 9 and the tailwater gage between service units 8 and 9 in the tailrace. Tailwater rating curves for various conditions of Bonneville pool are shown on chart 14.

6-21. Turbines for the main units were built by Baldwin-Lima-Hamilton Corporation. They are rated at 123,800 and 86,500 horsepower under net heads of 81 and 60 feet, respectively. The fishwater units were furnished by Allis-Chalmers and are rated at 18,800 and 13,500 horsepower under heads of 74 and 55 feet, respectively. The turbines are large enough to drive their respective generators at the guaranteed overload capacity. To meet the instantaneous peak loads, the turbines may be operated at gate openings and heads limited only by cavitation which are indicated on charts 2 and 3. The manufacturer's guarantee applies to the power output limitations shown on the charts. Turbine performance curves for various conditions of head and discharge are shown on charts 2 and 3.

6-22. Pitch of the blades and the gate opening for water entry are governor-controlled. The inclination of the blades is adjusted by the guide vanes or the wicket gates to meet changing power demands and variation in head, thus insuring the highest efficiency for the respective head and load. A governor mechanism regulates the speed of the unit under varying load by means of a Pelton flyball device which responds to speed changes of 0.01 percent of the rating. Time required to close the wicket gates is 5 seconds for the main units and 10 seconds for the fishwater units.

6-23. Flow through each turbine is measured by a Leeds and Northrup Centrimax flow meter installed near the generator barrel on the turbine floor. It is connected to two Winter-Kennedy piezometer taps in the scroll case. A recorder mounted on each governor measures the flow in cubic feet per second. A totalizing recorder shows the volume released

through each unit, in cubic feet, and the plant totalizer records the total discharge in cubic feet per second currently passing through the powerhouse as well as the total volume in cubic feet. For more details, reference is made to the Operation and Maintenance Manual.

6-24. Generators. - The main unit generators were built by General Electric Company. Each unit has 84 poles and generates 13,800 volts of 3-phase, 60-cycle power at a speed of 85.7 revolutions per minute. Each unit is rated at 82,105 kilovolt-amperes at 0.95 power factor or 78,000 kilowatts with a 60 degrees C. temperature rise and is guaranteed for continuous operation at a 15-percent overload capacity of 89,700 kilowatts or 94,420 kilovolt-amperes with an 80 degree C. temperature rise. The fishwater generators, furnished by Westinghouse Company, have 36 poles, operate at 200 revolutions per minute, and are rated as 3-phase, 60-cycle, 13,800 volts, with a permissible loading of 13,500 kilowatts or 14,210 kilovolt-amperes at 60 degrees C. temperature rise and 0.95 power factor and with a 15-percent overload, of 15,525 kilowatts or 16,350 kilovolt-amperes at 80 degrees C. temperature rise. Generator capabilities are indicated in charts 2 and 3. A line diagram of the plant generation capacity is shown on plate 13.

6-25. A separate cooling system is provided for each generator. Temperature is measured by thermoelements buried in the armature coils with leads to outside indicators that show the rise above an ambient temperature of 55 degrees C. Air circulation is induced by impellers on the generator rotors, and the cooling of each generator is affected by circulating water through the coolers placed within the air duct.

6-26. The main generator field coils are energized by a direct connected shunt wound exciter. Automatic voltage regulation is accomplished by means of a voltage regulator unit and independently motivated amplidyne generator. The output of the amplidyne generator may be connected in series with the main exciter field. The regulator supplies control field current to the amplidyne so the amplidyne voltage will buck or boost the exciter voltage impressed across the exciter field circuit. Load frequency control for both the initial and ultimate installation is described in the Columbia Basin Master Reservoir Regulation Manual.

6-27. Transformers. - The transformers are housed in individual vaults on intake deck at elevation 185. They are single phase, placed in banks of three opposite the pair of generators served. The transformers have no low voltage taps. The high voltage taps are:

1 at 5.0 percent above normal

1 at 2.5 percent above normal

1 at 5.0 percent below normal

1 at 2.5 percent below normal

6-28. The transformers connected to main unit generators were built by Ferranti, Ltd. of England. Their rating is 63,000 kilovolt-amperes for 55 degrees C. temperature rise. One bank of three transformers has a voltage capacity of 13.2 kilovolts at the primary and 115 kilovolts at the secondary end, and each of the remaining 18 have a capacity from 13.2 to 230 kilovolts. They are oil-insulated, self-cooled, using separately mounted oil-to-water heat exchangers. A nitrogen barrier is maintained between the surface of the hot transformer oil in the main tank and atmosphere.

6-29. The three transformers connected to the two fishwater unit generators were furnished by the Central Transformer Corporation. When self-cooled, their overload rating is 8,720 kilovolt-amperes for 55 degrees C. temperature rise. The overload rating, however, is 10,900 kilovolt-amperes with allowable temperature rise of 55 degrees C. with forced air used for cooling.

6-30. Station service units. - The two station service units, consisting of turbines, generators, transformers, and appurtenant equipment, will be operated within the manufacturer's guaranteed limitations. As they are for project use, commercial loads will not be connected to them. They will be put in service only when the required power load is in excess of the plant capacity. Under normal operating conditions, one unit will provide on-the-site power needs of the project with the second unit available as emergency standby. Scheduled operation of the service units is to alternate the units equally for normal and standby use. The make, type, and ratings are shown on the pertinent data sheets and in the Operation and Maintenance Manual for The Dalles project.

6-31. Metering of generation. -

a. Main units. - Metering equipment on the a-c side of the main unit generators includes ammeter, voltmeter, wattmeter, and varmeter, both at the generator switchboard and main control switchboard. In addition, a watt-hour meter is on the generator switchboard.

(1) On the d-c side of the generators, a voltmeter is provided on both the generator and main control switchboards for

the static or rotating amplifier exciter output circuit and a generator field ammeter is provided on the generator switchboard.

(2) For synchronizing, incoming and running voltmeters and frequency meters are provided in addition to the synchroscope and synchronizing lamps.

(3) Recording equipment records generator and transformer temperatures, unit water flow, power loads, total station water flow, total power loads, total reactive loads, forebay level, tailwater level, net head, and system frequency.

b. Fishwater units. - The fishwater units have metering and recording facilities similar to the main units. Station total quantities include the data from the fishwater units.

6-32. Switchboards. - The control room located in the station service bay next to the headwall at elevation 157.50 is equipped with three vertical duplex switchboards, designated as main control switchboard (SC), graphic instrument switchboard (SG), and load-frequency control switchboard (SL).

6-33. The main control switchboard has control switches, indicating instruments, annunciators, and a mimic bus mounted on the front panels and arranged to correspond to the physical arrangement of the units in the plant. Each unit control panel includes devices for control of two units. Mounted on the rear panels are the unit load controllers and automatic synchronizing equipment.

6-34. The graphic instrument switchboard contains instruments which record water levels, net head, total flow through main units, total plant loads, and individual main unit loads.

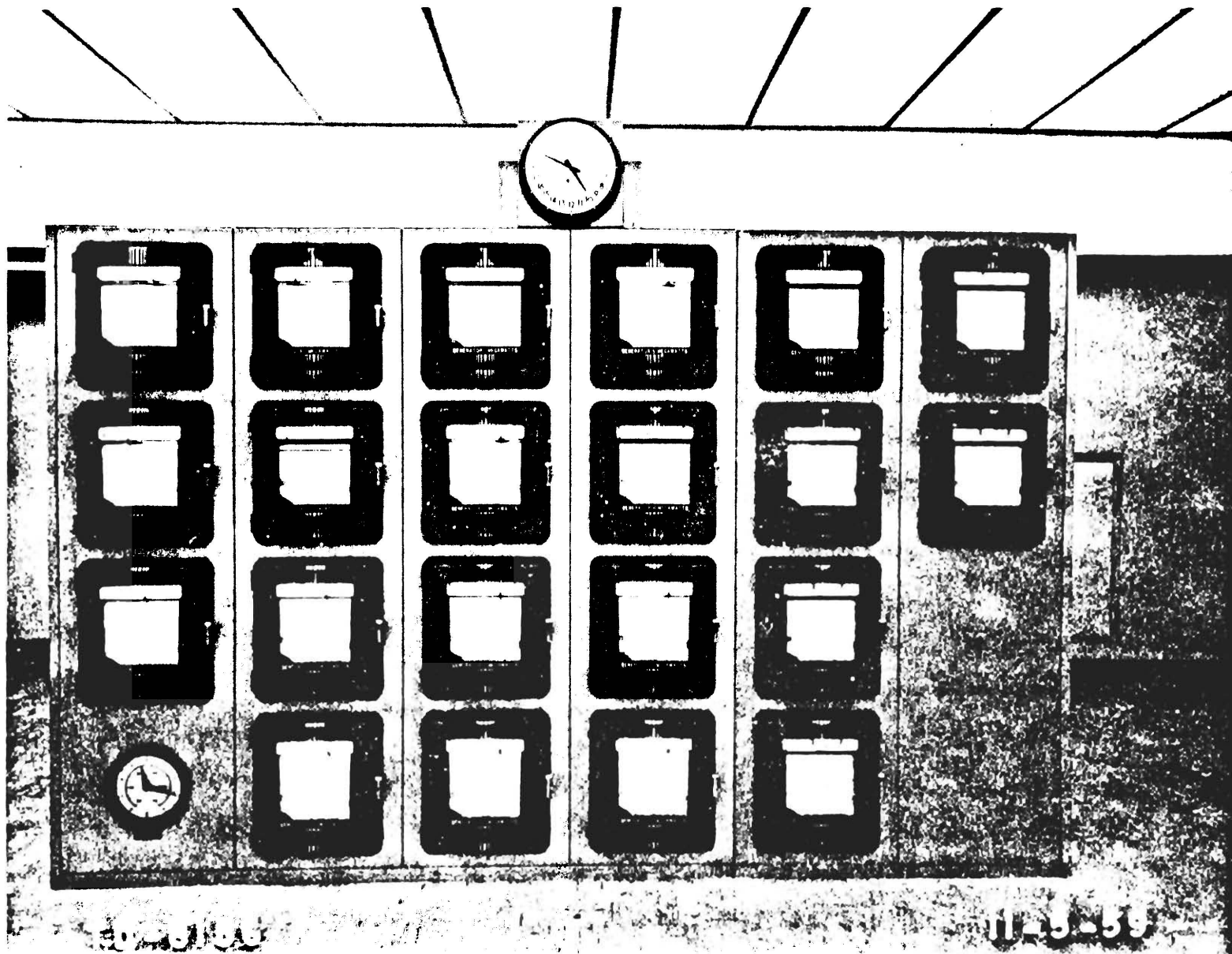
6-35. The load-frequency control switchboard has one set of standard time equipment, associated power amplifiers and load-frequency control equipment, recording controllers, indicating instruments, annunciators, control switches and indicating lights.

6-36. Generator switchboards located on the turbine floor contain control switches, indicating instruments, recorders, annunciators, and a mimic bus mounted on the front panels and protective relays on the rear panels. Each main generator switchboard, except one, controls four main units and is centrally located with respect to the units controlled. One switchboard controls only two main units because the total number of main units is not divisible by four. The generator switchboard for the fishwater units is arranged similarly except that it is more compactly arranged between the units.

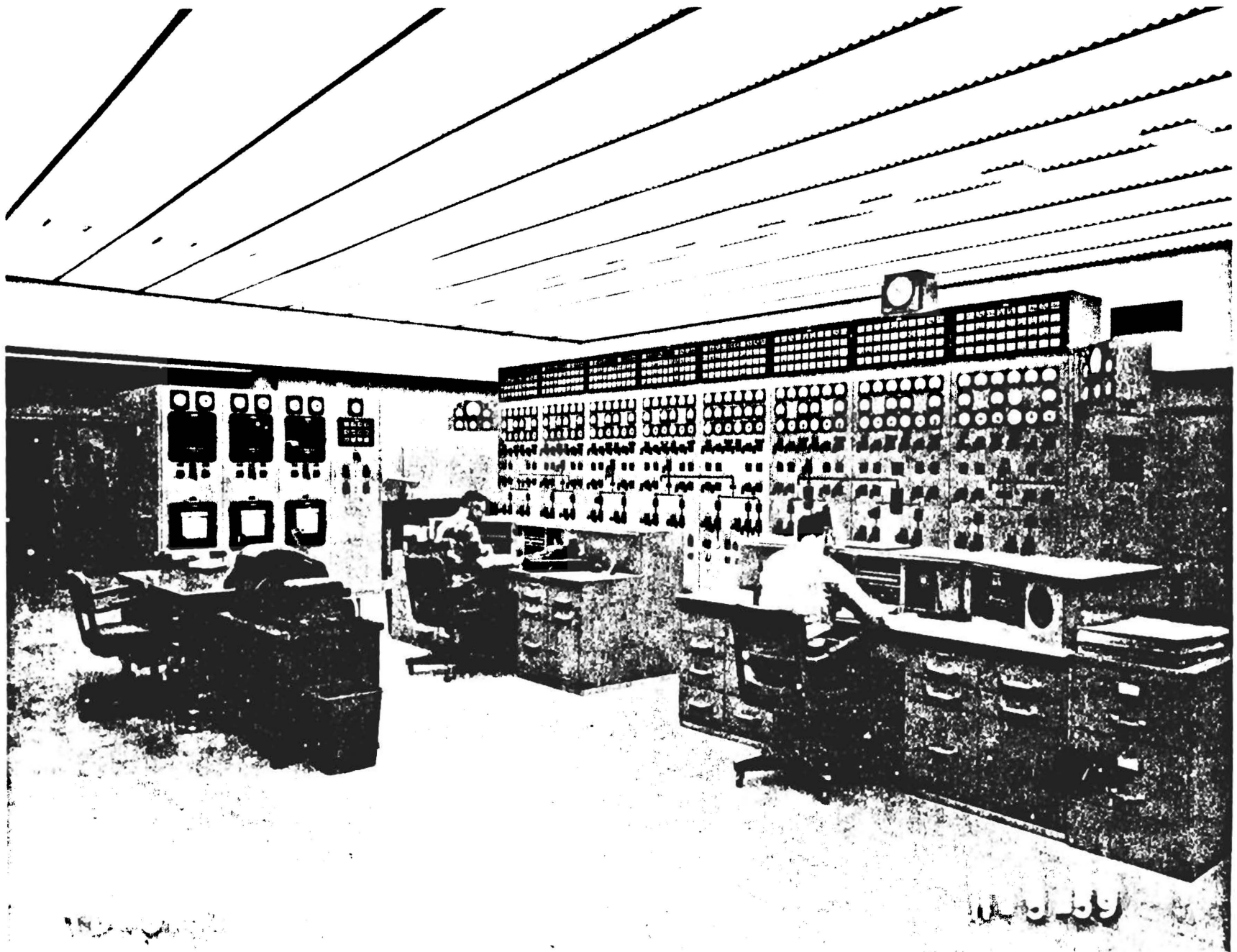
6-37. Circuit breakers. - The air circuit breakers for the main generators are 3-pole, single-throw, air blast station type breakers equipped with line and load disconnecting switches. The breakers are rated at 14.4 kilovolts, 4,000 amperes, 1,500 megavolt-amperes I.C. (interruption capacity). The breakers for units 1 to 8 were manufactured by General Electric Company, and for units 9 to 14 by Westinghouse Electric Company.

6-38. The circuit breakers for the fishwater units are of the metal-clad, solenoid-operated type rated 13.8 kilovolts, 1,200 amperes, 500 megavolt-amperes I.C.

6-39. Switching equipment. - The line disconnect switches for the 230-kilovolt equipment are of the outdoor, group operated, vertical



GRAPHIC INSTRUMENT SWITCHBOARD (SG)



LOAD-FREQUENCY CONTROL SWITCHBOARD (SL)
AND MAIN SWITCHBOARD (SC)

break type rated at 230 kilovolts, 1,200 amperes, 3 pole, with manual operated mechanism and were manufactured by Schwager-Wood Corporation.

6-40. The line disconnect switch for the 115-kilovolt equipment is similar to the 230-kilovolt type except that it is rated at 115 kilovolts, 600 amperes.

6-41. Selection of units for meeting power demand. - Unless full overload is required, the scheduled normal load will be supplied by the combination of units that can be operated most efficiently at the time. In order to achieve the most effective and efficient powerplant operation, continuous records are kept of turbine flow, tailwater and reservoir levels. Experience will determine the most efficient means of meeting increasing power demands. It may be met by either increasing the load on units in operation or by increasing the number of units on the line.

6-42. Load frequency control. - Operation with the initial equipment may be with or without master control. When the units are operated without master control the unit controller is set on a base load and the unit remains at that output. Use of the master controller allows for load frequency control by either of three methods: flat frequency, automatic time error compensation, or proportional load distribution.

6-44. Navigation. - Navigation is one of the principal functions of the project. The dam and lock provide for slack-water navigation from the

head of Bonneville pool near The Dalles to the John Day Dam site, a distance of approximately 23 miles. The lock is located on the Washington side of the dam and has a chamber 86 feet wide and 675 feet long. It is a single lift lock with a maximum lift of approximately 90 feet. Upper and lower sills are at elevation 140 and 54.5 feet, respectively. Depth of water over the upstream sill will be 20 feet at normal pool elevation of 160 feet and 15 feet at minimum pool elevation 155. Depth over the lower sill is a function of the Bonneville pool elevation and the flow in the river, but minimum depth will be 15 feet. A complete lockage requires approximately one-half hour and uses 125 acre-feet of water. Water level gages utilized in operating the locks are located in the tailrace of the locks, at both ends of the lock chamber, and in the pool at the Washington end of the spillway. The pool gage records in the navigation lock control room. Radio facilities are available for directing traffic through the locks.

6-45. Rules and regulations governing the use and administration of The Dalles navigation lock are in accordance with section 7 of the River and Harbor Act of 8 August 1917 (40 Stat. 266, 33 US. C. 1), section 207.705. These regulations have been published and are included as a part of this manual. See appendix B.

6-46. Recreation. - The Dalles pool will be maintained at a favorable level for most recreational activities. However, the lack of shade and the high frequency of strong winds detract from the recreational potential of the project. There are approximately 10 areas along the pool that are accessible for recreation, five on the Washington shore and five on the Oregon shore. The sites that have the greatest

potential for development are Horsethief Lake and Maryhill in Washington; and the mouth of the Deschutes and the town of Celilo in Oregon.

Viewpoints are available in the immediate vicinity of the dam. No special reservoir regulation is proposed for recreation.

6-47. The Corps of Engineers plans to develop recreational areas at Celilo, Maryhill, and Horsethief Lake with local governmental agencies to assume the operation and maintenance responsibility. Any development at the mouth of the Deschutes will be by the State of Oregon.

6-48. Reporting network. - To effectively coordinate The Dalles project with other reservoirs in the Columbia River Basin requires a comprehensive knowledge of past, current, and forecasted hydrologic conditions in the basin. This information is to be obtained through a basin-wide reporting network. Such a network is in existence in the Columbia River Basin with the U. S. Weather Bureau in Portland, Oregon, acting as the central collection and dissemination center. All groups participating in the system operation collect and transmit to the Weather Bureau in Portland all information of interest to the operating groups.

6-49. Groups that contribute to the reporting network are: U. S. Weather Bureau, Bureau of Reclamation, Bonneville Power Administration, Soil Conservation Service, and Corps of Engineers. Hydrologic and climatological reports are received from more than 90 stations. A large number of these stations report daily during the critical high-water season, April-July. In addition, snow survey reports are received from several hundred stations during the winter and early spring months. A number of these snow courses report bimonthly. Climatological reports are received from about 60 stations within the basin. These reports include

precipitation, temperature, and snow depth. Reservoir inflow, pool elevation, and outflow are received for all significant storage projects in the Columbia Basin. In addition, there are reports of river stages at all significant stations on the main stem of Columbia River and its tributaries. These hydrological and climatological data are the basis for making long- and short-range flow forecasts which are used in scheduling the operation of major reservoirs in the basin.

6-50. Information specifically furnished by the Portland District, exclusive of the Willamette River Basin:

Station	Stream	Data reported		
		River Stage	Climatological data	Reservoir data
The Dalles Dam	Columbia River	X	X	X
Bonneville	Columbia River	X	X	X

6-51. The Master Reservoir Regulation Manual for the Columbia River Basin will contain a more detailed listing of the stations in the reporting network with a description of the data collected, by whom, and the transmission facilities used in collecting and disseminating the information.

6-52. Communication. - Communication between the project and the District office is either by telephone or teletype. Both offices are connected by direct line and individual persons can be contacted in either office through a dialing system. It is also possible to communicate between offices by teletype. The teletype not only connects the District office with The Dalles Dam but also with all Corps of Engineers' projects and District offices in the Columbia Basin,

the North Pacific Division office, and Bonneville Power Administration. Messages between the various offices are transmitted over the teletype system, which operates 24 hours a day. These messages can be transmitted to a specific office or to all offices simultaneously. The teletype serves as a medium for transmitting much of the basic hydrological, climatological, and operating data between the various offices. The messages are punched on a tape and are sent automatically. In an emergency The Dalles Dam can be contacted by radio, wave length 2350 kilocycles.

6-53. River forecasting. - Two types of river forecasts are made for Columbia River at The Dalles. First, there are the long-range forecasts that are made several months prior to the annual spring freshet. These forecasts are used for advanced planning for power generation and flood regulation. In addition there are the 4- and 5-day short-term forecasts. Both types of forecasts are essential to the day-to-day storage regulation for power and flood control.

6-54. The long-range forecasts are made on the first of January, February, March, and April, and bimonthly thereafter through 1 June. They indicate the volume of the expected spring freshet and the most probable peak and date of occurrence. Even though they are subject to error the forecasts provide a basis for long-range planning for flood regulation. Precipitation, temperatures, soil moisture, antecedent streamflows and snow surveys are the various indices used to prepare these forecasts. Several agencies make long-range forecasts other than the Corps of Engineers. These agencies are the U. S. Weather Bureau, Bureau of Reclamation, and U. S. Soil Conservation Service.

6-55. Four- and five-day forecasts of the inflow to The Dalles pool are made by the U. S. Weather Bureau and the North Pacific Division office. These forecasts are based upon runoffs observed at upstream stations, forecasted weather conditions, power generation, upstream storage regulation, and channel routing. During the nonflood season, forecasts are less pretentious and daily changes are small. Considerable attention is given to the short-range forecasts during the flood season, and it is during this period that the North Pacific Division utilizes the IBM 650 to forecast streamflows throughout the Columbia River Basin.

6-56. The outflow from The Dalles is scheduled, utilizing the inflow forecasts and the forecasted power loading. The inflow forecasts are determined from McNary releases and the inflow from the local drainage between the two projects. Gaged flows on the John Day and Deschutes River provide an index to the local runoff.

6-57. Inflow determination. - Inflow to The Dalles pool is the gaged flow at the McNary tailwater station plus the inflow from the intervening area between McNary and The Dalles Dam. The principal tributaries between these two projects are: Umatilla River, John Day River, and Deschutes River, which comprise about 85 percent of the total intervening area. Gages on each of these three streams are included in the hydrologic reporting network and information on streamflow is collected and disseminated over the teletype reporting network.

6-58. The individual stations that are utilized for estimating the flow from the intervening area are: Umatilla on Umatilla River, Service Creek on John Day River, and Moody on Deschutes River. Runoff

from the ungaged area varies from 2 to 4 percent of the total runoff recorded for the three tributaries. Time of year and weather are factors considered in selecting the percentage to be used.

6-59. After the completion of the John Day Dam the inflow to The Dalles pool will be based upon the outflow from John Day plus runoff from the Deschutes River. This will require calibration of the various release facilities at John Day.

6-60. Outflow determination. - Outflow from The Dalles Dam can be computed in three ways: (1) By adding up the discharge through the powerhouse, spillway, navigation lock, fish facilities, and seepage losses; (2) by adjusting the reservoir inflow for change in storage; and (3) by a rated tailwater station. Experience has shown the three methods of computing outflow are not always in agreement and there has been nothing conclusive as to which might be the more accurate, particularly since the tailwater station is influenced by backwater from Bonneville Dam.

6-61. Discharge ratings for the powerhouse and spillway are theoretical determinations and their accuracy is dependent upon the proper selection of discharge coefficients used in computing the discharges. This method of determining releases through The Dalles Dam would be the most positive once the facilities are accurately rated. Rating the discharge facilities requires other means of measuring the flow through the dam such as with a current meter, the method used by the U. S. Geological Survey for rating most gaging stations throughout the country.

6-62. Estimating the outflow by adjusting the inflow for change of storage is dependent upon an accurate means of evaluating the pool

changes which are influenced by wind and fluctuations in the inflow and outflow. For short-term estimates this method has its deficiencies.

6-63. A rated tailwater station is probably the most satisfactory from the ease of obtaining the outflow at any specific time and for overall accuracy. However, where the tailwater station is influenced by backwater from a downstream dam the rating of such a station is very uncertain and complicated. This is the situation at The Dalles. A new type of gage is being considered for installation below The Dalles Dam, which would provide an index for measuring the velocity of the stream by determining electronically the difference in speed of sound traveling through the water with the current and against the current. There is much research to be accomplished before this method becomes a practical and reliable means of measuring streamflow.

6-64. For the present, the outflow from The Dalles will be computed using the releases through the various appurtenances at The Dalles Dam. Rating curves for the powerhouse turbines, spillways, and fish facilities are shown on charts 2 through 7, inclusive, and in table 6. Water discharged through the navigation locks will be based upon the number of lockages times 62.5 day-second-feet. Seepage is considered a constant, 200 second-feet.

6-65. Pool gages. - Several gages are located in The Dalles pool, see plate 10. At the dam there are four gages, one on the Washington side of the spillway and three on the Oregon side of the spillway. The gage on the Washington side of the spillway is located between the spillway and the navigation lock and transmits pool elevations to the navigation lock control room. The three gages on the

Oregon side of the dam are located as follows: (1) Immediately upstream from the south end of the spillway, (2) at unit 8, and (3) at upper end of powerhouse. The gage at the south end of spillway is a recording gage. The gage at unit 8 transmits pool elevations to the powerhouse control room whereas the gage at the upper end of the powerhouse is a staff gage.

6-66. Three gages are located in the upstream pool for evaluating wedge storage resulting from local inflow and the peaking operations at McNary and, ultimately, John Day projects. These gages are located at Celilo, Miller, and Rufus, and are equipped to record the water level at these locations as well as to transmit the information to The Dalles powerhouse. The upstream recording pool gages are serviced by the U. S. Geological Survey, while the transmitting equipment is maintained by the Project Engineer.

6-67. Below The Dalles Dam there are four gages in Bonneville pool. Their locations are at The Dalles, Lyle, Hood River, and Stevenson. All of these gages, except The Dalles gage, can be interrogated from the Bonneville powerhouse by radio.

6-68. Tailwater gages. - Tailwater gages are located between units 8 and 9 of the powerhouse and immediately downstream from the lower lock gate. The powerhouse tailwater gage used in determining the net head in the powerhouse turbines is equipped to transmit water surface elevations into the control room of the powerhouse. The navigation tailwater staff gage is used by the lock operators to determine the depth of water over the sill of the lower lock. Plate 10 shows the location of these gages.

6-69. Fish ladder gages. - The various fish ladders are equipped with a series of staff and recorder gages that are used in regulating the

flow of water through each facility. Plate 10 also shows the location of these gages.

6-70. Weather instrumentation. - The Dalles project is equipped to measure precipitation, maximum and minimum air temperatures, and water temperatures. Information on local wind and weather conditions is obtained from the official Weather Bureau stations in the city of The Dalles and from North Dalles airport.

6-71. The project weather station is located on the Washington side of the dam in the vicinity of the navigation lock. Observations are made at midnight by the personnel assigned to the operation of the locks and the data are telephoned to the powerhouse for official entry in the daily log for The Dalles project.

6-72. Reports. - Reports of many descriptions are prepared by personnel of The Dalles project. They provide a means for keeping the many interested parties informed on administrative, maintenance, and operation activities at the project and also to provide a permanent record of these activities. In general these reports are made on standard forms and have a prescribed distribution. In some instances these reports are for project use only whereas others are prescribed by regulations and require off-the-project distribution. This manual is primarily concerned with those reports pertaining to project operation involving navigation, fish, and power that have an off-the-project distribution.

6-73. Forms. - The standard forms that this manual is primarily concerned with are listed in the following tabulation. The listing includes pertinent information in regard to distribution, frequency of

preparation, and data reported. Copies of the forms are shown in appendix G.

FORMS FOR REPORTS

<u>Form number</u>	<u>Description and disposition</u>
NPD RF 12	Daily Number and Class of Vessels Through The Dalles Dam
Copies	3
Routing	1 The Dalles Dam; 2 and 3 Chief, Commercial Statistical Branch, Oper. Div., Portland Dist.
Frequency	Monthly
Use	Record of number and class of vessels, barges, and rafts locked through The Dalles
Type	Data report
NPD RF 55 (Rev.)	Report of Commerce at The Dalles Lock
Copies	1
Routing	Chief, Commercial Statistical Branch, Operations Division, Portland District
Frequency	15-day
Use	Detailed record of boat traffic, including class, draft, registered net tonnage, passenger count, commodities, and destination.
Type	Data report
NPP 56a (RCS-NPPVK-53)	Daily Operation Report - The Dalles Dam
Copies	7
Routing	1 Multiple-Purpose Projects; 2 The Dalles Dam; 3 Chief, Operations at Project; 4 Chief, Fishway Section; 5 Biologist at Bonneville; 6 Powerhouse Control Room; and 7 Powerhouse Superintendent
Frequency	Daily

<u>Form number</u>	<u>Description and disposition</u>
NPP 56a (cont'd)	
Use	Record of The Dalles weather, generation, spillway gate openings, river discharge, project gage readings, and upstream river stages
Type	Data report
RCS NPPGW-52 (Phamplet) Copies	Report on Passage of Fish at The Dalles Dam 2
Routing	1 The Dalles Dam; 2 Biologist at Bonneville (Note: Report is prepared at Bonneville and forwarded to District office; 41 copies of the edited report are forwarded to subscribers.)
Frequency	Monthly
Use	Monthly summary of number and type of salmonoid and scrap fish passing The Dalles Dam. Includes summary of weather, river flow, and remarks pertaining to fish
Type	Operating report
NPD RF 252 (RCS-NPPVK-52) Copies	Daily Fishways Report - The Dalles 11
Routing	3 to Engineering Div. through Multiple-Purpose Projects Br.; 4 Project file; 5 Fishway Foreman; 6 Chief, Operations at Project; 7 Ivan Donaldson, Fish Biologist at Bonneville; 8 Biologist at Walla Walla District; 9 Walla Walla District Engineer; 10 Washington State Fisheries; 11 U. S. Department of Interior at Seattle
Frequency	Daily
Use	Record of daily upstream fish migration, including project weather, discharge, forebay and tailwater elevations, and spillway gate positions
Type	Data report

<u>Form number</u>	<u>Description and disposition</u>
NPP 252 (Rev.) (RCS-NPPVK-57)	Power Production Report
Copies	9
Routing	1, 2, and 3 Multiple-Purpose Projects Branch; 4 North Pacific Division; 5 OCE; 6 and 7 Bonneville Power Administration; 8 Chief Oper. file; and 9 Project Superintendent
Frequency	Monthly - by the second of the month
Use	Record generation, disposition and condenser power of The Dalles power plant
Type	Operational record Data report
F.P.C. No. 4 (FPC-1001)	Monthly Power Plant Report
Copies	2
Routing	Federal Power Commission to Projects to Operations to Federal Power Commission; 1 copy retained at project
Frequency	Monthly
Use	Report to Federal Power Commission
Type	Operation data

6-74. Power studies. - In the interest of obtaining optimum power benefits the Power Sections in both the District and Division offices will continue to make system analyses incorporating changing power loads and new storage projects. System coordination is highly important and much is to be learned from actual operating experience. All changes in operating procedure must be coordinated through the Division office.

6-75. Emergency. - It is not possible to anticipate every unusual flood, power emergency, or combination of events and to provide for such contingencies in a reservoir regulation manual. Should an emergency occur or appear to be developing, the Project Engineer or his subordinate in charge should contact the District office, reporting the field situation and request instructions. In the event of a communication failure, repeated efforts should be made to contact the District office, but if such efforts fail, the decision as to the action to be taken must be made in the field. Should such an occurrence happen, all circumstances should be reported to the District office as soon as possible.

6-76. If the emergency involves power generation, not only the District office but the North Pacific Division office and the Bonneville Power Administration should be notified of the emergency. Navigation interests should be notified promptly if an emergency arises that would incapacitate the locks for any period of hours. All interested parties should be notified promptly of any operational emergency that might affect the pool elevation radically. The pool should not be permitted to exceed elevation 160 feet unless the discharge through the spillway exceeds 1,050,000 second-feet.

6-77. Public notices. - Public notices will be issued by the Portland District Operations Division whenever there is a departure from the normal operating procedure or any unusual development in which the public may be concerned. In the event of a sudden development that requires immediate action, the Resident Engineer or Project

Engineer will notify by telephone the District Operations Division of the action taken and all interested parties that might be affected by the sudden change in the operating plans. A list of these parties to be notified, with their primary concern and telephone numbers, is available in the office of the Powerhouse Superintendent and in the Project Engineer's office. Several examples of public notices that have been issued are shown in appendixes C, D, and E.

6-78. In addition, the Portland District issues, each month, a notice of channel conditions in all navigable waters within the District which include The Dalles and Bonneville projects. This is a general notice which has a wide circulation.

TABLES

<u>Number</u>	<u>Title</u>
1	Climatological Summary - The Dalles, Oregon
2	Monthly and Annual Precipitation - The Dalles, Oregon (3 sheets)
3	Columbia River Traffic in Tons
4	Temperature and Precipitation - Columbia Basin
5	Snow Course Data - Columbia Basin
6	Spillway Rating Table - 1 Bay
7	Gages (2 sheets)
8	Rating Table, Columbia River below McNary Dam (4 sheets)
9	Rating Table, Umatilla River near Umatilla, Oregon
10	Rating Table, John Day River at Service Creek
11	Rating Table, Deschutes River at Moody

TABLE 1
 Climatological Summary
 The Dalles, Oregon
 (Elevation 98 feet)
 Period of Record 1891-1957 and 1959-60

Item and description	Years of record	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
Precipitation, inches														
Average	100	2.81	1.91	1.37	0.64	0.41	0.56	0.16	0.12	0.49	1.02	2.52	2.76	11.02
Percent of average annual	---	18	13	9	4	4	4	1	1	3	7	16	18	100
Maximum	100	7.09	9.41	6.07	2.57 ¹	1.94	1.81	1.39	1.94	4.77	4.20	9.21	11.74	20.16
Year of maximum	---	1897	1917	1959	1959	1977	1947	1907	1949	1899	1977	1901	1957	1959
Minimum	100	0.43	0.00	7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Year of minimum	---	1949	1950	1951 ¹	1957	1957 ¹	1959 ¹	1964 ¹	1959 ¹	1957 ¹	1950 ¹	1940	1941	1949
Greatest in 24 hours ²	70	0.19	1.84	1.80	0.74	1.34	1.80	1.87	0.91	1.04	1.41	4.01	1.80	4.20
Date of greatest in 24 hours ²	---	1956	1890	1901	1907	1959	1903	1911	1943	1912	1893	1911	1943	1901, 1921
Avg. No. days with .01 inch or more	41	10	9	8	5	4	4	1	1	3	7	11	12	76
Average snowfall	85	10.1	5.9	0.8	7						7	0.1	7.7	29.1
Maximum snowfall	95	74.0	39.2	14.7	0.2						1.0	10.1	109.1	161.6
Year of maximum snowfall	---	1950	1916	1940	1895						1878	1901	1954	1954
Avg. No. days with 1 or more snowfall	39	4	3	4	4						4	1	0	10
Avg. No. days with 0.1 or more snowfall	39	4	2	4							4	1	1	8
Temperature, °F.														
Average	81	33.4	38.0	46.4	53.8	59.6	66.6	71.7	71.8	68	54.0	40.6	34.2	55.3
Average daily maximum	81	39.8	47.0	56.9	66.7	73.6	79.4	87.7	86.1	77.7	59.1	41.9	31.9	64.4
Average daily minimum	81	27.0	30.3	35.8	41.3	47.6	55.8	55.4	56.5	47.6	42.8	34.3	31.4	46.3
Absolute maximum	81	65	71	80	95	101	104	114	111	107	93	74	74	114
Year of absolute maximum	---	1914 ¹	1931	1915 ¹	1906	1914 ¹	1906 ¹	1918 ¹	1958	1951	1918	1921	1955	1911, 1918 ¹
Absolute minimum	81	-28	-21	-1	25	30	30	39	41	35	20	41	-31	-31
Year of absolute minimum	---	1930	1950	1891	1880 ¹	1887	1914	1914	1878 ¹	1901	1879	1891	1919	Dec., 1919
Avg. No. days minimum 31° or lower	49	11	15	8	1					4	1	10	17	75
Avg. No. days minimum 0° or lower	49	1	4									4	4	11
Miscellaneous data														
Average number of days clear	37	8	10	14	16	19	19	26	24	20	14	9	6	17
Average number of days partly cloudy	37	9	9	11	10	8	8	4	5	7	9	10	10	100
Average number of days cloudy	37	14	9		4	4	3	1	3	3	5	11	14	78
Prevailing wind direction	55	N.	N.	N.	N.	N.	N.	N.	N.	N.	N.	N.	E.	N.

1 Later date also.
 2 Estimated.
 3 Based on 1957-58 precipitation time.
 4 Less than one-half day.

STATION HISTORY

Station was established July 1, 1890, at Fort Dalles and has been moved to various locations. However, all records were made within the city limits of The Dalles. All meteorological instruments were located from 4 to 7 feet above the ground. Records from April 1891 to November 1920 are missing and not for years 1901, 1911, 1912, 1913, and 1914 are not complete.

31

Table 2

Sheet 1 of 3

- Estimated or Partially Estimated.

Monthly and Annual Precipitation
The Dalles, Oregon
(Elevation 98 feet)

Year	Precipitation in inches												Annual
	January	February	March	April	May	June	July	August	September	October	November	December	
1850	--	--	--	--	--	--	0.01	0.00	0.09	0.91	1.14	0.19	--
1851	3.81	1.70	1.79	--	--	--	--	--	--	--	--	--	--
1852	--	--	--	--	--	--	--	--	--	.25	2.75	8.01	--
1853	3.02	1.09	.27	1.29	.62	.00	.08	.61	1.41	.24	4.90	.95	14.48
1854	2.79	.73	.36	1.52	.00	.15	.00	.18	.84	1.91	1.41	2.50	12.39
1855	3.03	.63	1.87	.17	1.08	.24	.07*	.00	.69	.15	1.44	2.24	11.61*
1856		.54	.91	.79	--	--	--	--	--	--	--	10.79	--
1857	7.08	1.85	2.83	.00	.23	1.02	.58	.00	2.70	.25	5.38	7.42	29.34
1858	5.60	9.41	2.91	1.36	1.70	1.03	.00	.75	5.16	3.32	6.48	5.93	43.65
1859	5.33	6.00	6.07	2.50*	1.27	.20	.06	.47	5.77	2.14	4.25	3.66	37.72*
1860	5.30	2.00	1.33	.83	1.73	.59	1.38	.40	.35	.48	3.46	3.47	21.32
1861	2.68	3.26	1.59	1.46	1.34	2.08	.00	.14	.33	.75	6.97	8.25	28.85
1862	4.47	2.25	3.54	.20	2.61	1.03	.22	.07	.64	.43	.20	.63	16.29
1863	3.38	2.17	.62	.48	.65	.11	.88	.08	.30	.48	.74	4.11	14.00
1864	5.88	.22	--	--	.09	.36	--	--	.16	.27	1.44	2.95	--
1865	2.20*	1.66	1.52	.06	.00	.08	.55	.57	.59	2.06	6.37	2.55	18.21*
1866	6.35	2.83	5.56	--	--	--	--	--	--	--	--	--	--
1874	--	--	--	--	--	--	--	--	--	--	--	3.01	--
1875	4.17	.31	2.13	.59	.81	1.65	.14	.12	.72	4.80	6.18	4.80	26.42
1876	2.76	1.39	2.20	1.09	.20	.34	.07	.02	.13	2.37	4.31	.46	15.34
1877	.78	1.68	3.66	1.21	1.03	.15	.48	.10	1.24	1.66	4.18	1.58	17.75
1878	2.96	2.32	1.99	.20	.26	.02	.08	.13	1.01	.53	1.22	1.61	12.33
1879	1.43	6.32	3.15	1.34	2.94	.11	.31	.48	.79	.88	1.24	2.57	21.56
1880	2.04	1.33	.16	1.03	.94	.02	.02	.43	.08	.12	.69	6.75	13.61
1881	6.37	6.23	.38	1.29	.14	1.82	.11	.23	.26	2.62	.75	1.76	21.96
1882	1.49	2.92	.23	.53	.27	.60	.12	.72	.43	2.30	.75	5.14	15.50
1883	4.85	.61	2.32	1.21	.54	.01	.00	.00	.01	.46	2.19	1.77	13.97
1884	1.33	3.10	.74	1.33	.69	.93	.44	.12	.65	1.27	.82	7.04	18.46
1885	1.10	2.88	.14	.31	.81	1.01	.00	.00	.87	1.28	1.78	2.64	12.82
1886	5.45	.53	.95	.30	.11	.07	.00	.02	.14	.70	.21	5.06	13.54
1887	4.01	1.13	.79	.46	.32	.67	.00	.18	.36	.15	1.06	3.01	12.14
1888	3.36	.41	.94	.05	.70	.92	.29	.00	.02	.95	1.34	2.71	11.69
1889	.51	.04	1.26	.42	.66	.29	T	T	.16	.90	1.27	2.00	7.51
1890	2.97	4.33	1.89	.24	.02	.27	.06	.04	.11	1.16	.00	1.19	12.28
1891	1.13	2.47	.53	.01	.32	.51	.24	.11	.13	1.14	1.39	4.14	12.12
1892	1.35	.68	.70	1.00	.67	.06	.27	T	.14	.90	1.16	5.04	11.97
1893	.69	1.84	.96	1.69	.69	.06	.30	.00	1.21	4.40	4.36	1.77	17.97
1894	4.84	1.83	3.73	.64	.47	1.15	.10	T	1.02	2.08	.51	1.65	18.02
1895	4.72	.47	.65	.24	.94	.00	.32	.05	1.14	.00	1.20	4.15	13.88
1896	3.45	.72	1.00	.95	.63	.10	T	.28	.42	.60	5.87	2.74	16.76
1897	1.14	2.98	1.94	.23	.27	1.07	.24	.08	.54	.24	3.84	4.03	16.60
1898	.82	.98	.30	.11	.03	.90	.17	.02	.85	.13	2.13	1.14	7.58
1899	2.82	2.19	.94	1.05	.45	.20	.00	.86	.81	1.56	3.57	2.29	16.74
1900	1.90	1.94	1.62	.42	.03	.47	T	.55	1.09	2.02	2.25	1.33	13.62
1901	3.46	4.15	.68	.09	.39	.20	T	.16	1.84	.13	1.69	3.04	15.83
1902	1.61	3.79	.52	1.82	.63	.13	.26	.00	.36	.78	3.53	4.00	17.43
1903	2.87	.47	.56	.23	.05	2.11	.12	.11	.15	1.10	4.44	.56	12.77
1904	1.52	4.50	3.10	.98	.09	.46	.40	.04	.61	1.44	1.01	1.79	15.94
1905	3.27	.51	.63	.18	.66	1.27	.19	.10	1.19	1.88	.84	1.07	11.79
1906	1.90	1.67	1.21	.11	.95	1.05	T	.31	.35	.23	3.99	3.07	14.84

TABLE 2

Table 2

Sheet 2 of 3

Monthly and Annual Precipitation
The Dalles, Oregon
(Elevation 98 feet)

e - Estimated or partially estimated.

Year	Precipitation in inches												Annual
	January	February	March	April	May	June	July	August	September	October	November	December	
1907	3.92	3.08	1.30	1.67	0.41	0.42	0.22	0.74	0.29	0.29	2.22	5.50	20.06
1908	1.06	.77	1.50	.17	.92	.10	.36	.16	.03	1.42	.48	1.21	8.18
1909	4.06	1.41	.33	.08	.13	.13	.39	.00	1.05	.83	4.55	3.09	16.05
1910	1.87	2.67	.41	.83	1.31	.72	T	.00	.05	1.01	4.18	1.51	14.56
1911	1.23	.56	.22	.21	.80	.30	.00	.00	2.92	.33	1.19	1.23	8.99
1912	6.30	2.03	1.03	.28	.82	.43	.02	.55	.31	.47	1.62	2.86	16.72
1913	3.88	.28	.71	.69	.92	1.55	.09	T	.46	1.65	2.21	1.72	14.16
1914	3.33	1.06	.30	1.15	.35	.73	.01	.00	1.24	1.22	1.06	.91	11.36
1915	2.24	2.05	1.59	.42	1.63	.00	.76	.00	.22	.52	3.95	2.49	15.87
1916	2.28	3.33	2.89	.60	.66	.98	1.28	.01	.18	.30	1.20	1.83	15.54
1917	.68	1.08	.71	2.05	.33	.10	.00	.00	.37	.00	2.53	4.99	12.84
1918	2.42	1.87	.14	.24	1.16	.00	.24	.30	1.40	2.18	1.03	1.01	11.99
1919	2.57	2.97	1.11	.87	.21	.15	.22	.05	.60	.66	2.86	2.92	15.19
1920	2.22	.00	.82	.98	.07	.69	.10	.54	1.05	.65	2.82	2.94	12.88
1921	2.58	4.12	1.93	.65	.36	.34	.00	.01	.71	.46	9.41	1.13	21.70
1922	1.00	.74	1.12	.50	.01	.09	.00	.58	.17	1.30	1.05	2.95	9.51
1923	4.40	.57	1.58	1.20	.34	.65	1.18	.70	.93	.58	1.04	3.05	16.22
1924	1.81	1.39	.35	.02	.00	.41	.15	.18	.20	1.32	3.35	1.15	10.33
1925	4.04	2.49	.52	.80	1.47	T	T	.01	.81	.03	1.94	1.11	13.22
1926	1.71	3.06	T	.18	.62	.00	T	.23	.44	.75	5.50	1.42	13.91
1927	4.19	3.35	.45	T	.40	.30	T	T	2.51	.81	3.02	.87	15.90
1928	3.50	.23	2.92	1.04	T	.34	.12	.00	.09	.15	1.81	2.61	13.01
1929	2.24	.02	T	.40	T	.55	.00	T	.13	.23	.02	4.96	8.55
1930	2.18	1.85	.88	.20	.12	.12	.00	.03	.21	1.06	1.60	.75	9.00
1931	1.26	.38	3.25	.50	T	1.35	.00	T	.85	.80	1.83	1.38	11.60
1932	1.82	1.72	1.42	.68	1.62	T	T	T	.00	1.01	2.28	2.19	12.74
1933	1.52	1.07	.99	T	1.34	.45	.00	T	.84	1.04	1.07	4.79	13.11
1934	2.15	.38	1.72	.59	.28	.05	T	.23	.88	1.80	3.08	2.85	14.01
1935	.73	.52	1.03	.48	.03	.14	.11	.02	.44	.56	.69	2.11	6.86
1936	5.07	1.90	.63	.19	.90	1.57	.04	.00	.08	.08	.05	2.39	12.90
1937	2.62	2.49	1.28	1.09	.09	2.19	.29	.71	.25	.58	3.11	4.56	19.26
1938	1.71	2.69	2.30	.40	.09	.37	.16	T	T	1.10	1.59	1.46	11.87
1939	.66	1.35	1.18	T	.28	.33	.02	.09	.11	.13	.09	2.13	6.37
1940	1.95	4.79	1.27	1.01	.20	.24	.14	.00	1.38	1.43	1.76	1.33	15.50
1941	2.31	.81	.32	.39	.86	.08	.00	.33	.56	.82	2.48	2.69	11.65
1942	1.53	2.80	.09	.26	1.25	.30	.02	.08	.00	.26	5.10	3.96	15.65
1943	3.39	1.57	1.53	1.48	.30	.87	.10	.95	T	3.84	1.49	.65	16.17
1944	.90	1.85	.13	.49	.25	.68	.00	T	.50	.26	2.05	.72	7.83
1945	1.43	1.72	.61	.57	2.05	T	T	.03	.22	.65	3.33	3.91	14.52
1946	2.13	1.81	1.39	T	.32	.80	.31	.06	.24	1.50	2.11	.92	11.59
1947	1.45	.99	1.07	.95	.03	2.81	.41	.01	1.14	3.15	1.60	.76	14.37
1948	3.31	2.80	1.67	.59	1.04	1.53	.30	.20	1.60	.46	3.15	3.88	20.53
1949	.43	3.45	1.27	.03	.57	.17	.03	T	.27	.49	2.48	.93	10.12
1950	5.57	1.79	2.03	.51	.12	.40	T	.02	.70	3.98	3.28	3.42	21.82
1951	4.05	2.39	2.10	.22	.90	.43	.03	.41	.35	2.45	1.80	2.87	18.00

TABLE 2

TABLE 2

Sheet 3 of 3

e - Estimated or partially estimated.

Monthly and Annual Precipitation
The Dalles, Oregon
(Elevation 98 feet)

Year	Precipitation in inches												
	January	February	March	April	May	June	July	August	September	October	November	December	Annual
1952	2.65	1.90	.35	.05	.78	1.21	.00	.00	.17	.01	.29	2.81	10.32
1953	6.18	1.98	.60	.63	1.59	.50	.00	.71	.02	.58	2.68	3.47	18.96
1954	5.59	.60	.65	.28	.63	.58	.10	.08	.47	.84	1.36	.88	12.06
1955	.57	.43	1.92	1.26	.37	.38	.21	.00	.64	2.39	3.58	4.72	16.47
1956	6.57	1.24	.91	.06	.54	.57	.00	.49	.49	.88	.23	1.74	15.32
1957	1.23	1.38	3.84	.66	.21	.02	.07	.14	.00	1.91	.93	3.74	14.15
1958	3.15	3.11	1.00	1.24	.32	1.47	T	T	.21	.20	3.03	1.86	15.61
1959	2.36	1.56	1.35	.10	.33	.17	T	.00	.94	1.12	.54	.48	8.95
1960	1.92	2.06	3.20	1.17	1.22	.06	T	.13	.15	.85	3.52	1.44	15.80
Avg.	2.86	1.96	1.37	.64	.62	.56	.16	.13	.69	1.08	2.38	2.78	11.25
Max.	7.08	9.41	6.07	2.52 ^e	2.34	2.31	1.38	.95	5.77	4.80	9.41	10.73	43.63
Min.	.43	.00	T	.00	.00	.00	.00	.00	.00	.00	.00	.00	0.37

TABLE 3
COLUMBIA RIVER TRAFFIC, TONS

YEAR	THROUGH BONNEVILLE LOCK	THROUGH THE DALLES LOCK
1930	79,747	None
1931	105,717	987
1932	59,777	408
1933	85,815	15,640
1934	87,029	23,408
1935	67,527	3,631
1936	59,490	7,295
1937	15,228	5,626
1938	161,920	44,349
1939	416,814	139,542
1940	707,444	325,900
1941	923,606	392,863
1942	692,021	324,013
1943	681,665	433,145
1944	791,919	559,339
1945	802,901	598,980
1946	1,018,679	744,352
1947	1,150,581	804,572
1948	1,139,997	699,077
1949	1,340,336	900,246
1950	1,143,901	834,303
1951	1,357,852	1,022,997
1952	1,521,616	1,023,395
1953	1,343,575	785,445
1954	1,372,725	791,192
1955	1,578,865	1,061,691
1956	1,518,924	1,139,563
1957	1,481,590	1,148,043
1958	1,702,752	1,313,579
1959	2,043,494	1,504,119

Source: "Waterborne Commerce of the United States, Part 4", year 1958, Waterways and Harbors, Corps of Engineers.

Notes:

1. Commerce shown above for Bonneville prior to 1938 represents traffic at Cascades Canal, about 3.5 miles upstream, which was inundated by pool formed by Bonneville Dam in February 1938. Bonneville Project depth: 27 feet in lock approach canal and 24 feet over miter sills at adopted low water.
2. Tonnages shown from 1949 through 1956 represent traffic through The Dalles-Celilo canal. The canal and locks were closed on 2 January 1957 and were subsequently inundated.

TABLE 4

TEMPERATURE AND PRECIPITATION

(Columbia River Basin above The Dalles Project)

Station	Basin	Period of Record	Station Elevation	Temperatures				Annual Precipitation Depths				Snowfall		
				Period	Normal	Max.	Min.	Period	Normal	Max.	Min.	Period	Ave. Annual Depth	
				Years	Deg. F.	Deg. F.	Deg. F.	Years	Inches	Inches	Inches	Years	Inches	
<u>Canada</u>														
Cranbrook B.C.	E. Kootenay	1901 - 1958	3,013	49	41	102	-42	49	14.88	-	-	-	49	55.6
Fernie B.C.	E. Kootenay	1913 - 1958	3,305	42	40	97	-40	42	39.90	-	-	-	42	132.8
Glacier B.C.	N. Columbia	1893 - 1957	4,094	53	36	96	-32	54	54.68	-	-	-	54	398.1
Golden B.C.	N. Columbia	1902 - 1958	2,583	52	40	104	-51	49	17.89	-	-	-	49	69.5
Nelson B.C.	N. Kootenay	1898 - 1956	1,760	53	46	103	-17	55	28.01	-	-	-	55	83.7
Princeton B.C.	Okanogan	1893 - 1942	2,075	47	42	102	-49	49	12.68	-	-	-	49	42.9
Revelstoke B.C.	N. Columbia	1898 - 1958	1,497	54	43	105	-30	55	40.71	-	-	-	55	146.7
<u>Idaho</u>														
Boise	Boise	1864 - 1958	2,842	94	50.8	121	-28	94	11.52	25.80	6.69	63	23.9	
Glenns Ferry	Snake	1905 - 1958	2,569	34	52.0	115	-31	36	8.58	13.99	4.13	37	19.4	
Hailey	Big Wood	1894 - 1958	5,322	48	43.5	109	-36	50	15.33	22.01	6.76	47	86.4	
Idaho Falls	Snake	1881 - 1958	4,730	64	44.3	104	-37	64	11.61	21.31	5.93	51	44.2	
Kooskia	Clearwater	1908 - 1958	1,261	40	50.5	116	-30	50	23.43	36.68	15.75	38	25.9	
Lewiston	Snake	1878 - 1958	1,413	81	52.1	117	-23	81	13.12	21.71	8.40	50	13.0	
New Meadows	Salmon	1903 - 1958	3,870	41	41.4	104	-49	44	22.50	33.78	12.70	44	94.5	
Obsidian	Salmon	1909 - 1958	6,870	31	35.4	95	-44	37	16.10	23.50	8.15	41	85.4	
Pocatello	Portneuf	1899 - 1958	4,444	58	47.2	105	-31	58	12.47	22.43	6.43	50	42.0	
Porthill	Kootenay	1890 - 1958	1,800	61	44.8	102	-31	63	19.29	38.63	9.26	58	67.3	
Salmon	Salmon	1906 - 1958	3,949	47	44.0	106	-37	47	8.64	14.36	3.63	38	24.1	
Sand Point	Clark Fork	1911 - 1958	2,100	47	45.4	104	-35	48	29.10	42.06	17.93	42	72.4	
<u>Oregon</u>														
Arlington	Columbia	1891 - 1958	266	35	54.2	114	-3	46	9.07	13.17	5.02	40	13.4	
Baker	Powder	1889 - 1952	3,446	62	45.4	104	-25	62	11.22	18.23	5.79	59	40.4	
La Grande	Grande Ronde	1886 - 1958	2,805	70	49.4	108	-34	70	20.09	28.41	12.09	61	41.6	
Moro	Columbia	1894 - 1958	1,868	47	49.4	111	-23	49	11.83	17.17	6.43	21	22.4	
The Dalles	Columbia	1850 - 1958	102	79	54.0	115	-30	97	13.80	43.65	6.37	85	29.6	
Umatilla	Columbia	1877 - 1958	270	71	53.4	117	-23	71	7.83	13.73	4.07	49	6.8	
<u>Montana</u>														
Kalispell	Flathead	1896 - 1958	2,960	58	43.2	101	-34	61	16.35	21.87	10.39	58	51.8	
Missoula	Missoula	1870 - 1958	3,200	67	44.1	105	-28	80	12.76	22.43	6.71	52	37.6	
Thompson Falls	Clark Fork	1911 - 1958	2,380	42	47.7	109	-32	47	20.34	32.08	9.74	34	40.5	
<u>Washington</u>														
Cle Elum	Yakima	1899 - 1953	1,900	55	46.0	105	-33	55	22.65	34.81	5.25	52	83.7	
Colville	Columbia	1860 - 1952	1,635	52	46.4	106	-29	71	16.54	25.45	8.22	52	40.8	
Okanogan	Okanogan	1927 - 1947	910	22	50.7	112	-23	22	11.65	20.52	3.67	17	31.2	
Pullman	Palouse	1893 - 1958	2,545	64	48.1	104	-29	66	19.45	30.87	11.31	58	44.7	
Spokane	Spokane	1881 - 1958	2,357	77	47.1	108	-30	77	14.97	25.99	7.54	59	37.7	
Walla Walla	Walla Walla	1872 - 1958	749	86	54.2	113	-29	85	15.07	23.07	10.12	54	20.7	
Yakima	Yakima	1904 - 1958	1,061	49	50.2	111	-25	49	7.21	11.69	3.90	49	22.1	
<u>Wyoming</u>														
Moran	Snake	1911 - 1958	6,798	45	34.2	92	-63	46	21.21	29.32	13.51	40	143.3	

TABLE 5
Representative Snow Course Data
Columbia River Basin

Course	Location		River Basin		Elevation Feet U.S.L.	Observed Snow Water Contents														
	Lat. or Township	Long. or Range	In	Near		Avg. About 1 Jan.		Avg. About 1 Feb.		Avg. About 1 Mar.		Avg. About 1 Apr.		Avg. About 1 May		Maximum Recorded		Minimum of About 1 Apr.		
						Depth Inches	No. of Years	Depth Inches	No. of Years	Depth Inches	No. of Years	Depth Inches	No. of Years	Depth Inches	No. of Years	Depth Inches	Month	Year	Depth Inches	Year
Dumping Lake, Wash.	46°-52'	121°-18'	Yakima	White	3450	6.7	25	11.2	31	13.9	33	13.5	34	7.5	23	32.5	April	1949	0	1926, 34
Tunnel Avenue, Wash.	21N	12E	Yakima	White	2450	10.5	11	17.5	12	23.0	12	24.1	12	17.5	9	44.2	March	1949	1.3	1941
Blewett Pass, Wash.	22N	17E	Yakima	Wenatchee	4270	9.2	8	12.4	10	16.1	12	12.2	14	4.3	14	28.7	April	1949	0	1943
Rainy Pass, Wash.	48°-34'	120°-44'	Chelan	Wetlow	4780	-	-	-	-	-	-	35.4	21	-	-	51.9	April	1949	21.9	1941, 44
Trout Creek, B. C.	49°-46'	120°-12'	Okanogan	--	4700	-	-	4.8	16	6.2	14	7.1	17	5.9	5	11.2	April	1951	3.1	1941
McCulloch, B. C.	49°-47'	119°-13'	Okanogan	Kettle	4200	-	-	5.1	16	6.6	16	6.8	15	3.6	5	9.8	March	1946	3.7	1941
Farron, B. C.	49°-17'	118°-07'	Kettle	Upper Col.	4000	-	-	8.9	13	11.7	13	11.9	15	3.5	4	19.2	April	1951	3.6	1941
Revelstoke, B. C.	50°-54'	118°-16'	Upper Col.	--	1800	-	-	6.8	11	10.9	14	9.5	15	-	-	16.3	March	1951	0.6	1941
Glacier, B. C.	51°-14'	117°-29'	Upper Col.	--	4100	-	-	14.5	12	19.9	14	22.9	16	22.6	6	32.9	April	1946	13.5	1937
Ferguson, B. C.	50°-40'	117°-30'	Kootenai	Upper Col.	2900	-	-	-	-	-	-	19.5	15	14.8	6	31.1	April	1946	5.6	1942
Nelson, B. C.	49°-25'	117°-14'	Pend Oreil.	Kootenai	3050	-	-	9.8	14	13.2	13	13.8	15	-	-	20.2	March	1949	5.4	1941
Sinclair Pass, B. C.	50°-41'	115°-59'	Kootenai	Upper Col.	4500	-	-	4.8	5	5.5	7	5.0	16	1.2	6	9.5	April	1951	1.4	1941
Bluebird Basin, Mont.	37N	26W	Kootenai	Flathead	6800	-	-	-	-	-	-	35.9	14	36.1	14	53.7	May	1950	21.4	1944
Benton Spring, Idaho	58N	3W	Pend Oreil.	Kootenai	4900	8.3	16	13.8	16	18.6	17	20.5	16	13.3	16	32.8	April	1949	10.0	1941
Mosquito Ridge, Idaho	54N	2E	Pend Oreil.	Spokane	5110	-	-	-	-	-	-	35.0	16	25.6	14	50.6	April	1950	19.5	1944
Barce Mountain, Mont.	25N	31W	Clark Fork	Kootenai	6000	-	-	-	-	-	-	39.9	14	39.5	16	63.9	May	1950	19.2	1941
Copper Ridge, Idaho	50N	1W	Spokane	Clark Fork	4800	10.4	10	16.2	10	25.5	16	30.5	17	23.2	16	45.4	April	1949	15.3	1941
Lookout, Idaho	47N	6E	Spokane	Pend Oreil.	5250	17.9	5	22.1	16	29.8	28	33.4	16	21.8	15	48.7	April	1949	17.1	1941
Forty-Nine Meadows, Idaho	43N	5E	Clearwater	Spokane	5000	13.2	10	19.3	8	30.0	14	34.9	16	26.9	13	57.0	April	1950	15.6	1941
Freezeout Summit, Mont.	15N	27W	Clark Fork	Clearwater	7000	-	-	-	-	-	-	31.7	16	27.8	13	57.2	April	1950	16.3	1941
Shanghai Summit, Idaho	37N	6E	Clearwater	--	4600	-	-	-	-	-	-	25.0	15	15.2	14	41.7	April	1949	8.2	1941
Fackers Meadow, Idaho	38N	15E	Clearwater	Bitterroot	5700	-	-	12.7	13	18.0	13	21.7	16	13.4	15	34.4	April	1949	8.4	1941
Savage Pass, Idaho	36N	15E	Clearwater	Bitterroot	6600	-	-	-	-	-	-	25.4	15	21.8	13	35.7	April	1949	11.6	1941
Marion Pass, Mont.	48°-19'	113°-21'	Blackfoot	Missouri	5250	7.6	17	11.7	17	15.0	19	17.7	17	9.9	18	28.6	April	1950	5.6	1941
Ten Mile Creek (upper), Mont.	8N	5W	Clark Fork	Missouri	8000	6.2	17	8.4	17	10.7	18	13.4	17	9.7	18	18.8	May	1950	6.4	1941
Gibbons Pass, Mont.	2S	19W	Bitterroot	Salmon	7000	-	-	14.9	14	19.0	19	23.2	14	19.6	17	30.6	March	1943	14.3	1941
Nes Perce, Idaho	28N	16E	Clearwater	Salmon	6575	-	-	11.1	14	15.1	15	17.6	16	9.5	15	27.2	March	1943	6.2	1941
Williams Creek Summit, Ida.	21N	20E	Salmon	--	8710	-	-	-	-	10.9	14	13.2	16	10.6	6	20.2	April	1950	7.1	1941
Mill Creek Summit, Idaho	15N	17E	Salmon	--	8870	-	-	-	-	-	-	20.8	16	16.2	7	35.5	April	1943	11.3	1941
Boulder Creek, Idaho	20N	1W	Weiser	Salmon	5500	-	-	-	-	-	-	23.4	15	-	-	37.1	April	1952	12.6	1944
Crawford Ranger Station, Ida.	14N	4E	Payette	Salmon	4800	2.7	10	5.8	14	7.4	16	5.8	15	-	-	13.8	April	1936	0	Several
Deadwood River Dam, Idaho	11N	7E	Payette	Salmon	5500	8.0	13	11.6	16	15.8	16	16.3	17	16.0	5	25.7	April	1952	7.0	1944
Mores Creek Summit, Idaho	7N	7E	Boise	Payette	6100	13.4	10	22.1	11	27.5	18	30.9	17	23.8	19	56.7	April	1943	17.6	1944
Atlanta Summit, Idaho	5N	10E	Boise	--	7500	17.8	4	-	-	26.9	6	32.0	16	30.4	5	43.8	May	1952	16.8	1944
Graham Ranch, Idaho	5N	17E	Big Wood	Salmon	6200	5.3	17	8.8	17	12.3	17	13.3	17	-	-	23.2	April	1938	5.9	1939
Masoot Mine, Idaho	4N	20E	Little Wood	Big Lost	7900	3.7	5	8.0	7	14.1	15	15.8	17	-	-	24.7	April	1943	8.3	1937
Camp Creek, Idaho	13N	36E	Camas Cr.	Big Horn	6930	3.9	16	6.3	17	9.2	17	9.8	17	-	-	23.7	April	1952	4.4	1940
Big Springs, Idaho	14N	44E	Henry's Fk.	Madison	6500	7.1	17	12.8	17	18.5	17	21.4	17	15.5	4	34.7	April	1952	14.0	1940
Aster Creek, Wyoming	44°-17'	110°-37'	Snake	Yellowstone	7700	-	-	14.5	31	22.1	32	27.2	32	29.8	32	50.8	April	1943	12.0	1931
Noran Bay, Wyoming	45N	116W	Snake	Henry's Fork	6800	-	-	9.9	31	15.2	32	18.9	32	20.0	30	37.5	April	1936	7.5	1931
Turpin Meadows, Wyoming	45N	112W	Snake	Yellowstone	6930	-	-	7.1	17	-	-	10.7	17	-	-	19.9	April	1943	7.2	1944
Greys Boundary, Wyoming	37N	118W	Snake	--	5800	4.9	13	7.4	17	10.8	17	11.4	17	0.7	8	18.9	April	1936	5.3	1944
Siug Creek Divide, Idaho	10S	44E	Blackfoot	Upper Snake	7225	-	-	-	-	-	-	16.3	16	-	-	28.0	April	1936	9.4	1939
Sublett, Idaho	12S	30E	Reft	Goose Cr.	6000	3.4	5	6.6	5	10.8	12	12.8	16	-	-	20.9	April	1936	7.7	1940
Jack Creek, Lower, Nevada	42N	53E	Owyhee	Humboldt	7000	-	-	-	-	4.7	25	4.2	18	-	-	10.3	April	1952	0	Several
South Mountain No. 2, Ida.	9S	5W	Owyhee	--	5100	4.8	8	9.1	12	11.9	13	11.5	12	-	-	23.8	March	1952	3.6	1947
Blue Mountain Springs, Ore.	15S	35E	Malheur	John Day	5900	6.0	17	9.8	21	15.2	17	15.2	23	-	-	23.1	April	1952	4.1	1930
Kilerton Meadows, Oregon	8S	28E	Powder	John Day	5400	4.1	20	8.1	13	11.5	14	12.0	20	-	-	17.5	April	1932	6.5	1944
Aneroid Lake No. 1, Oregon	4S	45E	Grande Ronde	Imahua	7480	-	-	21.2	22	31.4	9	36.2	18	35.3	7	47.5	April	1952	21.0	1944
Neechan	1S	35E	Umatilla	Grande Ronde	4300	-	-	6.3	24	9.7	16	8.4	24	2.5	5	20.6	March	1949	0	1934, 41
Tollgate	4N	28E	Walla Walla	Grande Ronde	5070	-	-	17.5	21	25.6	14	27.8	22	-	-	44.9	March	1949	0	1934

TABLE 6

THE DALLES SPILLWAY RATINGS
FLOW UNDER GATE IN 1,000 C.F.S. FOR GATE DATE
GATE OPENING IN FEET 1/

POOL ELEV. M.S.L.																															POOL 2/ ELEV. M.S.L.	FREE FLOW OVER SPILLWAY CREST			
	0.5	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29			30		
162.0	0.80	1.60	3.1	4.7	6.2	7.7	9.2	10.7	12.2	13.6	15.1	16.5	18.0	19.5	21.0	22.4	23.9	25.3	26.8	28.2	29.7	31.1	32.6	34.0	35.5	37.0	38.7	40.3	42.0	43.8	45.9	162.0	40.5		
.8	0.80	1.60	3.1	4.7	6.2	7.7	9.2	10.7	12.1	13.6	15.1	16.5	18.0	19.4	20.9	22.4	23.8	25.2	26.7	28.1	29.6	31.0	32.5	33.9	35.4	36.9	38.6	40.2	41.9	43.7	45.8	.8	49.1		
.6	0.80	1.60	3.1	4.7	6.2	7.7	9.2	10.6	12.1	13.5	15.0	16.5	17.9	19.4	20.8	22.3	23.7	25.2	26.6	28.0	29.5	30.9	32.4	33.8	35.3	36.8	38.5	40.1	41.8	43.6	45.7	.6	48.7		
.4	0.80	1.55	3.1	4.6	6.2	7.7	9.1	10.6	12.1	13.5	15.0	16.4	17.9	19.3	20.8	22.2	23.6	25.1	26.5	28.0	29.4	30.8	32.3	33.7	35.2	36.7	38.4	40.0	41.7	43.5	45.6	.4	48.4		
.2	0.80	1.55	3.1	4.6	6.2	7.6	9.1	10.6	12.0	13.5	14.9	16.4	17.8	19.3	20.7	22.1	23.6	25.0	26.4	27.9	29.3	30.7	32.2	33.6	35.1	36.6	38.3	39.9	41.6	43.4	45.5	.2	48.0		
161.0	0.80	1.55	3.1	4.6	6.1	7.6	9.1	10.5	12.0	13.4	14.8	16.3	17.8	19.2	20.7	22.1	23.5	24.9	26.4	27.8	29.2	30.6	32.0	33.5	35.0	36.4	38.2	39.8	41.5	43.3	45.4	161.0	47.6		
.8	0.80	1.55	3.1	4.6	6.1	7.6	9.1	10.5	12.0	13.4	14.8	16.3	17.7	19.2	20.6	22.0	23.4	24.8	26.3	27.7	29.1	30.5	31.9	33.4	34.8	36.3	38.1	39.6	41.4	43.2	45.3	.8	47.2		
.6	0.80	1.55	3.1	4.6	6.1	7.6	9.0	10.5	11.9	13.4	14.8	16.2	17.7	19.1	20.5	21.9	23.3	24.7	26.2	27.6	29.0	30.4	31.8	33.2	34.7	36.2	38.0	39.5	41.3	43.1	45.2	.6	46.8		
.4	0.80	1.55	3.1	4.6	6.1	7.5	9.0	10.5	11.9	13.3	14.7	16.2	17.6	19.1	20.5	21.9	23.3	24.7	26.1	27.5	29.0	30.3	31.7	33.1	34.6	36.1	37.8	39.4	41.2	43.0	45.2	.4	46.5		
.2	0.80	1.55	3.0	4.5	6.1	7.5	9.0	10.4	11.9	13.3	14.7	16.1	17.5	19.0	20.4	21.8	23.2	24.6	26.0	27.4	28.9	30.2	31.6	33.0	34.5	36.0	37.7	39.3	41.1	42.9	45.1	.2	46.2		
159.0	0.75	1.55	3.0	4.5	6.0	7.5	9.0	10.4	11.8	13.3	14.7	16.1	17.5	19.0	20.4	21.8	23.2	24.6	26.0	27.3	28.7	30.1	31.5	32.9	34.3	35.7	37.6	39.2	41.0	42.8	45.0	160.0	45.8		
.8	0.75	1.50	3.0	4.5	6.0	7.5	9.0	10.4	11.8	13.2	14.6	16.0	17.5	18.9	20.3	21.7	23.1	24.5	25.9	27.2	28.6	30.0	31.4	32.8	34.2	35.6	37.5	39.1	40.9	42.7	44.9	.8	45.4		
.6	0.75	1.50	3.0	4.5	6.0	7.5	8.9	10.3	11.7	13.2	14.6	16.0	17.4	18.8	20.2	21.6	23.0	24.4	25.8	27.1	28.5	29.9	31.3	32.7	34.1	35.5	37.4	39.0	40.8	42.6	44.8	.6	45.0		
.4	0.75	1.50	3.0	4.5	6.0	7.5	8.9	10.3	11.7	13.2	14.6	16.0	17.4	18.8	20.2	21.5	22.9	24.3	25.7	27.0	28.4	29.8	31.2	32.6	34.0	35.4	37.2	38.9	40.7	42.5	Free Flow	.4	44.6		
.2	0.75	1.50	3.0	4.5	6.0	7.5	8.9	10.3	11.7	13.1	14.5	15.9	17.3	18.7	20.1	21.5	22.9	24.2	25.6	26.9	28.3	29.7	31.1	32.5	34.0	35.3	37.2	38.8	40.5	42.4	"	.2	44.2		
159.0	0.75	1.50	3.0	4.5	6.0	7.4	8.9	10.3	11.7	13.1	14.5	15.9	17.3	18.7	20.0	21.4	22.8	24.1	25.5	26.8	28.2	29.6	31.0	32.4	33.8	35.4	37.1	38.7	40.5	42.4	"	159.0	43.7		
.8	0.75	1.50	3.0	4.5	6.0	7.4	8.9	10.2	11.6	13.0	14.4	15.8	17.2	18.6	20.0	21.4	22.7	24.1	25.4	26.7	28.1	29.5	30.9	32.3	33.7	35.2	37.0	38.6	40.4	42.3	"	.8	43.5		
.6	0.75	1.50	3.0	4.5	6.0	7.4	8.8	10.2	11.6	13.0	14.4	15.8	17.1	18.5	19.9	21.3	22.6	24.0	25.3	26.7	28.0	29.4	30.8	32.2	33.6	35.1	36.9	38.5	40.3	42.2	"	.6	43.1		
.4	0.75	1.50	3.0	4.5	5.9	7.4	8.8	10.2	11.6	12.9	14.3	15.7	17.1	18.5	19.9	21.2	22.6	23.9	25.3	26.6	27.9	29.3	30.7	32.1	33.5	35.0	36.7	38.4	40.3	42.1	"	.4	42.7		
.2	0.75	1.50	3.0	4.4	5.9	7.4	8.8	10.1	11.5	12.9	14.3	15.7	17.0	18.4	19.8	21.1	22.5	23.8	25.2	26.5	27.8	29.2	30.6	31.9	33.4	35.0	36.6	38.3	40.2	42.0	"	.2	42.3		
158.0	0.70	1.50	2.9	4.4	5.9	7.3	8.7	10.1	11.5	12.9	14.3	15.6	17.0	18.4	19.7	21.1	22.4	23.7	25.1	26.4	27.8	29.1	30.5	31.9	33.3	34.8	36.5	38.2	40.1	42.0	"	158.0	42.0		
.8	0.70	1.45	2.9	4.4	5.9	7.3	8.7	10.1	11.5	12.8	14.2	15.6	16.9	18.3	19.6	21.0	22.3	23.7	25.0	26.3	27.7	29.0	30.4	31.7	33.0	34.4	36.1	37.8	39.7	41.6	Free Flow	.8	41.6		
.6	0.70	1.45	2.9	4.4	5.9	7.3	8.7	10.1	11.4	12.8	14.2	15.5	16.9	18.2	19.5	20.9	22.2	23.5	24.8	26.2	27.5	28.9	30.2	31.5	32.8	34.2	35.9	37.6	39.5	41.4	"	.6	41.2		
.4	0.70	1.45	2.9	4.4	5.9	7.3	8.7	10.0	11.4	12.8	14.1	15.5	16.8	18.2	19.5	20.9	22.2	23.5	24.8	26.1	27.4	28.7	29.9	31.2	32.5	34.0	35.7	37.4	39.3	41.2	"	.4	40.8		
.2	0.70	1.45	2.9	4.4	5.8	7.3	8.6	10.0	11.4	12.7	14.1	15.4	16.8	18.1	19.5	20.8	22.1	23.4	24.7	26.0	27.3	28.6	29.9	31.2	32.5	34.0	35.7	37.4	39.2	41.1	"	.2	40.4		
157.0	0.70	1.45	2.9	4.4	5.8	7.2	8.6	10.0	11.3	12.7	14.0	15.4	16.7	18.1	19.4	20.7	22.0	23.3	24.6	25.9	27.2	28.5	29.9	31.3	32.6	34.0	35.7	37.4	39.1	40.9	"	157.0	40.1		
.8	0.70	1.45	2.9	4.4	5.8	7.2	8.6	9.9	11.3	12.6	14.0	15.3	16.7	18.0	19.3	20.6	21.9	23.2	24.5	25.8	27.1	28.4	29.7	31.0	32.3	33.7	35.4	37.1	38.8	40.6	Free Flow	.8	39.7		
.6	0.70	1.45	2.9	4.4	5.8	7.2	8.6	9.9	11.3	12.6	14.0	15.3	16.6	17.9	19.2	20.5	21.8	23.1	24.4	25.7	27.0	28.3	29.6	30.9	32.2	33.6	35.3	37.0	38.7	40.5	"	.6	39.3		
.4	0.70	1.45	2.9	4.3	5.8	7.2	8.5	9.9	11.2	12.6	13.9	15.2	16.5	17.9	19.2	20.5	21.8	23.1	24.4	25.7	27.0	28.2	29.5	30.8	32.1	33.5	35.2	36.9	38.6	40.4	"	.4	38.9		
.2	0.70	1.45	2.9	4.3	5.8	7.1	8.5	9.8	11.2	12.5	13.9	15.2	16.5	17.8	19.1	20.4	21.7	23.0	24.3	25.6	26.9	28.1	29.4	30.7	32.0	33.3	35.0	36.7	38.4	40.2	"	.2	38.5		
156.0	0.70	1.45	2.9	4.3	5.8	7.1	8.5	9.8	11.2	12.5	13.8	15.1	16.5	17.8	19.1	20.4	21.7	23.0	24.2	25.5	26.7	28.0	29.3	30.6	31.9	33.2	34.5	36.2	37.9	39.6	41.3	156.0	38.2		
.8	0.70	1.45	2.9	4.3	5.7	7.1	8.5	9.8	11.1	12.4	13.8	15.1	16.4	17.7	19.0	20.3	21.6	22.9	24.1	25.4	26.6	27.8	29.1	30.3	31.6	32.9	34.6	36.3	38.0	39.7	41.4	"	.8	37.8	
.6	0.70	1.45	2.9	4.3	5.7	7.1	8.4	9.8	11.1	12.4	13.7	15.0	16.3	17.6	18.9	20.2	21.5	22.8	24.0	25.3	26.5	27.7	28.9	30.1	31.3	32.6	34.3	36.0	37.7	39.4	41.1	"	.6	37.4	
.4	0.70	1.45	2.9	4.3	5.7	7.0	8.4	9.7	11.1	12.4	13.7	15.0	16.3	17.6	18.9	20.2	21.4	22.7	23.9	25.2	26.4	27.6	28.8	29.9	31.1	32.3	34.0	35.7	37.4	39.1	40.8	"	.4	37.1	
.2	0.70	1.45	2.9	4.3	5.7	7.0	8.4	9.7	11.0	12.3	13.6	14.9	16.2	17.5	18.8	20.1	21.3	22.6	23.8	25.0	26.1	27.3	28.5	29.6	30.8	32.0	33.2	34.9	36.6	38.3	39.9	41.5	"	.2	36.7
155.0	0.70	1.40	2.8	4.2	5.7	7.0	8.3	9.7	11.0	12.3	13.6	14.9	16.2	17.5	18.7	20.0	21.2	22.5	23.7	24.9	26.0	27.2	28.4	29.5	30.7	31.9	33.1	34.3	35.5	36.7	38.0	39.2	155.0	36.4	

NOTES:

1/ Gate opening is the vertical distance in feet between gate lip and gate seal at elevation 119.50.

2/ Pool elevation is the elevation of the water surface observed at the Navigation Lock forebay gage.

TABLE 7

GAGES

Sheet 1 of 2

Location	:River: :Mile :	Type	:Operating: : Agency :	: Purpose :	Notes
Bonneville Pool (Acoustic Flow Meter) Proposed	188.1	S.W.	U.S.G.S.	Discharge	1
The Dalles - Court St.	189.4	S	U.S.W.B.	Pool elev.	1
The Dalles - Court St.	189.4	R	U.S.G.S.	Pool elev.	1
Navigation Lock tailrace	191.5	S	C. E.	Tailwater elev.	1
Navigation Lock	191.5	S	C. E.	Tailwater & pool elev.	1
Navigation Lock	191.5	S	C.E.	Tailwater & pool elev.	1
North Fish Counting Stn.	191.6	S	C. E.	Pool elev.	1
North Fishladder Entrance	191.6	S	C. E.	Tailwater elev.	1
Navigation Lock Forebay	191.7	T.R.	C. E.	Pool elev.	1
South Fishladder Entrance	191.7	S	C. E.	Tailwater elev.	1
Spillway Forebay	191.8	R	C. E.	Pool elev.	1
West Powerhouse Fish- ladder Entrance	192.0	S	C. E.	Tailwater elev.	1
Powerhouse Forebay	192.1	T.R.	C. E.	Pool elev.	1
Powerhouse Tailrace	192.1	T.R.	C. E.	Tailwater elev.	1
East Powerhouse Fish- ladder Entrance	192.4	S	C. E.	Tailwater elev.	1
Fishlock Entrance	192.5	S	C. E.	Tailwater elev.	1

TABLE 8

B-210
(Sept. 1952)

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

File No. Washington 14-0192-00
Field _____

Rating table for Columbia River below McNary Dam, near Umatilla, Oreg.
from Oct. 1, 1955, to _____, 19____

Gage height	Gage height 26.00			Gage height 27.00			Gage height 28.00			Gage height 29.00			Gage height 30.00			Gage height 31.00			Gage height 32.00			Gage height 33.00				
	Feet	Discharge Cfs	Difference Cfs	Feet	Discharge Cfs	Difference Cfs	Feet	Discharge Cfs	Difference Cfs	Feet	Discharge Cfs	Difference Cfs	Feet	Discharge Cfs	Difference Cfs	Feet	Discharge Cfs	Difference Cfs	Feet	Discharge Cfs	Difference Cfs	Feet	Discharge Cfs	Difference Cfs		
24.00	332,000	2,700		26.00	393,000	2,800		28.00	453,000	3,400		30.00	522,000	3,800		32.00	600,000	4,300								
.10	340,700			.10	395,800			.10	456,400			.10	525,800			.10	604,200									
.20	343,400			.20	398,600			.20	459,800			.20	529,600			.20	608,400									
.30	346,100			.30	401,400			.30	463,200			.30	533,400			.30	612,600									
.40	348,800			.40	404,200	2,800		.40	466,600			.40	537,200			.40	616,800									
.50	351,500			.50	407,000	3,000		.50	470,000			.50	541,000			.50	621,000									
.60	354,200			.60	410,000			.60	473,400			.60	544,800			.60	625,200									
.70	356,900			.70	413,000			.70	476,800			.70	548,600			.70	629,400									
.80	359,600			.80	416,000			.80	480,200			.80	552,400			.80	633,600									
.90	362,300	2,700		.90	419,000			.90	483,600	3,400		.90	556,200	3,800		.90	637,800									
25.00	365,000	2,800		27.00	422,000			29.00	487,000	3,500		31.00	560,000	4,000		33.00	642,000									
.10	367,800			.10	425,000			.10	490,500			.10	564,000			.10	646,200									
.20	370,600			.20	428,000			.20	494,000			.20	568,000			.20	650,400									
.30	373,400			.30	431,000			.30	497,600			.30	572,000			.30	654,600									
.40	376,200			.40	434,000	2,800		.40	501,000			.40	576,000			.40	658,800									
.50	379,000			.50	437,000	3,200		.50	504,500			.50	580,000			.50	663,000									
.60	381,800			.60	440,200			.60	508,000			.60	584,000			.60	667,200									
.70	384,600			.70	443,400			.70	511,500			.70	588,000			.70	671,400									
.80	387,400			.80	446,600			.80	515,000			.80	592,000			.80	675,600									
.90	390,200	3,800		.90	449,800	3,200		.90	518,500	3,500		.90	596,000	4,000		.90	679,800	4,200								

The above table is not applicable for ice or obstructed channel conditions. It is based on _____ discharge measurements made during _____

and is _____ well defined between _____ cfs and _____ cfs.

Computed by H. M. D.

Checked by D. J. B.

Date 10-6-59

Provisional.

TABLE 9

9-210
(Sept. 1962)

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

Washington
File No. 225

Rating table for Umatilla River near Umatilla, Oreg.
Current Records
from Feb. 1, 1960, to 19

Gage height	Discharge	Difference	Gage height	Discharge	Difference	Gage height	Discharge	Difference	Gage height	Discharge	Difference	Gage height	Discharge	Difference
Feet	Cfs	Cfs	Feet	Cfs	Cfs	Feet	Cfs	Cfs	Feet	Cfs	Cfs	Feet	Cfs	Cfs
1.00			3.00	270	50	5.00	2,810	210	7.00	7,600	250	.00		
.10			.10	320	50	.10	3,020	220	.10	7,850	250	.10		
.20			.20	370	60	.20	3,240	220	.20	8,100	250	.20		
.30			.30	430	70	.30	3,460	230	.30	8,350	250	.30		
.40			.40	500	80	.40	3,690	230	.40	8,600	300	.40		
.50	3	1	.50	580	90	.50	3,920	230	.50	8,900	300	.50		
.60	4	1	.60	670	90	.60	4,150	240	.60	9,200	300	.60		
.70	5	2	.70	760	100	.70	4,390	240	.70	9,500	300	.70		
.80	7	4	.80	860	100	.80	4,630	240	.80	9,800	300	.80		
.90	11	4	.90	960	110	.90	4,870	240	.90	10,100	300	.90		
2.00	15	7	4.00	1,070	130	6.00	5,110	240	8.00	10,400	300	.00		
.10	22	9	.10	1,200	140	.10	5,350	250	.10	10,700	300	.10		
.20	31	12	.20	1,340	150	.20	5,600	250	.20	11,000	300	.20		
.30	49	15	.30	1,490	160	.30	5,850	250	.30	11,300	300	.30		
.40	58	22	.40	1,650	170	.40	6,100	250	.40	11,600	300	.40		
.50	80	30	.50	1,820	180	.50	6,350	250	.50			.50		
.60	110	30	.60	2,000	200	.60	6,600	250	.60			.60		
.70	140	40	.70	2,200	200	.70	6,850	250	.70			.70		
.80	180	40	.80	2,400	200	.80	7,100	250	.80			.80		
.90	220	50	.90	2,600	210	.90	7,350	250	.90			.90		

The above table is not applicable for ice or obstructed channel conditions. It is based on 6 discharge measurements made during period June 22, 1959, to Feb. 23, 1960

and is fairly well defined between 11 cfs and 8,600 cfs.

Same as Table No. 2 (1-28-59) above 3.8 ft. g. ht.

Computed by E.H.S.

Checked by E.M.M.

Date 2-25-60

TABLE 10

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY (WATER RESOURCES DIVISION)

Washington
File No. Field 14-0465.00

9-210
N-71a

Provisional

Rating table for

John Day River at Service Creek, Oreg.
CURRENT RECORDS
from Jan 13, 1959 to 19 from 19 to 19

Stage height	Discharge	Difference	Stage height	Discharge	Difference	Stage height	Discharge	Difference	Stage height	Discharge	Difference	Stage height	Discharge	Difference	Stage height	Discharge	Difference	Stage height	Discharge	Difference	
Feet	Cfs	Cfs	Feet	Cfs	Cfs	Feet	Cfs	Cfs	Feet	Cfs	Cfs	Feet	Cfs	Cfs	Feet	Cfs	Cfs	Feet	Cfs	Cfs	
2.00			4.00	830	120	6.00	4,200	200	8.00	8,500	250	10.00	13,600	300							
			10	950	130	10	4,400		10	8,750		10	13,900								
			20	1,080	140	20	4,600		20	9,000		20	14,200								
			30	1,220	150	30	4,800		30	9,250		30	14,500								
			40	1,370	160	40	5,000		40	9,500		40	14,800								
			50	1,530	170	50	5,200		50	9,750		50	15,100								
			60	1,700		60	5,400		60	10,000		60	15,400								
			70	1,870		70	5,600		70	10,250		70	15,700								
	66	25	80	2,040		80	5,800		80	10,500		80	16,000								
	91	32	90	2,210	170	90	6,000		90	10,750		90	16,300	300							
3	123	38	5	2,380	180	7	6,200		9	11,000		11	16,600								
	161	45	15	2,560		15	6,400		15	11,250		15									
	206	51	20	2,740		20	6,600		20	11,500		20									
	257	58	25	2,920		25	6,800	200	25	11,750		25									
	315	65	30	3,100		30	7,000	250	30	12,000		30									
	380	70	35	3,280		35	7,250		35	12,250		35									
	450	80	40	3,460		40	7,500		40	12,500		40									
	530	90	45	3,640		45	7,750		45	12,750	250	45									
	620	100	50	3,820	180	50	8,000		50	13,000	300	50									
	720	110	55	4,000	200	55	8,250	250	55	13,300	300	55									

TABLE 10

This table is applicable for open channel conditions. It is based on 10 discharge measurements made during Jan. 20 to Sept. 22, 1959, PZF, and older measurements 251-255 and is well defined between 66 cfs and 16,000 cfs. Comp by J.F.C. date 10-19-59. Ckd by G.H. date 10-22-59.

TABLE 11

8-210
(Repl. 1962)

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

File No. Washington
Field 14-1030.00

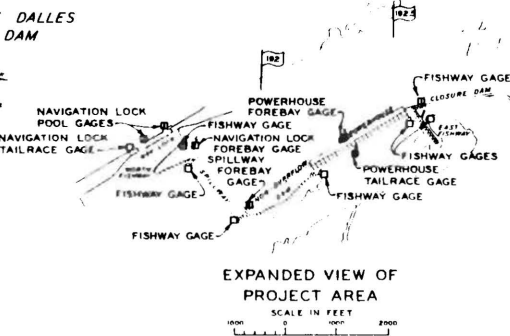
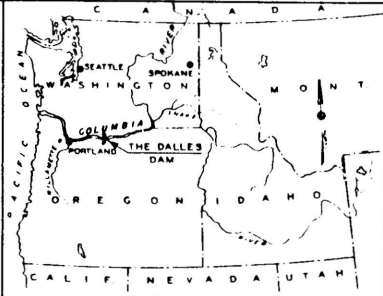
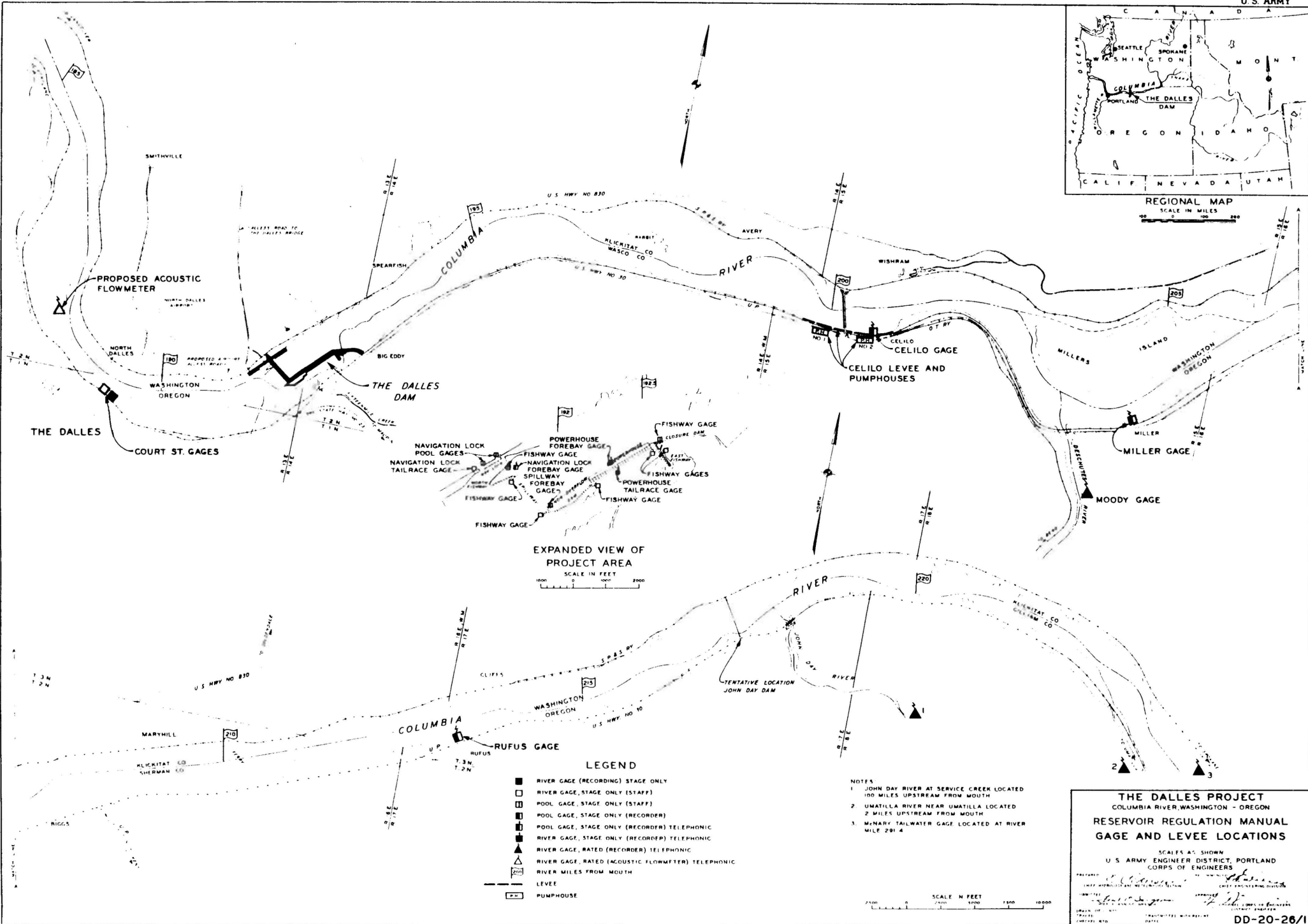
Rating table for Deschutes River at Meady, near Biggs, Oreg.
from Nov. 8, 1958, to , 19

Gage height	Discharge	Difference	Gage height	Discharge	Difference	Gage height	Discharge	Difference	Gage height	Discharge	Difference	Gage height	Discharge	Difference
Feet	Cfs	Cfs	Feet	Cfs	Cfs	Feet	Cfs	Cfs	Feet	Cfs	Cfs	Feet	Cfs	Cfs
.00			3.00	5,810	310	5.00	13,750	450	7.00	23,900	550	.00		
.10			.10	6,120	320	.10	14,200		.10	24,450		.10		
.20			.20	6,490	330	.20	14,650	450	.20	25,000		.20		
.30			.30	6,770	340	.30	15,100	500	.30	25,550		.30		
.40			.40	7,110	350	.40	15,600		.40	26,100		.40		
.50			.50	7,460	370	.50	16,100		.50	26,650		.50		
.60			.60	7,830	380	.60	16,600		.60	27,200		.60		
.70			.70	8,210	390	.70	17,100		.70	27,750		.70		
.80			.80	8,600	400	.80	17,600		.80	28,300		.80		
.90			.90	9,000		.90	18,100		.90	28,850	550	.90		
2.00			4.00	9,400	400	6.00	18,600		8.00	29,400		.70		
.10			.10	9,800	410	.10	19,100		.10			.10		
.20			.20	10,210	420	.20	19,600		.20			.20		
.30			.30	10,630	430	.30	20,100	500	.30			.30		
.40	4,120	270	.40	11,060	440	.40	20,600	550	.40			.40		
.50	4,390	270	.50	11,500	450	.50	21,150		.50			.50		
.60	4,660	280	.60	11,950		.60	21,700		.60			.60		
.70	4,940	280	.70	12,400		.70	22,250		.70			.70		
.80	5,220	290	.80	12,850		.80	22,800		.80			.80		
.90	5,510	300	.90	13,300	450	.90	23,350	550	.90			.90		

The above table is not applicable for ice or obstructed channel conditions. It is based on 9 discharge measurements made during 1958-59 (260-268),

and is fairly well defined between 4,400 cfs and 9,400 cfs, and is the same as Table No. 1 above 4.0 ft.

Computed by JMA
Checked by Am
Date 10-15-59



- LEGEND**
- RIVER GAGE (RECORDING) STAGE ONLY
 - RIVER GAGE, STAGE ONLY (STAFF)
 - ▣ POOL GAGE, STAGE ONLY (STAFF)
 - ▤ POOL GAGE, STAGE ONLY (RECORDER)
 - ▥ POOL GAGE, STAGE ONLY (RECORDER) TELEPHONIC
 - ▧ RIVER GAGE, STAGE ONLY (RECORDER) TELEPHONIC
 - ▨ RIVER GAGE, RATED (RECORDER) TELEPHONIC
 - ▲ RIVER GAGE, RATED (ACOUSTIC FLOWMETER) TELEPHONIC
 - RIVER MILES FROM MOUTH
 - LEVEE
 - ⊞ PUMPHOUSE

- NOTES**
1. JOHN DAY RIVER AT SERVICE CREEK LOCATED 100 MILES UPSTREAM FROM MOUTH
 2. UMATILLA RIVER NEAR UMATILLA LOCATED 2 MILES UPSTREAM FROM MOUTH
 3. McNARY TAILWATER GAGE LOCATED AT RIVER MILE 291.4



THE DALLES PROJECT
 COLUMBIA RIVER, WASHINGTON - OREGON
RESERVOIR REGULATION MANUAL
GAGE AND LEVEE LOCATIONS
 SCALES AS SHOWN
 U.S. ARMY ENGINEER DISTRICT, PORTLAND
 CORPS OF ENGINEERS

PREPARED BY: [Signature]
 CHECKED BY: [Signature]
 APPROVED BY: [Signature]
 DATE: [Date]
 TRANSMITTED WITH REPORT: []
 DATA: []

CHARTS

<u>Number</u>	<u>Title</u>
1	Frequency Curve - Columbia River at The Dalles
2	Operation Curves - Main Units
3	Operation Curves - Fishwater Units
4	Spillway Discharge Rating Curves - 23 Bays
5	Discharge Rating Curve - North Fish Ladder
6	Discharge Rating Curve - North Fishway Auxiliary Water Tainter Gate
7	Discharge Rating Curve - East Fish Ladder
8	Storage Capacity Curves - The Dalles Reservoir
9	Functional Chart
10	Organizational Chart - The Dalles Project
11	Organizational Chart - Portland District
12	Organizational Chart - North Pacific Division
13	Organizational Chart - Bonneville Power Administration
14	Tailwater Rating Curves - Opposite Unit No. 8

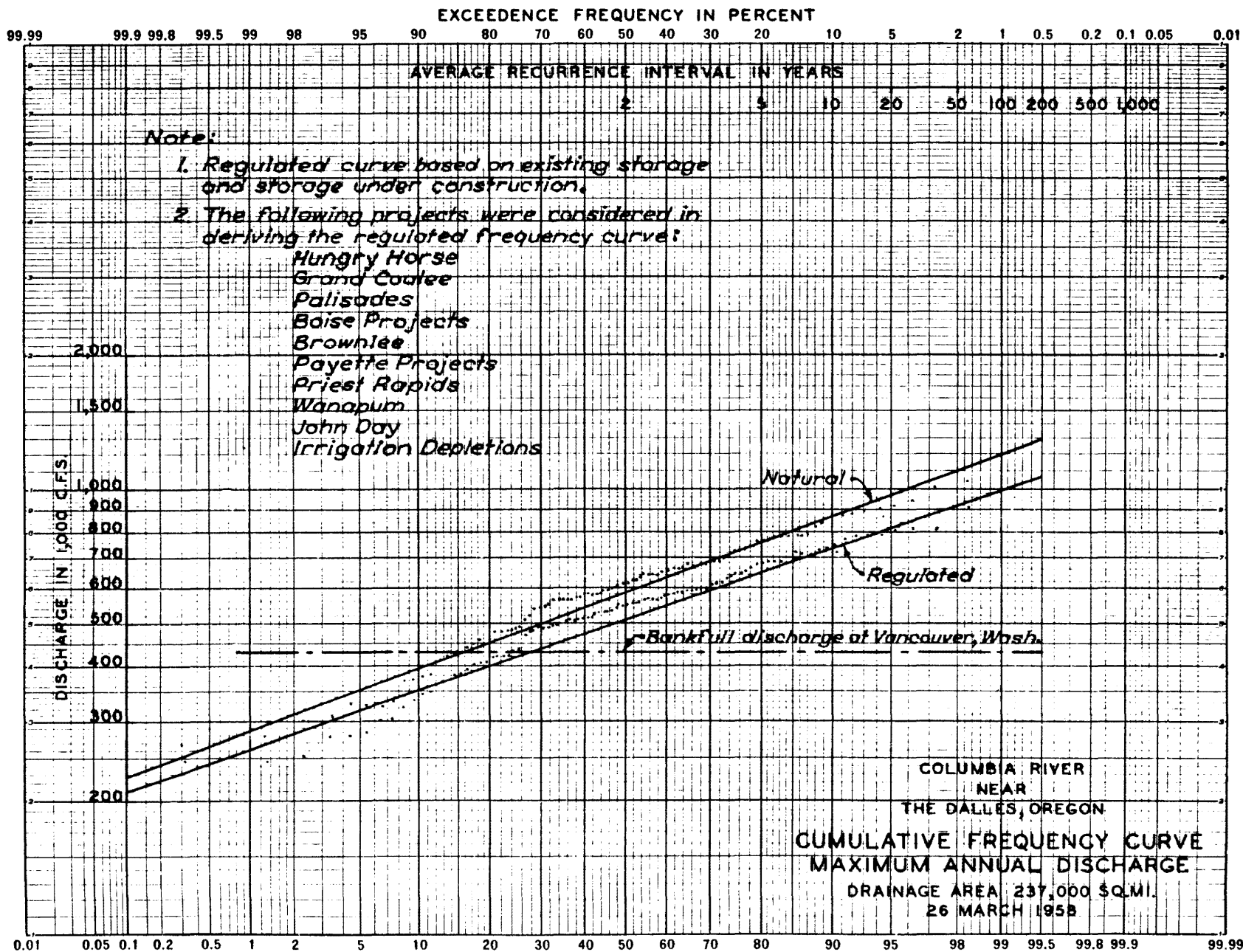
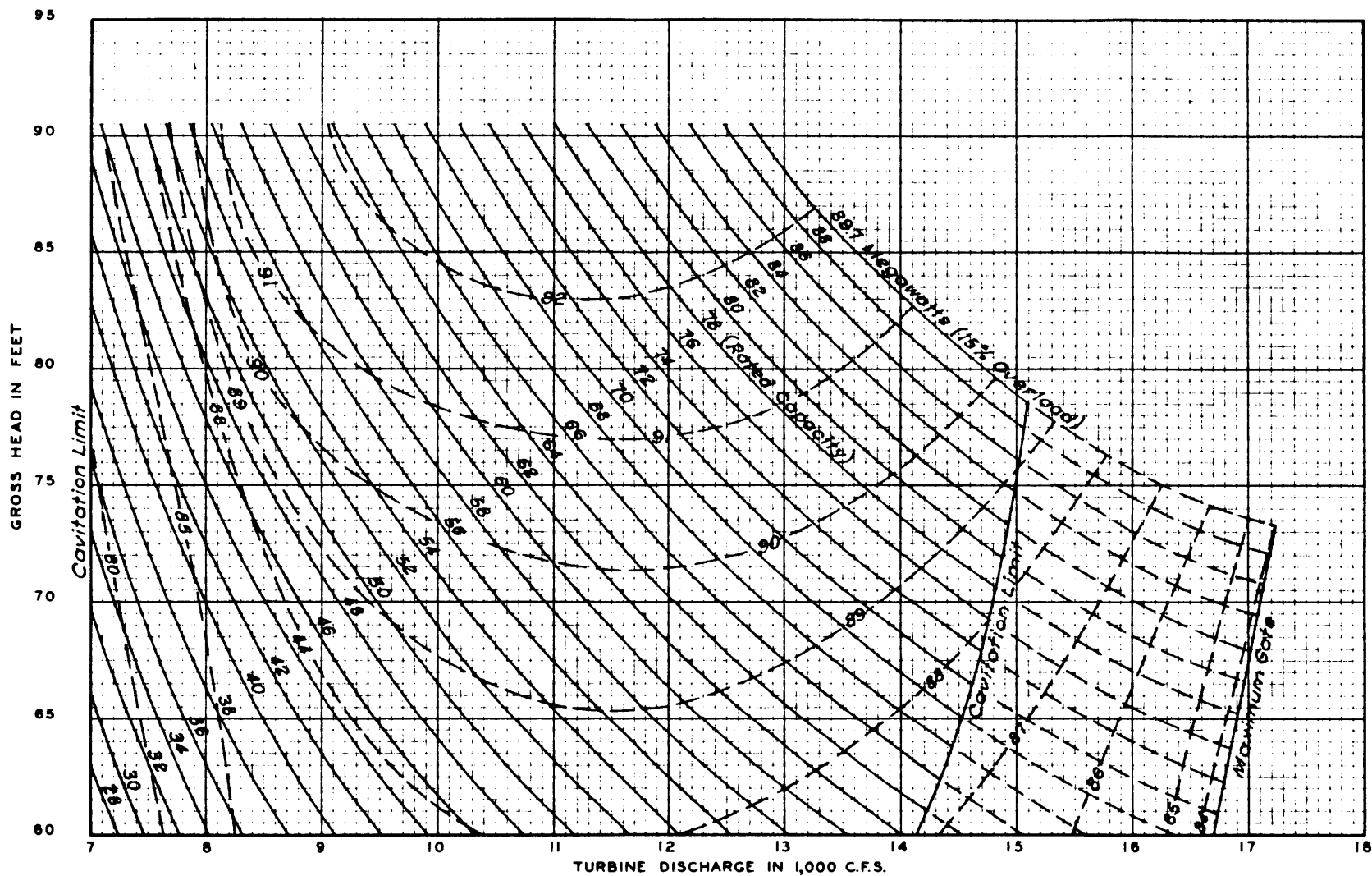


CHART I



Note:

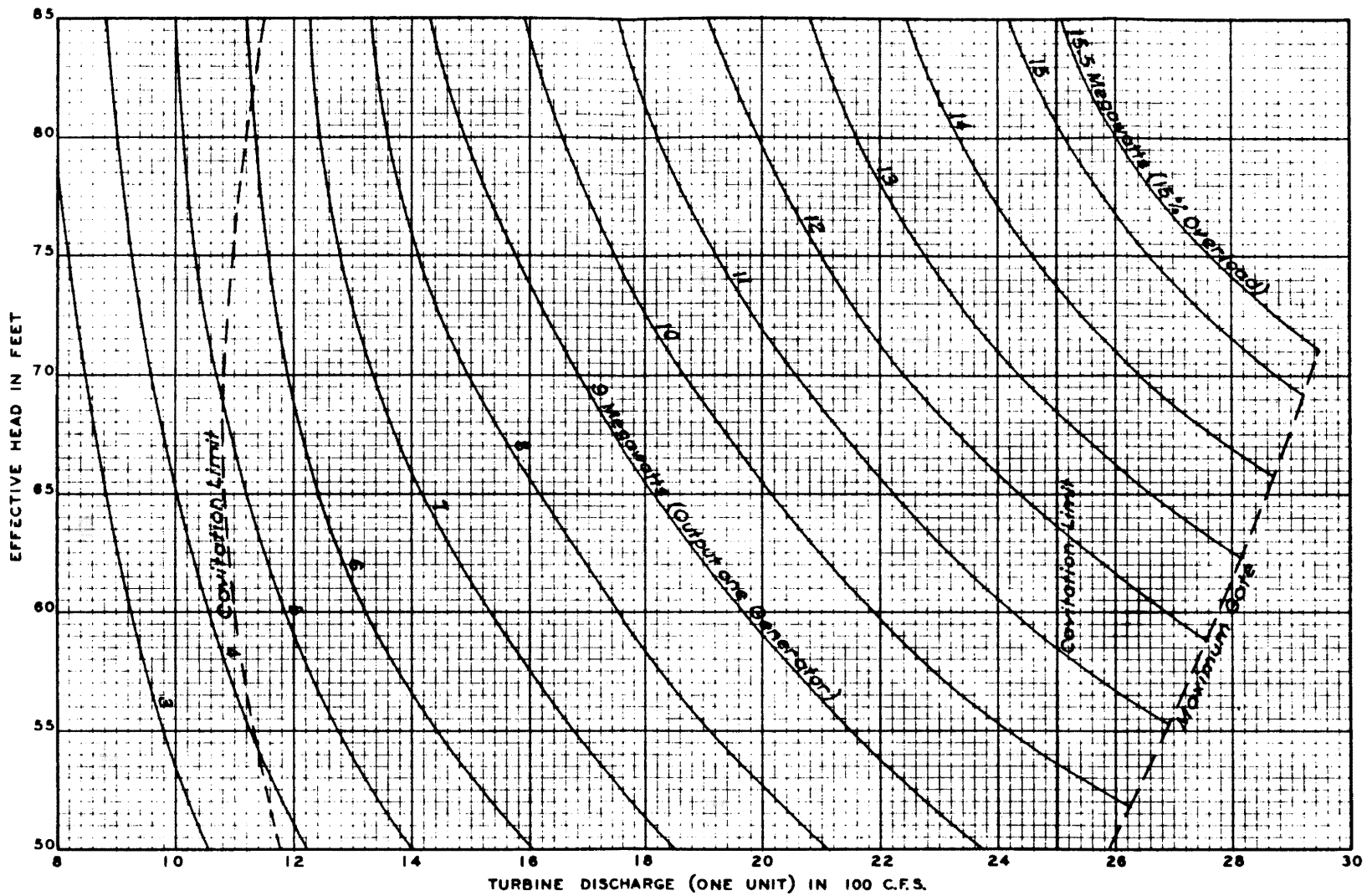
Broken lines denote overall efficiency of turbine and generator.

Source of data:

Prototype index tests at 63, 71, 78.5 and 85.5 foot heads and model tests.

This sheet supersedes previous issue of Operation Curves dated 8 November 1954.

THE DALLES DAM
OPERATION CURVES
MAIN UNITS
DECEMBER 1960



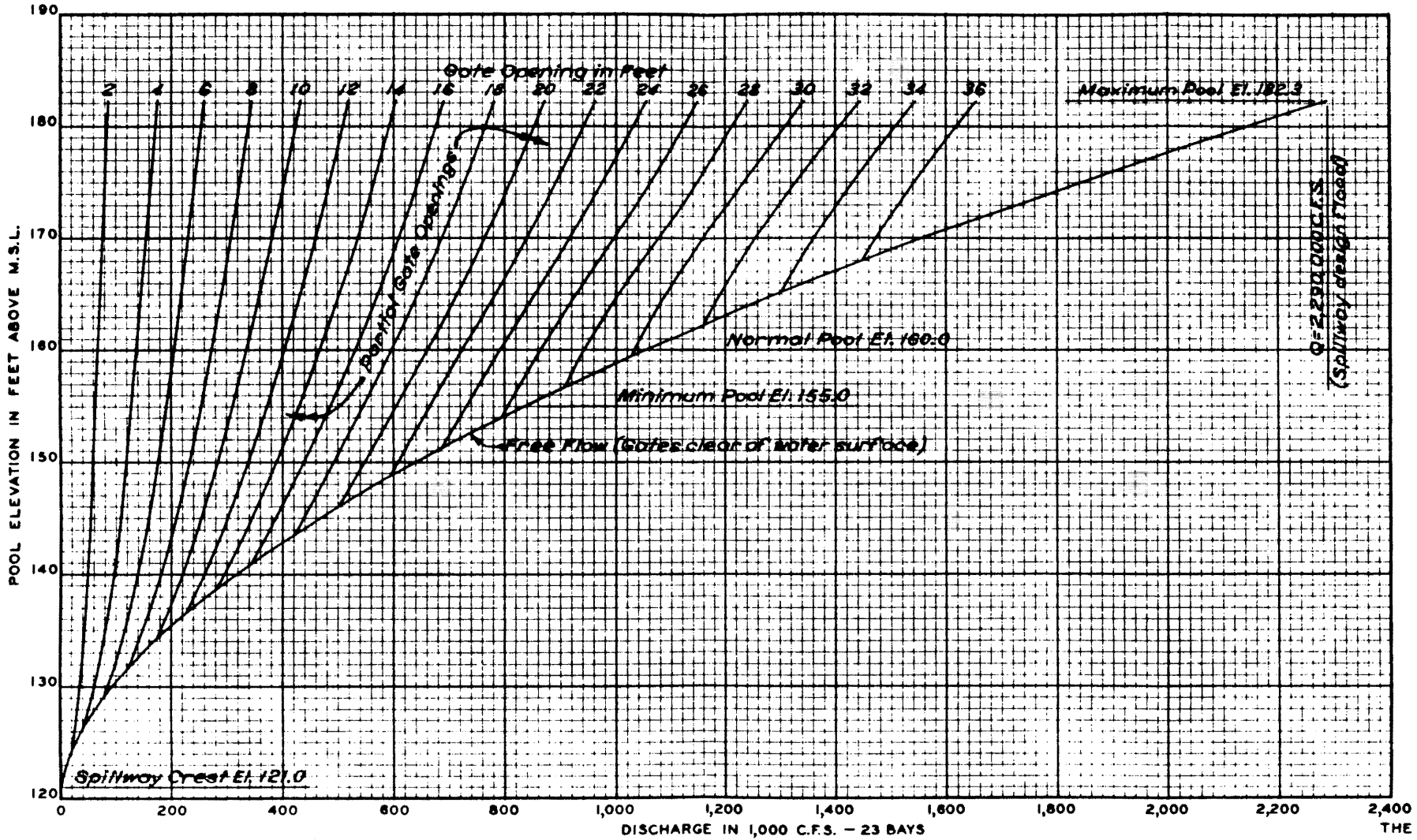
Note:

1. Curves are derived from prototype index tests at 56, 64.5, 73, and 81.4 foot heads. Assumed maximum turbine efficiency 92.8 percent.
2. This sheet supersedes temporary curves dated 15 March 1957.

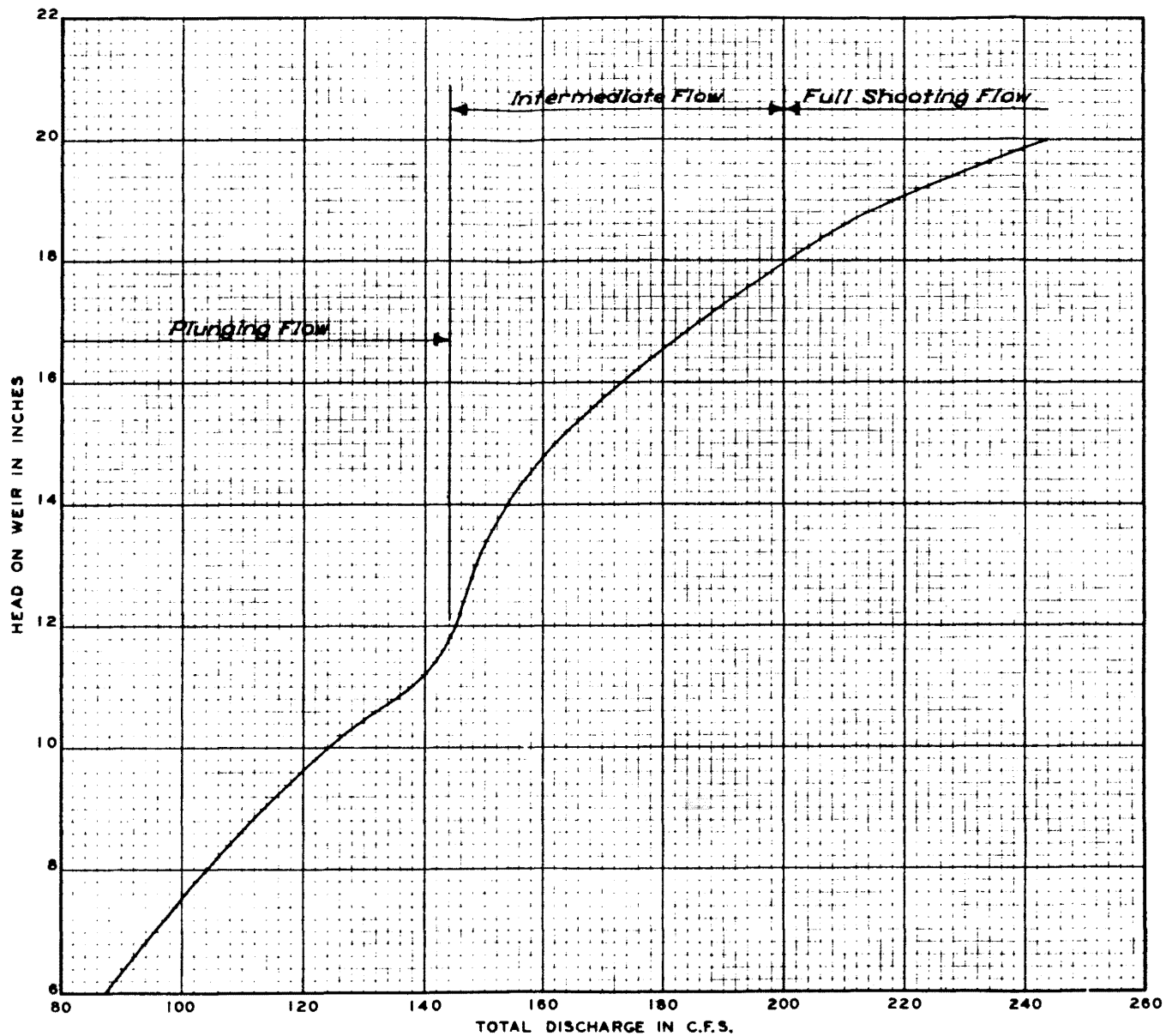
THE DALLES DAM
 OPERATION CURVES
 FISHWATER UNITS
 DECEMBER 1960

Note:

1. Pool elevation is the elevation of the energy grade line of the spillway which is the same as the elevation of the water surface of the navigation lock forebay gage.
2. Gate opening is the vertical distance between gate lip and gate seal at elevation 119.50.
3. Curves computed on basis of model studies at Bonneville Hydraulic Laboratory.



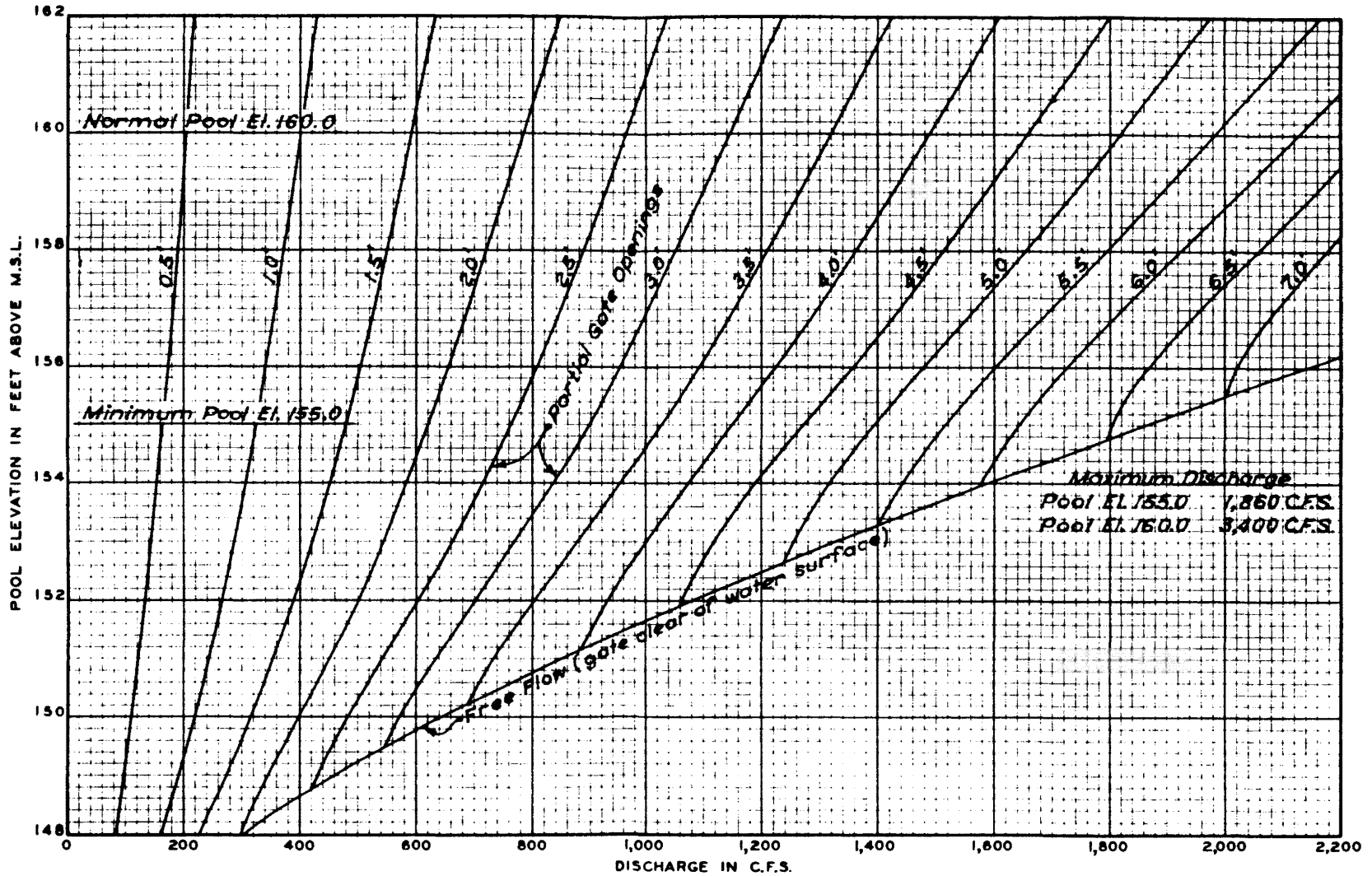
THE DALLES DAM
 SPILLWAY DISCHARGE
 RATING CURVES
 23 BAYS
 DECEMBER 1960



Note:

1. Rating curve is based on model studies.
2. Head on weir is measured at pool elevation 149.
3. Surging action occurs when head on weir is less than approximately 9.5 inches.

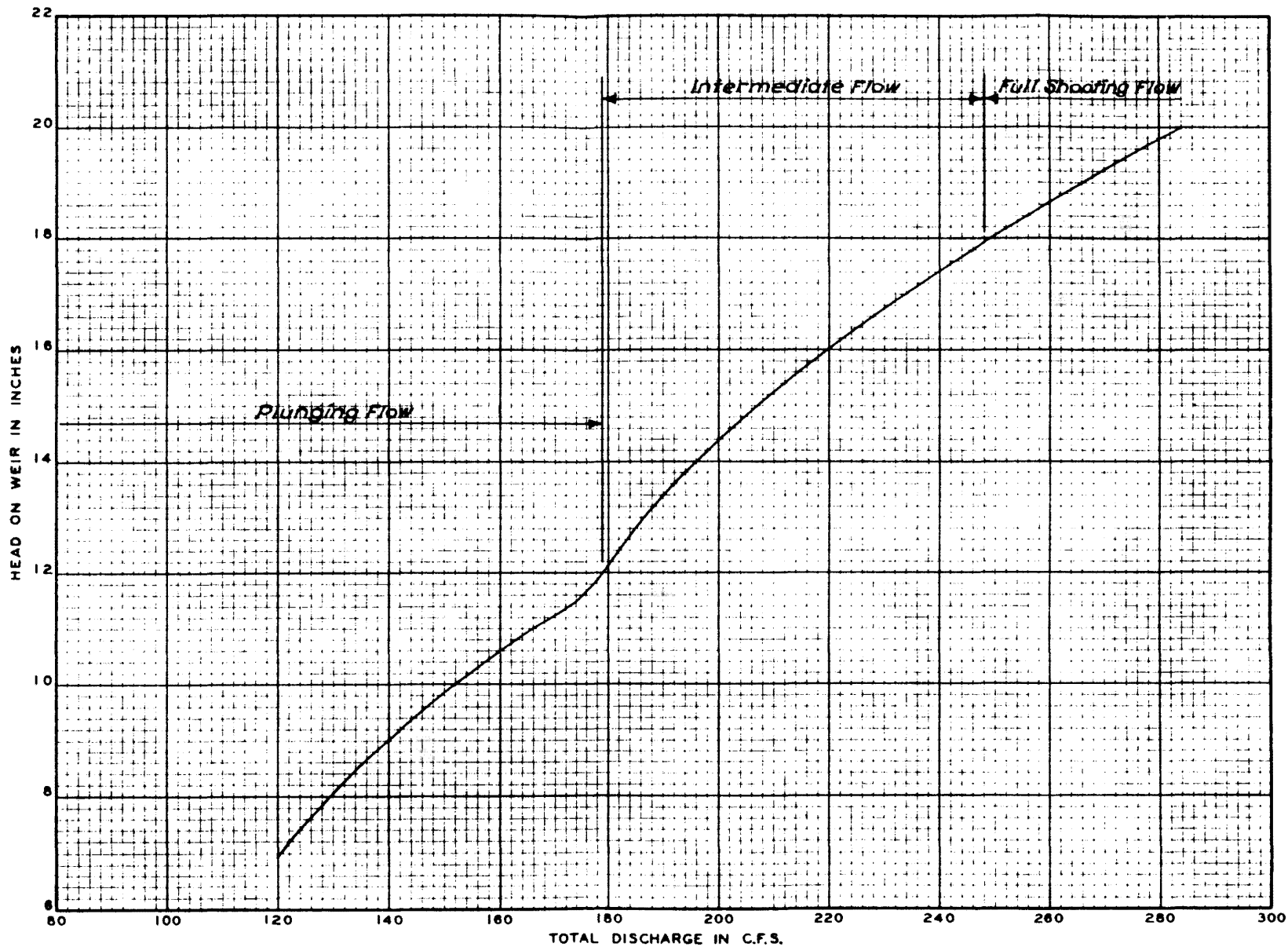
THE DALLES DAM
 RATING CURVE
 NORTH FISHLADDER
 DECEMBER 1960



Note:

1. Pool elevation is the elevation of the water surface at navigation lock forebay gage.
2. Gate opening is the vertical distance between gate lip and gate seat elevation 145.0.

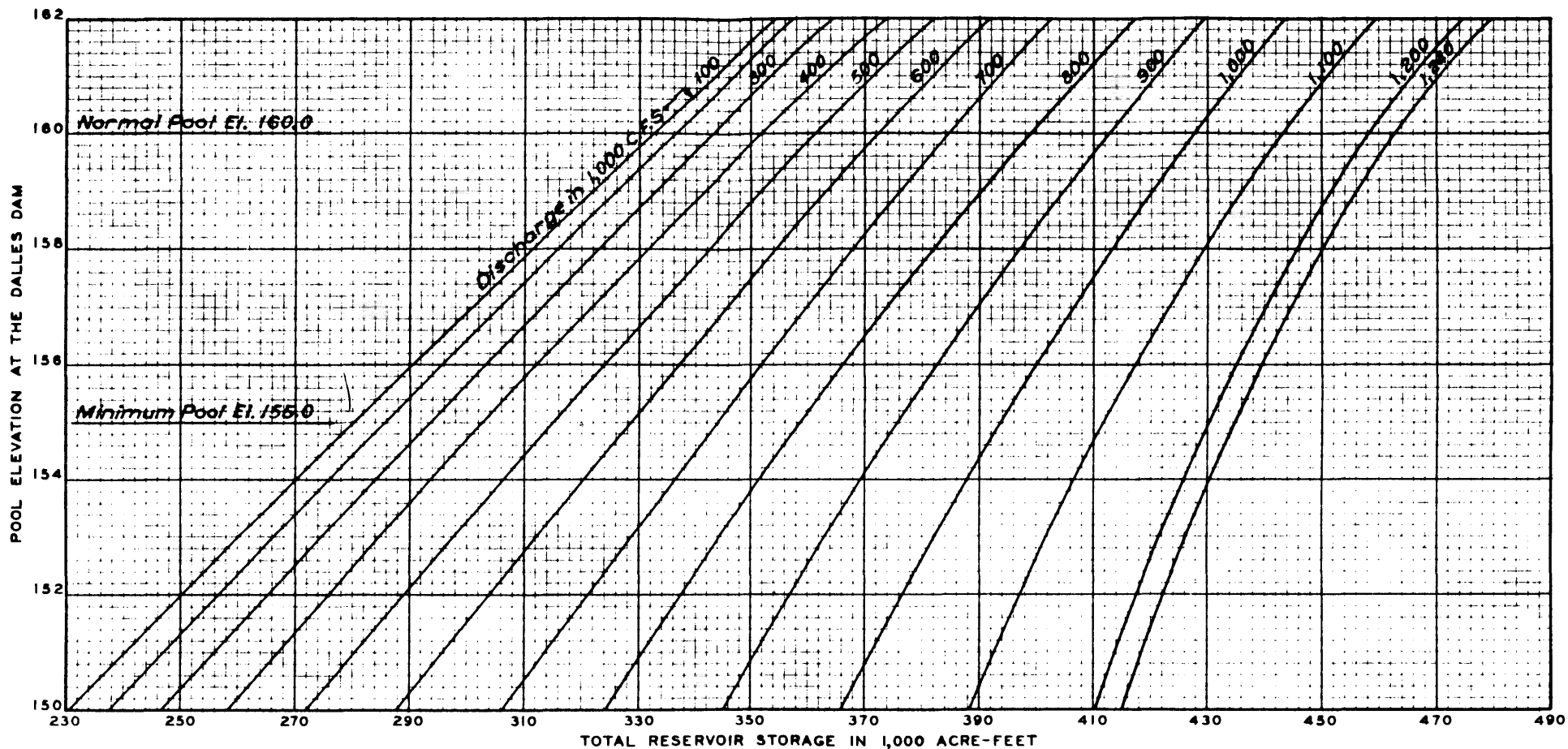
THE DALLES DAM
 DISCHARGE RATING CURVES
 NORTH FISHWAY AUXILIARY
 WATER TANTIER GATE
 DECEMBER 1960



Note:

1. Rating curve is based on model studies.
2. Head on weir is measured at pool elevation 146.
3. Surging action occurs when head on weir is less than approximately 11 inches.

THE DALLES DAM
 RATING CURVE
 EAST FISHLADDER
 DECEMBER 1960

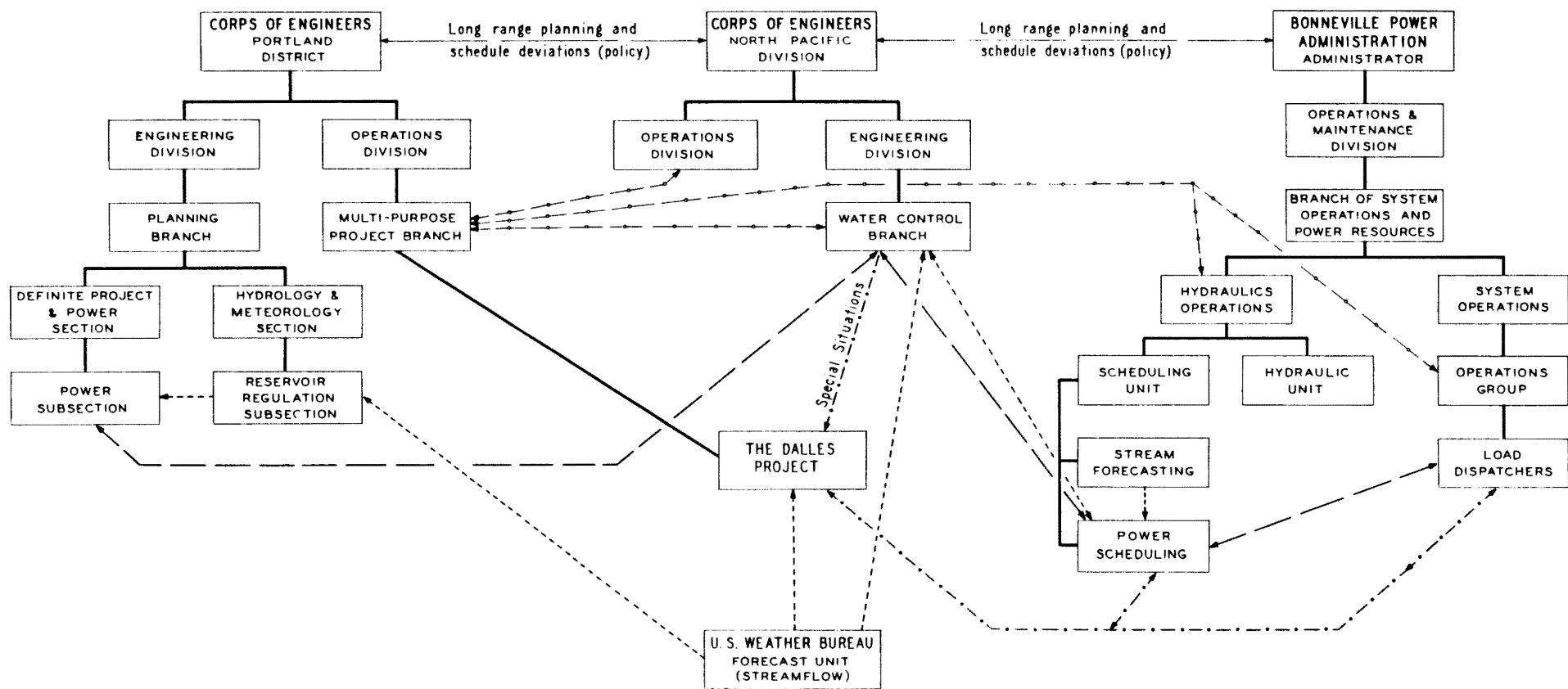


Note:

1. These curves are based on backwater studies and on volumes determined from areas measured from cross-sections prepared for backwater studies.
2. These curves reflect the storage in slope in the reservoir.

THE DALLES DAM
 RESERVOIR STORAGE
 CAPACITY CURVES
 DECEMBER 1960

FUNCTIONAL ORGANIZATION CHART FOR OPERATION OF THE DALLES PROJECT (POWER)

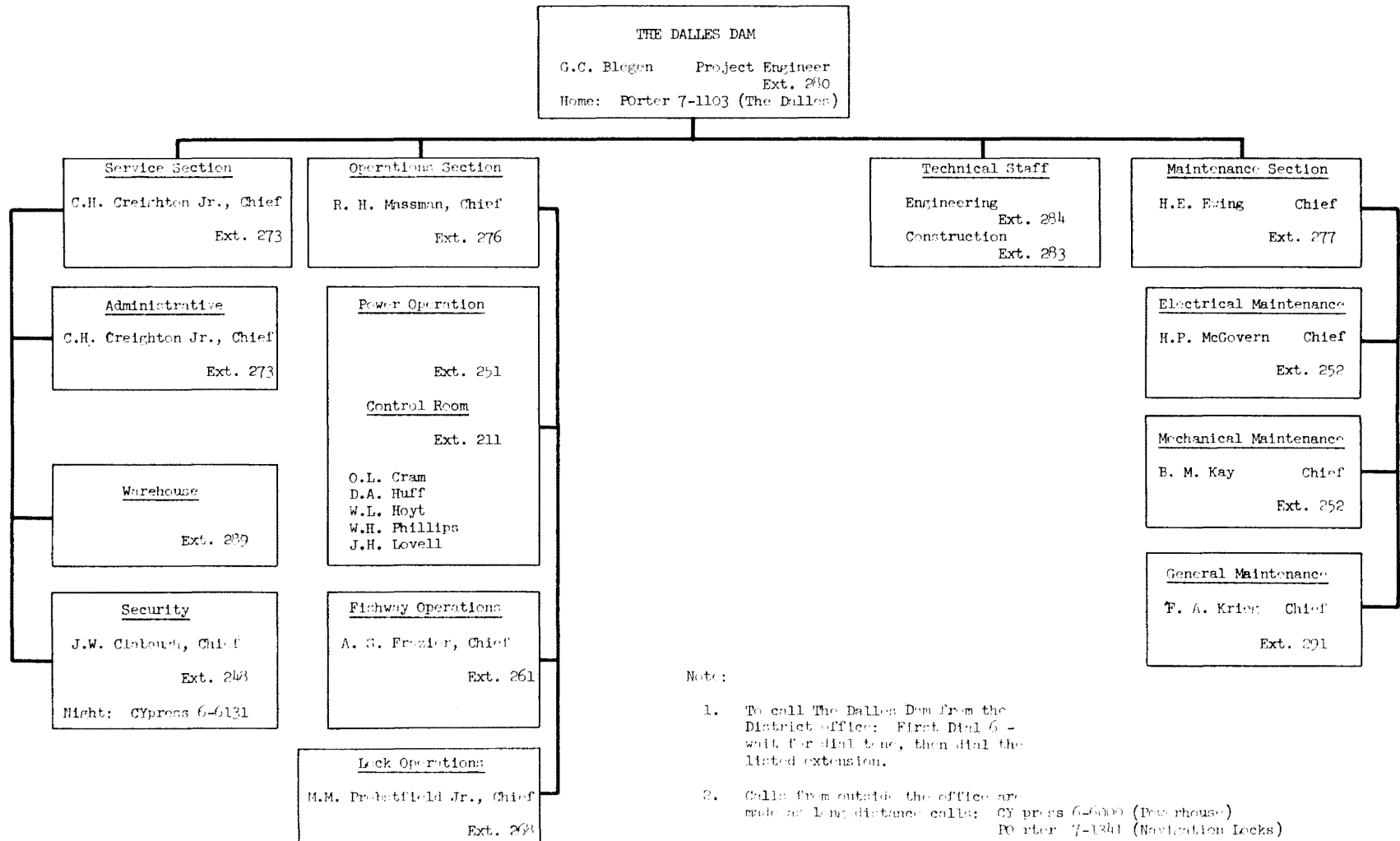


LEGEND

- FORECASTS
- SCHEDULING
- DISPATCHING
- OPERATIONAL PROBLEMS

15 DECEMBER 1960

CHART 10
 THE DALLES DAM PROJECT
 ORGANIZATION CHART
 (Key Personnel)



Note:

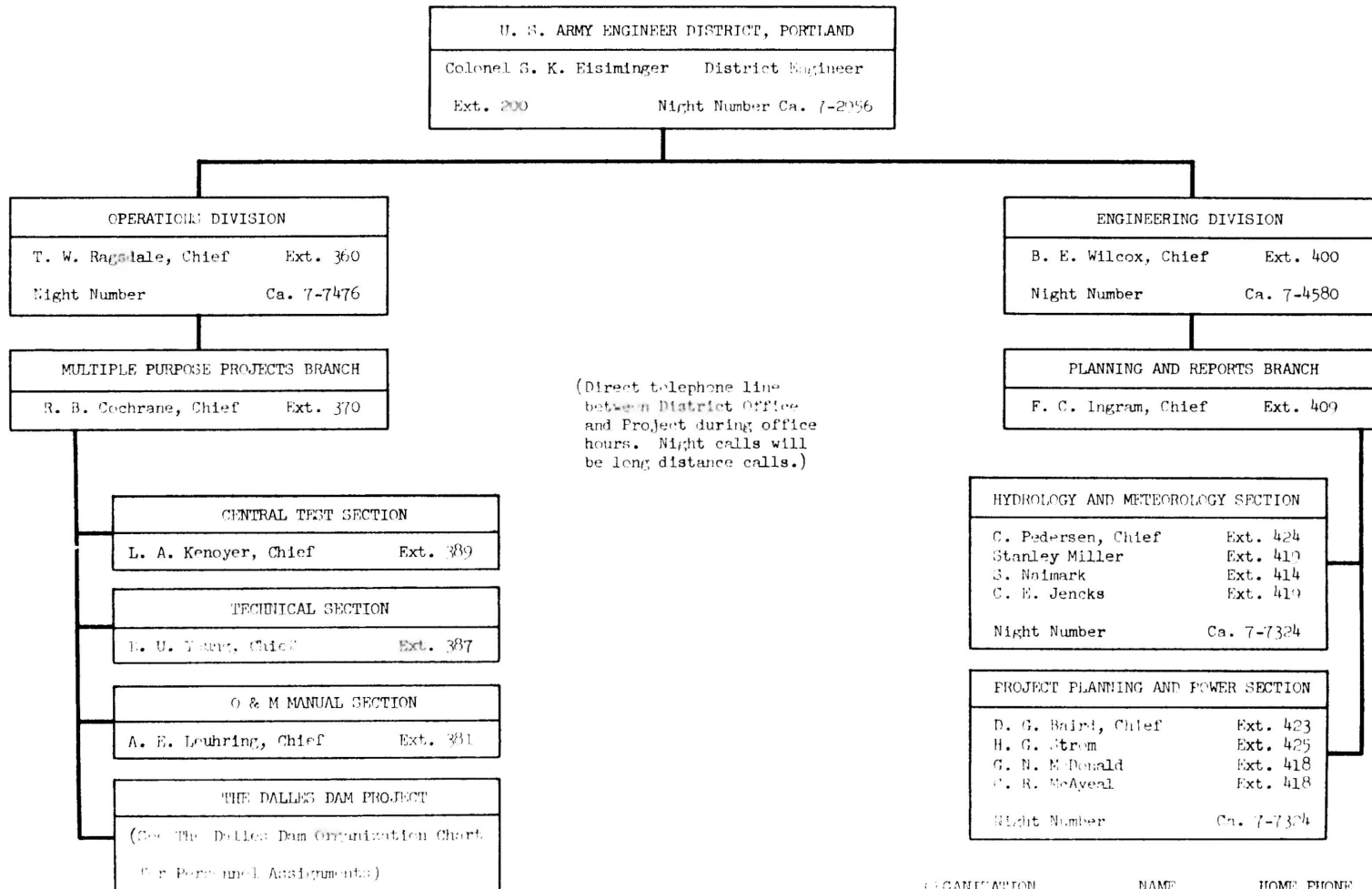
1. To call The Dalles Dam from the District office: First Dial 6 - wait for dial tone, then dial the listed extension.
2. Calls from outside the office are made as long distance calls: Cypress 6-6131 (New house) Porter 7-1381 (Navigation Locks)

July 1961

CHART II
Portland, Oregon, District

ORGANIZATIONAL CHART

(Pertinent to Power Scheduling and Reservoir Regulation)

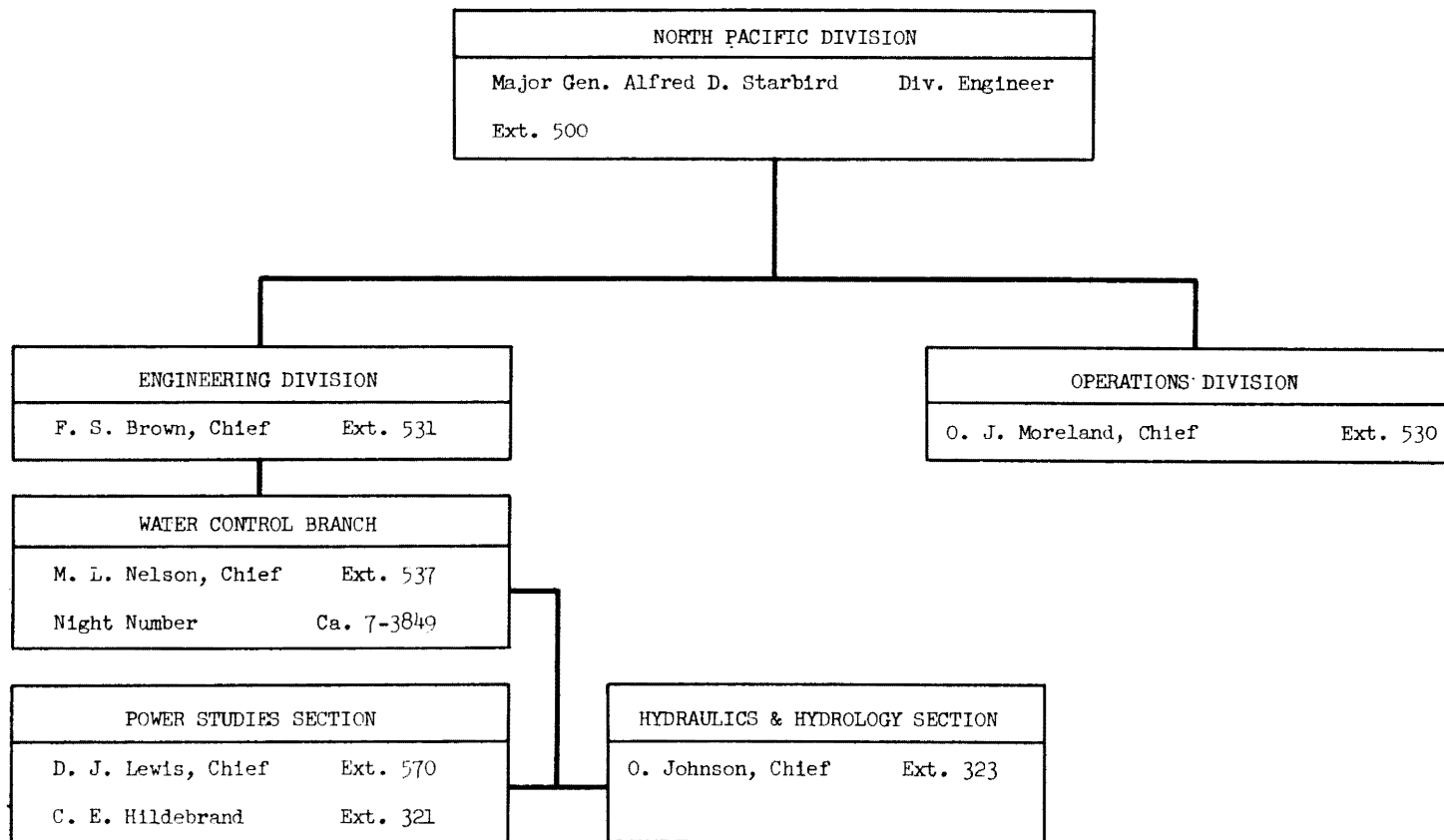


ORGANIZATION	NAME	HOME PHONE
District Engineer	- Col. Eisiminger	
EDP Engineering	- Wilcox	PR 1-1803
EDP Operations	- Ragsdale	CA 3-6475
EDP Hydrology	- Pedersen	BU 9-2036
EDP Power	- Baird	BE 6-8348

July 1961

CHART 12
 NORTH PACIFIC DIVISION
 ORGANIZATION CHART

(Pertinent to Power Scheduling & Reservoir Regulation)



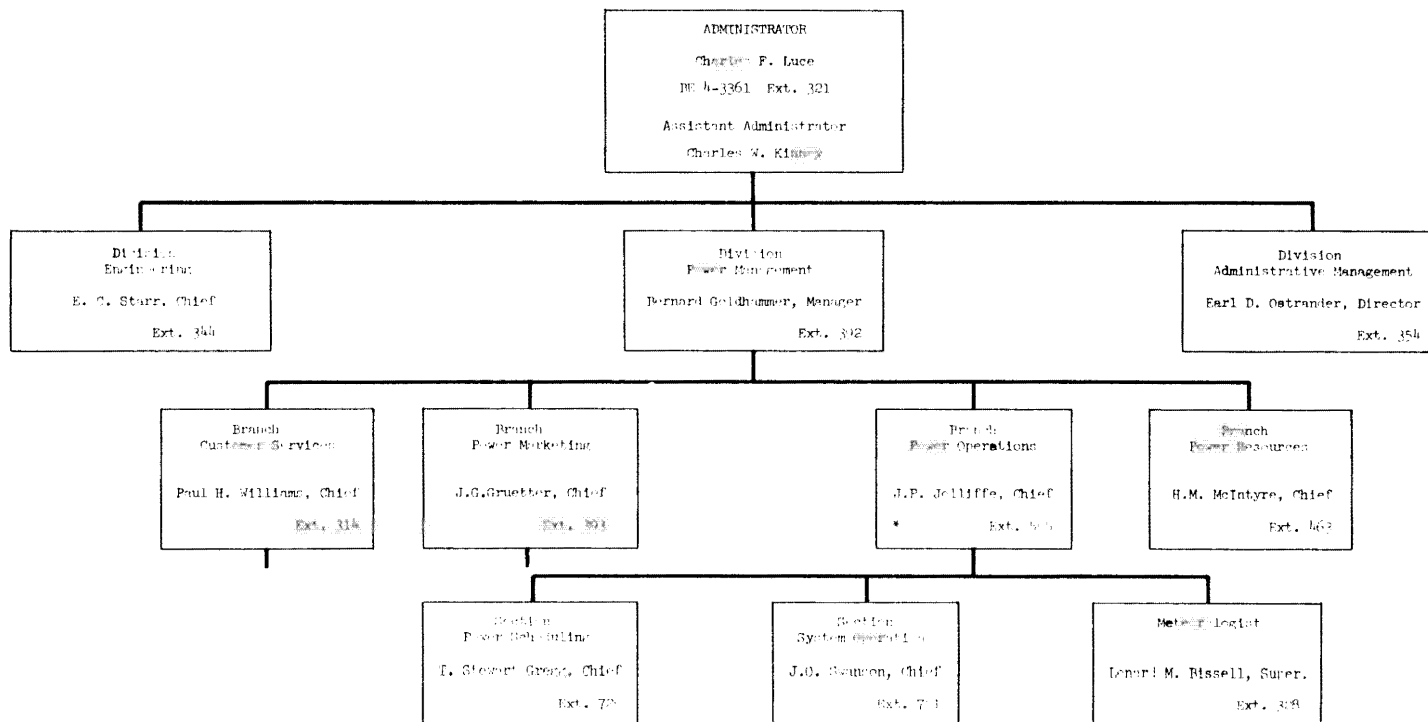
ORGANIZATION	NAME	HOME PHONE
NPD Engineering	Brown	Cy. 2-3378
NPD Operations	Moreland	Ch. 4-8064
NPD Water Control	Nelson	Ch. 6-3462
NPD Power Section	Lewis	Al. 3-0247
NPD Power Section	Hildebrand	Cy. 2-3497
NPD Hydrology	Johnson	Ne. 6-4174

(Direct telephone line between Division Office and The Dalles Dam during office hours. Night calls will be long distance.)

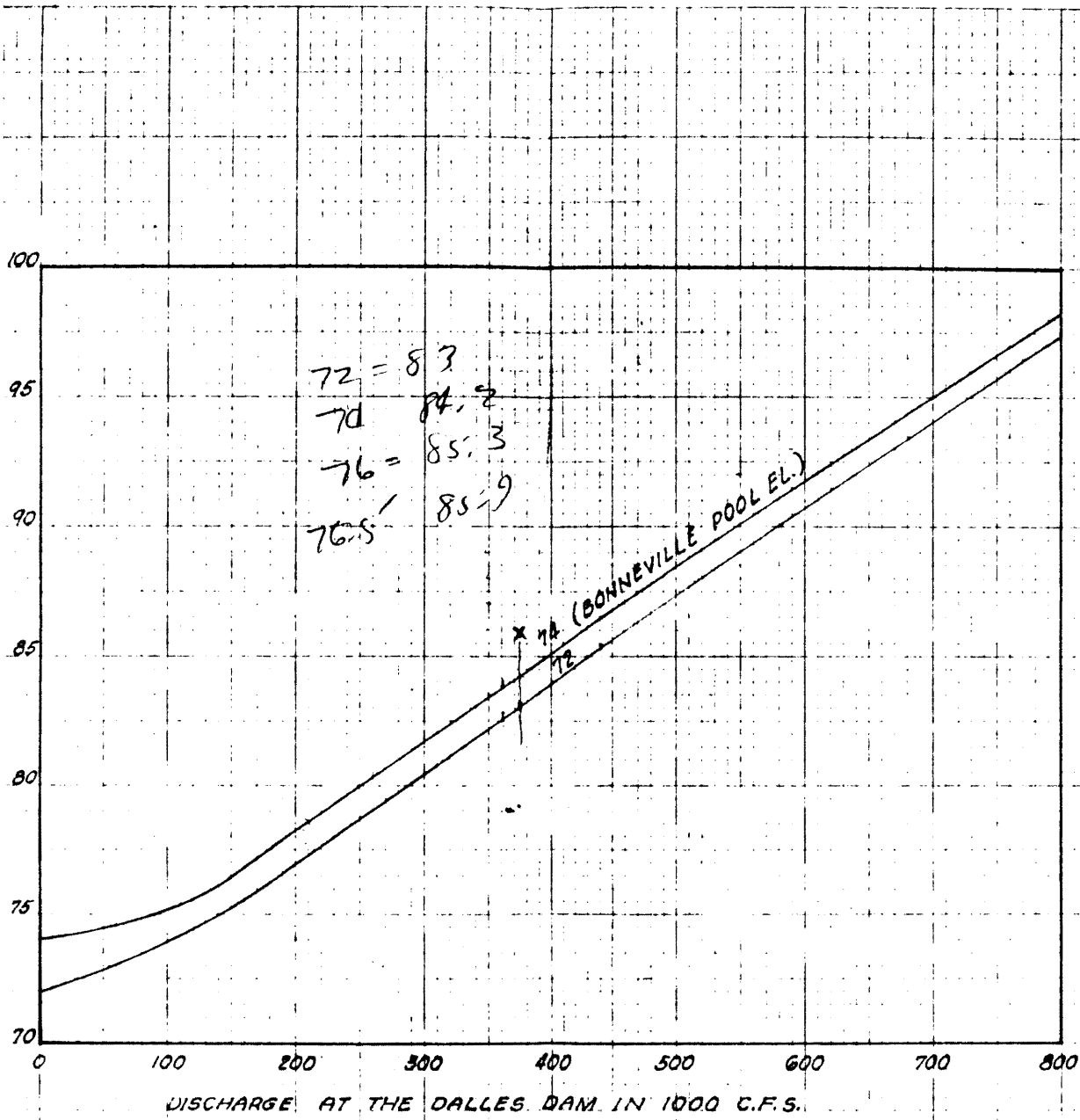
July 1961

CHART 13

PONNEVILLE POWER ADMINISTRATION
 ORGANIZATIONAL CHART
 (Pertinent to Power Scheduling and Reservoir Regulation)



* The Branch of Power Resources and Power Operations are directly concerned with river control, forecasting and power planning, and handling our emergency river control. The supervisory Meteorologist is primarily concerned with the forecasting emergency river control; the Chief of Power Resources is responsible for long range planning, river control involving plus two years or more in the future.



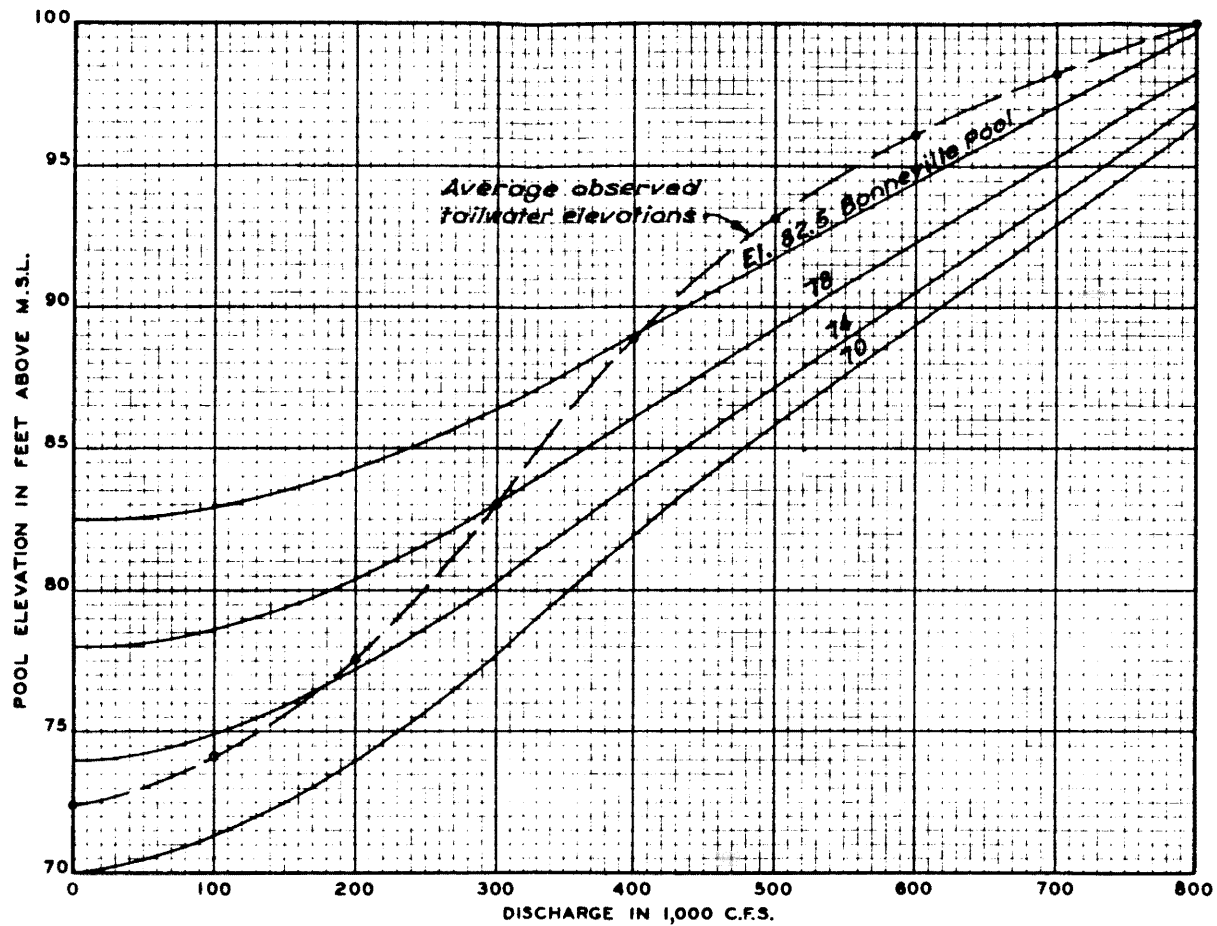
Notes:

1. Curves are based on observed data up to a discharge of 670,000 c.f.s. and represent tailwater elevations at the tailwater gage for Bonneville Dam pool elevations as indicated.
2. Model study curves were used as a basis for extending curves above a discharge of 670,000 c.f.s.
3. Normal operating range for Bonneville pool is from elevation 73 to 74.

THE DALLES DAM
 TAILWATER RATING CURVES
 (OPPOSITE UNIT NO. 8)
 WATER CONTROL SECTION

16 SEPT. 1965

G.E.G.



Note:

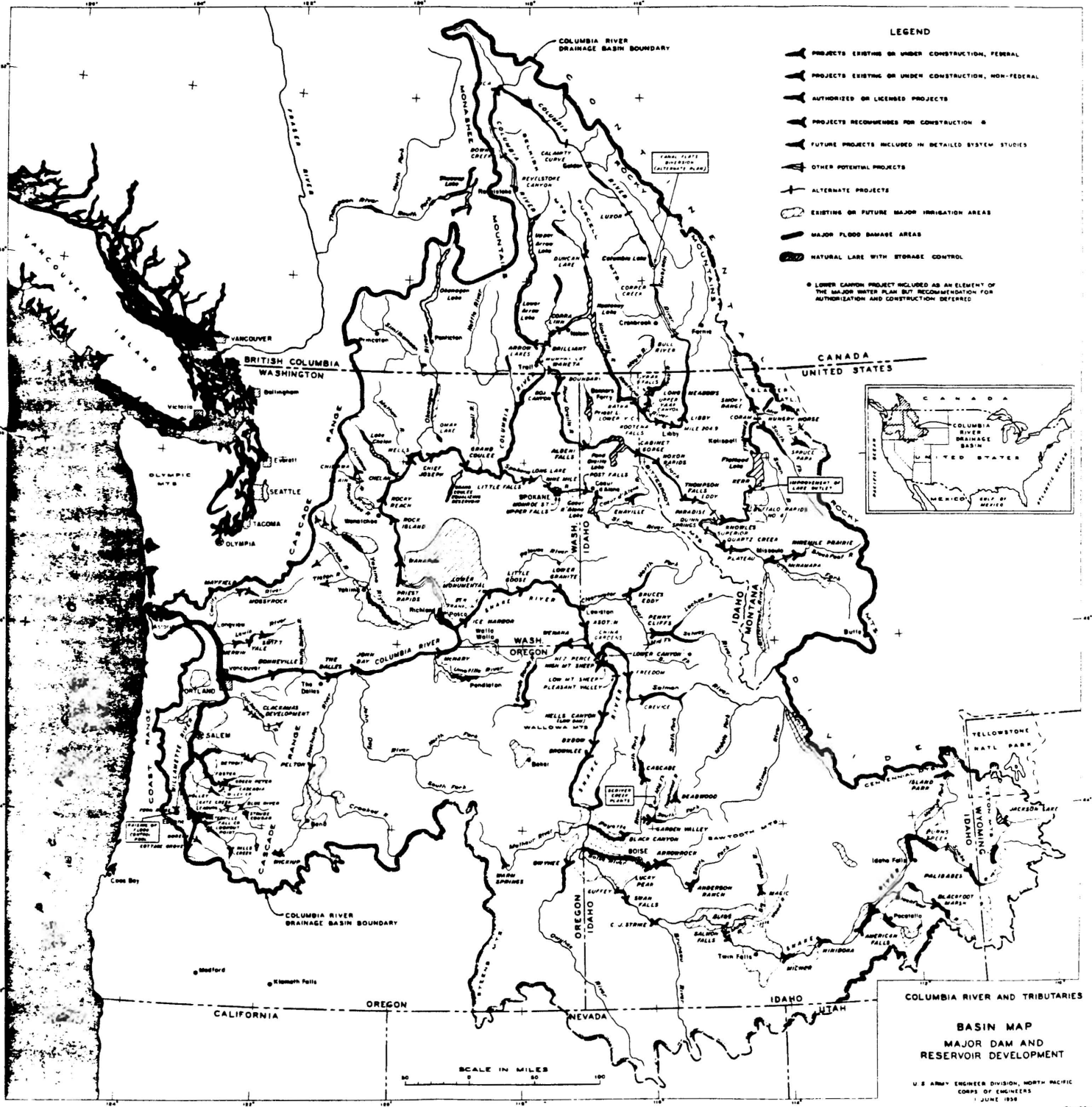
Curves are based on model data and represent average tailwater elevations at the tailwater gage opposite Unit No. 8 for:

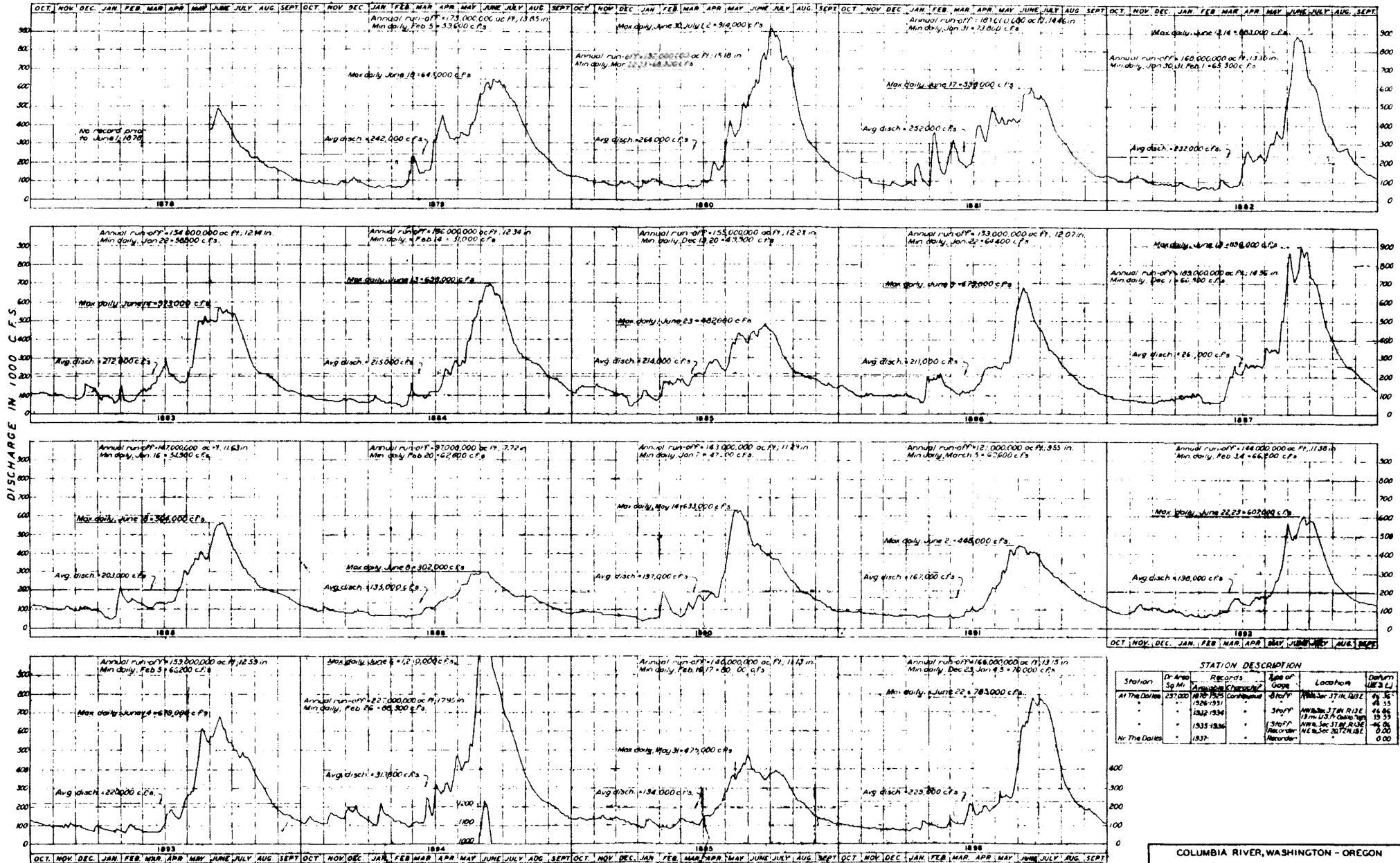
- (1) Bonneville Dam pool elevations as indicated.
- (2) Uniform discharge from 14 units in The Dalles powerhouse.
- (3) Steady flow conditions.

THE DALLES DAM
 TAILWATER RATING CURVES
 (OPPOSITE UNIT NO. 8)
 DECEMBER 1960

PLATES

<u>Number</u>	<u>Title</u>
1	Basin Map - Columbia River and Tributaries
2	The Dalles Dam - General Plan and Sections
3	Daily Discharge Hydrograph, Columbia River at The Dalles (Sheet 1 of 5)
4	Daily Discharge Hydrograph, Columbia River at The Dalles (Sheet 2 of 5)
5	Daily Discharge Hydrograph, Columbia River at The Dalles (Sheet 3 of 5)
6	Daily Discharge Hydrograph, Columbia River at The Dalles (Sheet 4 of 5)
7	Daily Discharge Hydrograph, Columbia River at The Dalles (Sheet 5 of 5)
8	Summary Hydrographs, Columbia River at The Dalles
9	Maximum Annual and Minimum Daily Discharges, Columbia River at The Dalles
10	Gage and Levee Locations
11	Backwater Profiles
12	Backwater Profiles
13	Main One Line diagram

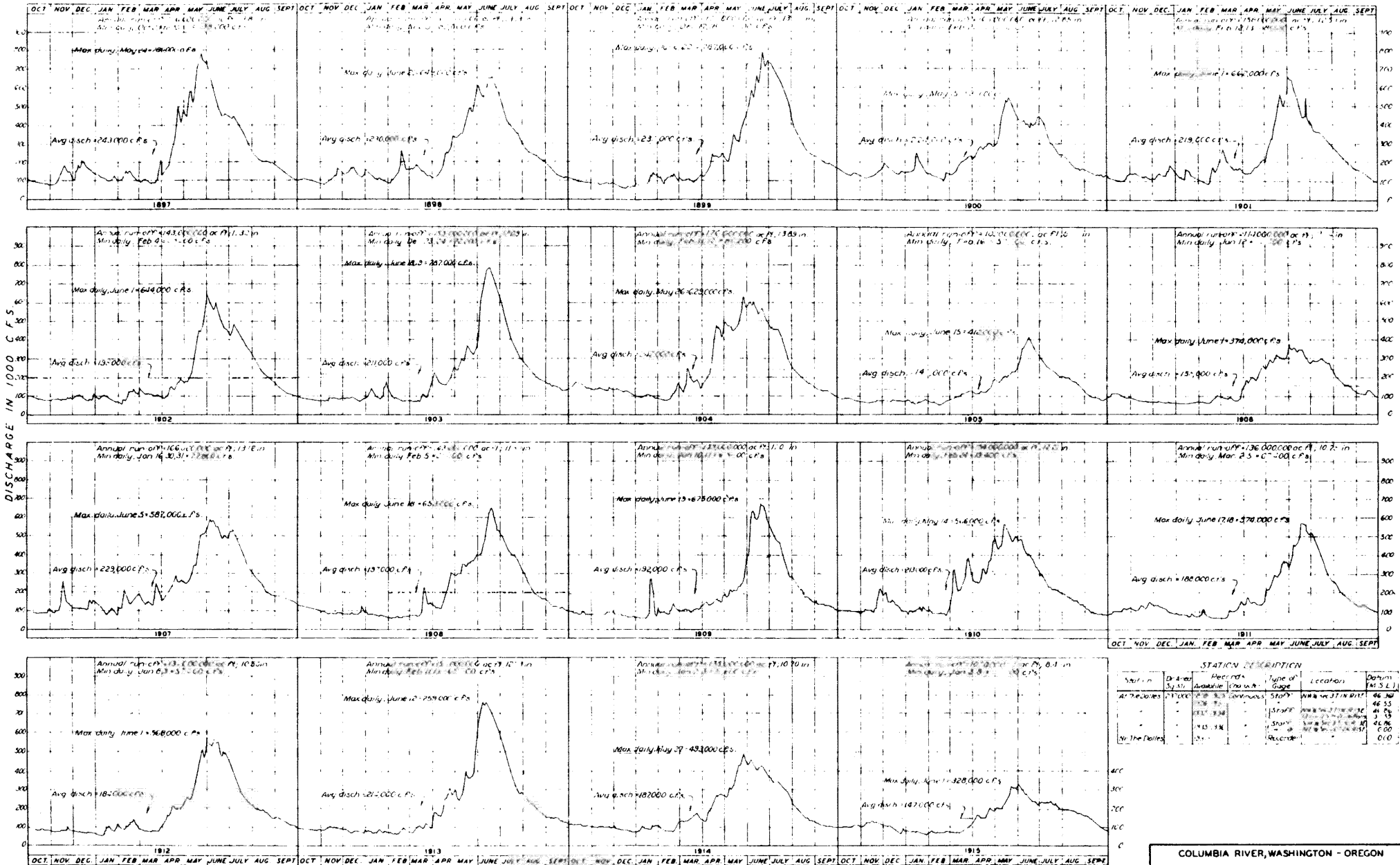




STATION DESCRIPTION						
Station	D-4 No	Records	Type of Gage	Location	Datum	Remarks
At The Dalles	237,000	1878-1935	Contractor	At the J.T.M. Rise	46.35	
"	"	1936-1937	"	"	46.35	
"	"	1932-1934	"	"	46.06	
"	"	1935-1936	"	"	19.39	
At The Dalles	"	1937	"	"	0.00	

COLUMBIA RIVER, WASHINGTON - OREGON
 DAILY DISCHARGE HYDROGRAPH
 COLUMBIA RIVER AT THE DALLES, OREGON

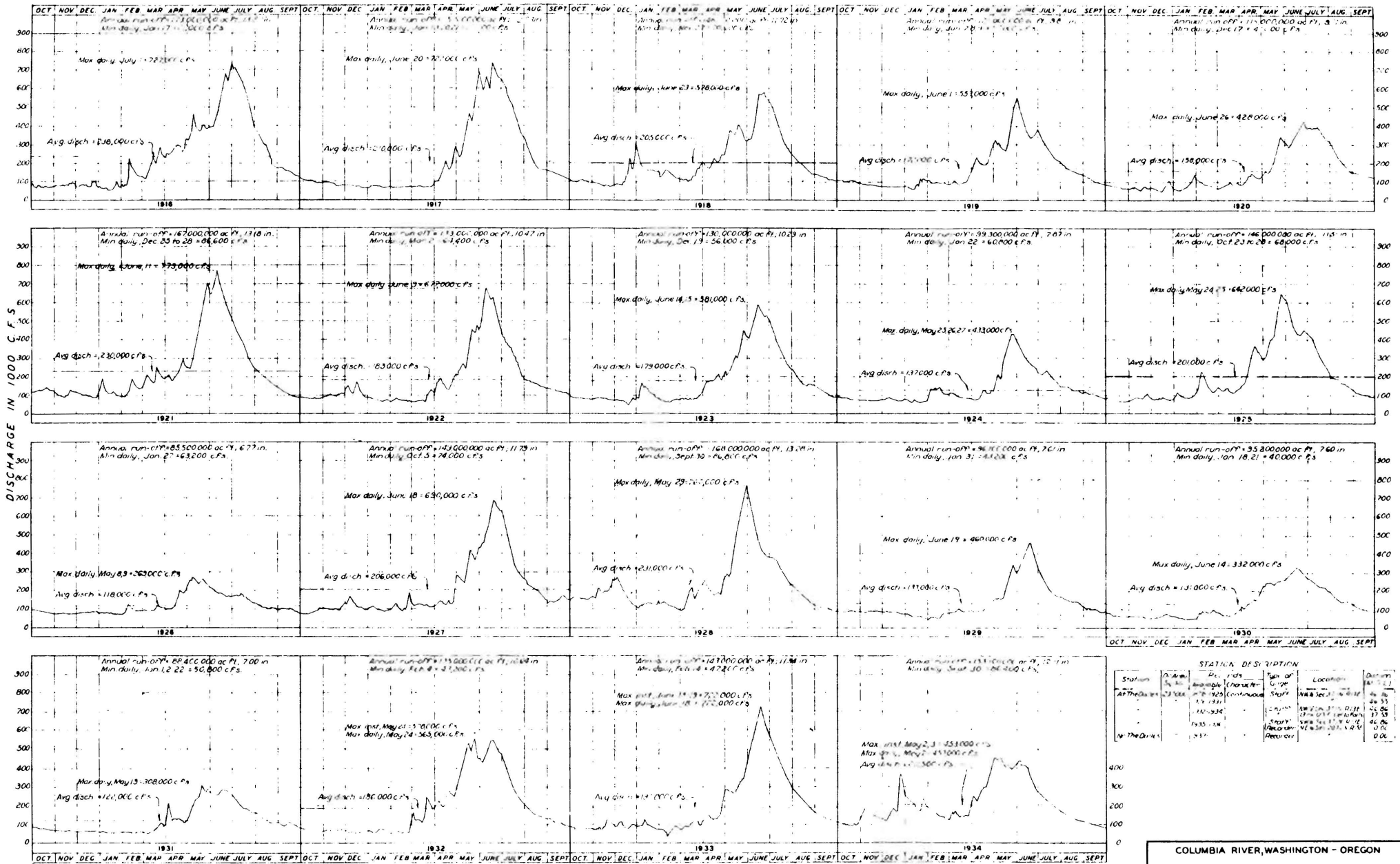
PORTLAND DISTRICT, CORPS OF ENGINEERS
 SUPERVISOR: *G. Peterson*
 DRAWN BY: *G. Peterson*
 CHECKED BY: *L. Peterson*
 APPROVED BY: *L. Peterson*
 DATE: *1937*



STATION DESCRIPTION						
Station	Depth	Records	Type of	Location	Date	
At the Dalles	57.5 ft	1897-1915	Staff	At the Dalles	1897	46.30
						46.55
						46.70
						46.85
						47.00
						47.15
						47.30
						47.45
						47.60
						47.75
						47.90
						48.05
						48.20
						48.35
						48.50
						48.65
						48.80
						48.95
						49.10
						49.25
						49.40
						49.55
						49.70
						49.85
						50.00

COLUMBIA RIVER, WASHINGTON - OREGON
 DAILY DISCHARGE HYDROGRAPH
 COLUMBIA RIVER AT THE DALLES, OREGON

PORTLAND DISTRICT, CORPS OF ENGINEERS
 PREPARED BY: C. Peterson
 CHECKED BY: Tom L. Peterson
 APPROVED BY: [Signature]
 DATE: [Date]



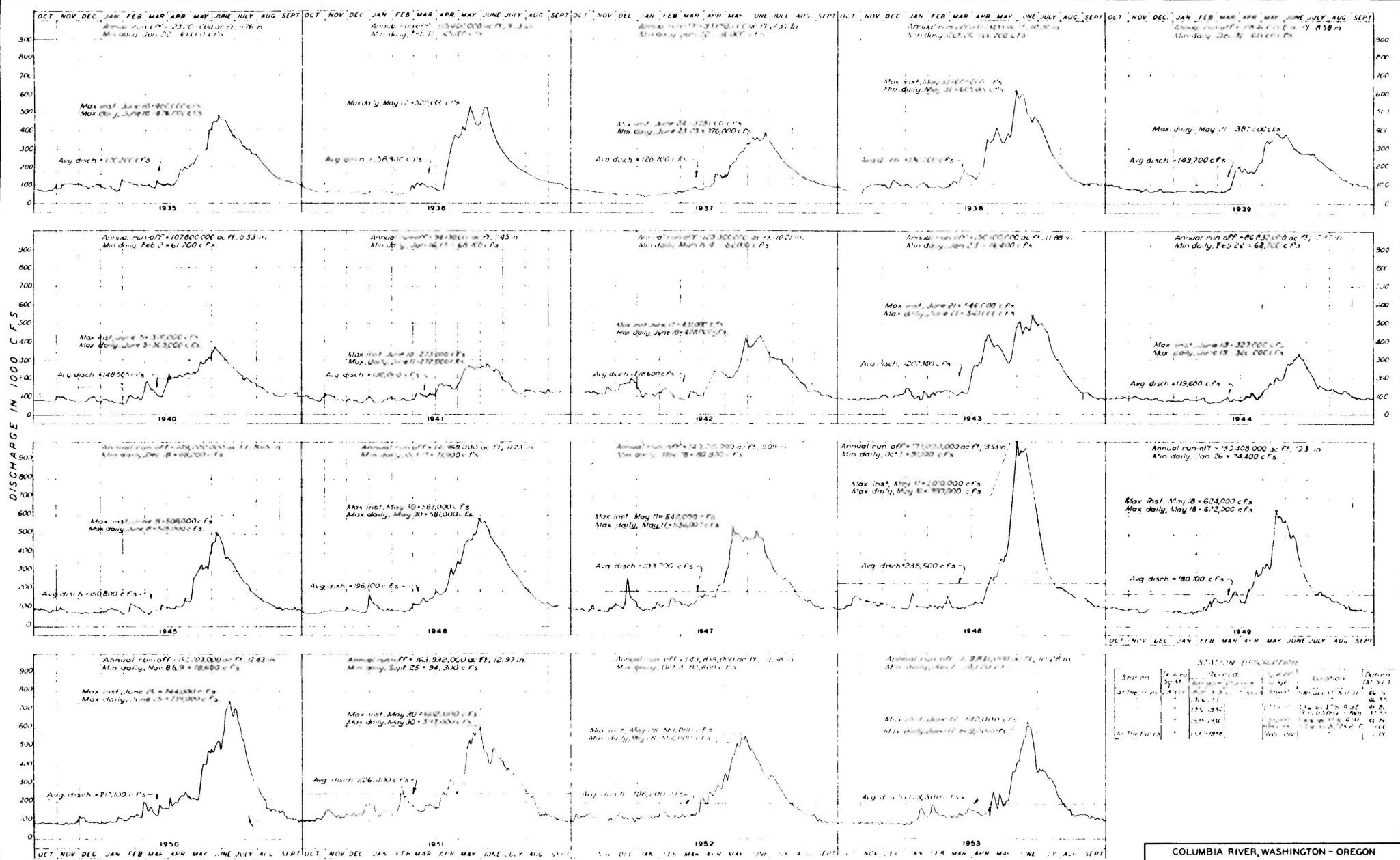
Station	Alt.	Dist.	Type of Gauge	Location	Dist. from Sta. (ft)
AP 1000	1925	Continuous	Staff	W. side of river	40.5
W. The Dalles	1935	1937	Staff	W. side of river	44.0
			Staff	W. side of river	33.5
			Staff	W. side of river	40.0
			Reed	W. side of river	0.0

COLUMBIA RIVER, WASHINGTON - OREGON
DAILY DISCHARGE HYDROGRAPH
COLUMBIA RIVER AT THE DALLES, OREGON

SHEET NO. 3

PORTLAND DISTRICT, CORPS OF ENGINEERS

DESIGNED BY: *A. Peterson* REVISIONS BY: *W. L. Plummer*
 CHECKED BY: *W. L. Plummer* APPROVED BY: *W. L. Plummer*
 DRAWN BY: *W. L. Plummer* DATE: *1934*



STATION DISCHARGES

Station	Year	Max Daily Discharge (cfs)	Date
1	1935	476,000	June 25
1	1936	220,000	May 17
1	1937	176,000	June 23
1	1938	460,000	May 21
1	1939	380,000	May 11
1	1940	3,300	June 3
1	1941	230,000	June 10
1	1942	410,000	June 10
1	1943	340,000	June 21
1	1944	300,000	June 13
1	1945	380,000	June 8
1	1946	580,000	May 30
1	1947	360,000	May 11
1	1948	900,000	May 11
1	1949	620,000	May 18
1	1950	730,000	June 25
1	1951	540,000	May 30
1	1952	450,000	May 26
1	1953	500,000	June 27

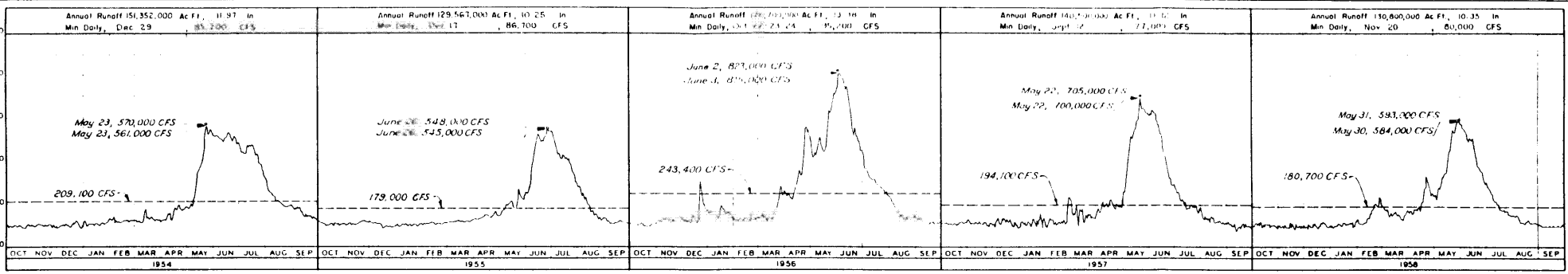
Notes:
 1. Discharge is measured at the Dalles, Oregon, by means of a weir. The weir is a concrete structure with a crest width of 100 feet. The discharge is measured by means of a float and a scale. The scale is a vertical rod with a float attached to it. The float is a cylindrical object that floats on the water surface. The scale is a vertical rod that is fixed to the weir structure. The discharge is measured by means of the float and the scale. The discharge is measured in cubic feet per second (cfs). The discharge is measured in 1000 cfs on the hydrographs.

2. The discharge is measured at the Dalles, Oregon, by means of a weir. The weir is a concrete structure with a crest width of 100 feet. The discharge is measured by means of a float and a scale. The scale is a vertical rod with a float attached to it. The float is a cylindrical object that floats on the water surface. The scale is a vertical rod that is fixed to the weir structure. The discharge is measured by means of the float and the scale. The discharge is measured in cubic feet per second (cfs). The discharge is measured in 1000 cfs on the hydrographs.

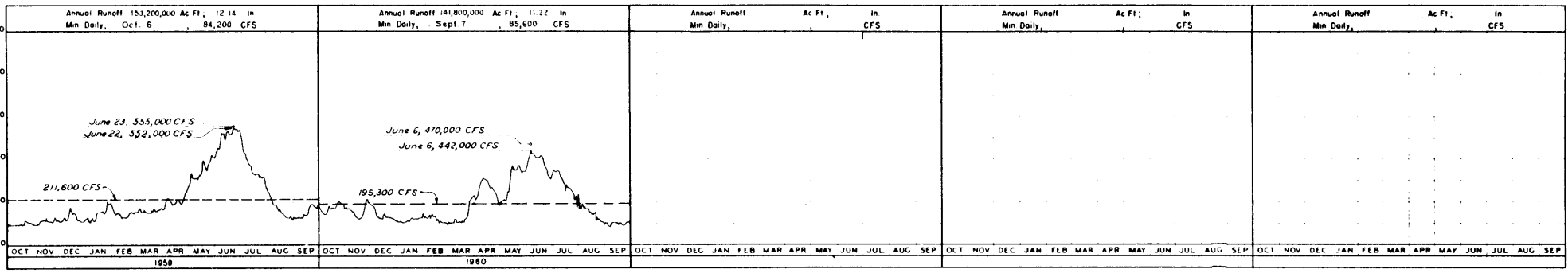
COLUMBIA RIVER, WASHINGTON - OREGON
 DAILY DISCHARGE HYDROGRAPH
 COLUMBIA RIVER AT THE DALLES, OREGON

PORTLAND DISTRICT, CORPS OF ENGINEERS
 SUPERVISOR: C. Pedersen
 DRAWN BY: J. H. ...
 CHECKED BY: ...
 APPROVED: A. Peterson
 DATE: ...

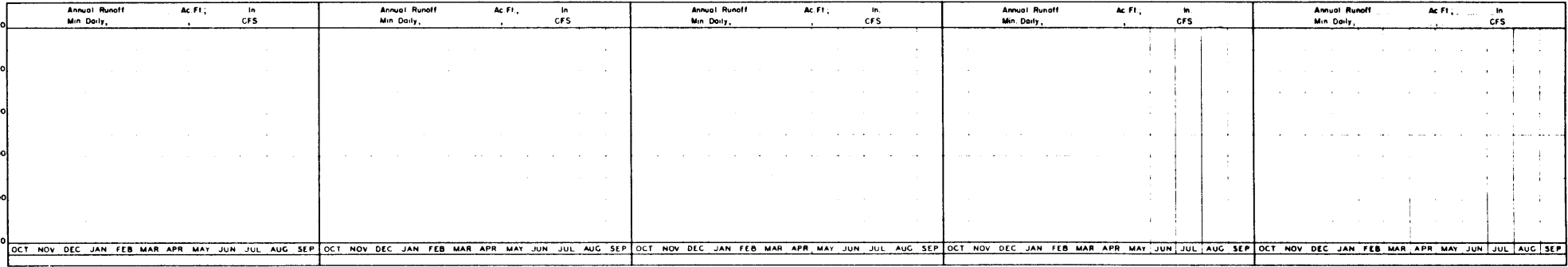
D



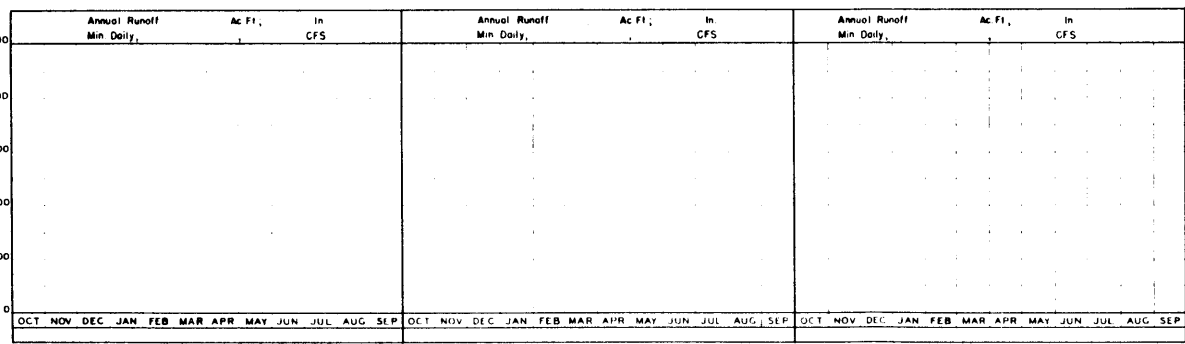
C



B



A



STATION DESCRIPTION						
Station	Dr Area Sq Miles	Records Available 1876-1925	Character	Type of Gage	Location	Datum MSL ±
At The Dalles	231,000	1876-1925	Continuous	Staff	NW 1/4 Sec 3, T1N, R1E	46.36
"	"	1926-1931	"	"	"	46.55
"	"	1932-1934	"	Staff	NW 1/4 Sec 3, T1N, R1E	46.86
"	"	1935-1936	"	Staff Recorder	SW 1/4 Sec 3, T1N, R1E	46.86
Nr The Dalles	"	1937-1966	"	"	NW 1/4 Sec 2, T1N, R1E	0.00
At The Dalles	"	1957	"	"	NW 1/4 Sec 1, T1N, R1E	0.00

LEGEND

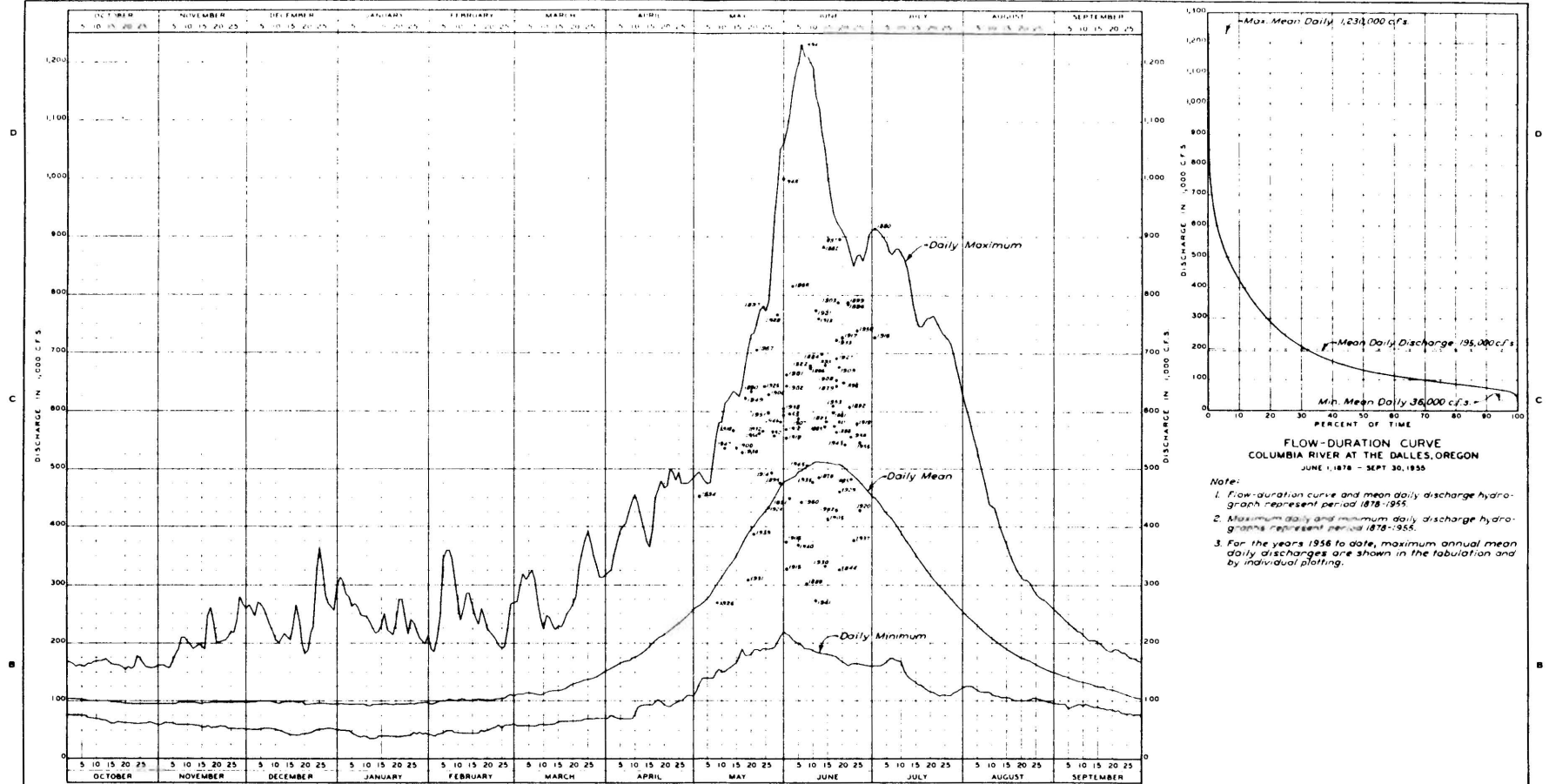
- MAXIMUM INSTANTANEOUS DISCHARGE
- MAXIMUM DAILY DISCHARGE
- MEAN DISCHARGE

* From 1878-1950, datum of gages is at mean sea level, 1929 adjustment.
From 1957, datum of gages is at mean sea level, 1929 adjustment, supplementary adjustment of 1947.

COLUMBIA RIVER, WASHINGTON - OREGON
DAILY DISCHARGE HYDROGRAPH
COLUMBIA RIVER AT THE DALLES, OREGON

PORTLAND DISTRICT, CORPS OF ENGINEERS SHEET NO. 5

APPROVED: *A. Peterson*
CHECKED: *Ben J. Peterson*
DRAWN: *Paul J. Peterson*
PLATE NO. *PD-25-8/5*



FLOW-DURATION CURVE
COLUMBIA RIVER AT THE DALLES, OREGON
 JUNE 1, 1878 - SEPT 30, 1955

Note:
 1. Flow-duration curve and mean daily discharge hydrograph represent period 1878-1955.
 2. Maximum daily and minimum daily discharge hydrographs represent period 1878-1955.
 3. For the years 1956 to date, maximum annual mean daily discharges are shown in the tabulation and by individual plotting.

MAXIMUM ANNUAL MEAN DAILY Q												COLUMBIA RIVER AT THE DALLES, OREGON											
YEAR	DAY	C.F.S.	YEAR	DAY	C.F.S.	YEAR	DAY	C.F.S.	YEAR	DAY	C.F.S.	YEAR	DAY	C.F.S.	YEAR	DAY	C.F.S.						
1878	12 June	485,000	1893	14 June	679,000	1908	18 June	653,000	1923	14 15 June	581,000	1938	31 May	604,000	1953	17 June	609,000						
1879	18	643,000	1894	6	1,230,000	1909	19	675,000	1924	25-27 May	433,000	1939	21	381,000	1954	23 May	561,000						
1880	1 July	914,000	1895	31 May	475,000	1910	14 May	506,000	1925	24 25	642,000	1940	5 June	368,000	1955	26 June	544,000						
1881	17 June	598,000	1896	22 June	785,000	1911	17 18 June	574,000	1926	8 9	288,000	1941	11	272,000	1956	3	823,000						
1882	13 14	683,000	1897	24 May	760,000	1912	1	386,000	1927	18 June	670,000	1942	18	428,000	1947	22 May	706,000						
1883	14	573,000	1898	20 21 June	649,000	1913	12	759,000	1928	29 May	766,000	1943	21	541,000	1948	31	593,000						
1884	13	698,000	1899	22	707,000	1914	27 May	493,000	1929	19 June	460,000	1944	19	326,000	1959	23 June	555,000						
1885	23	482,000	1900	15 May	536,000	1915	1 June	328,000	1930	14	312,000	1945	8	605,000	1960	6 June	442,000						
1886	9	673,000	1901	1 June	662,000	1916	1 July	727,000	1931	19 May	308,000	1946	30 May	581,000									
1887	19	896,000	1902	1	644,000	1917	20 June	727,000	1932	24	585,000	1947	11	536,000									
1888	18	564,000	1903	18 19	787,000	1918	25	678,000	1933	18 June	721,000	1948	31	699,000									
1889	5 8	302,000	1904	26 May	629,000	1919	1	653,000	1934	2 May	453,000	1949	18	622,000									
1890	14 20 May	633,000	1905	15 June	412,000	1920	26	608,000	1935	10 June	476,000	1950	25 June	739,000									
1891	2 June	448,000	1906	1	374,000	1921	15	773,000	1936	17 May	429,000	1951	26 May	597,000									
1892	22 23	607,000	1907	5	587,000	1922	9	677,000	1937	23-25 June	374,000	1952	28	552,000									

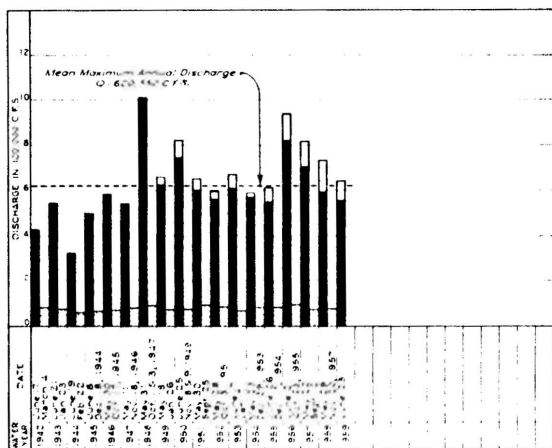
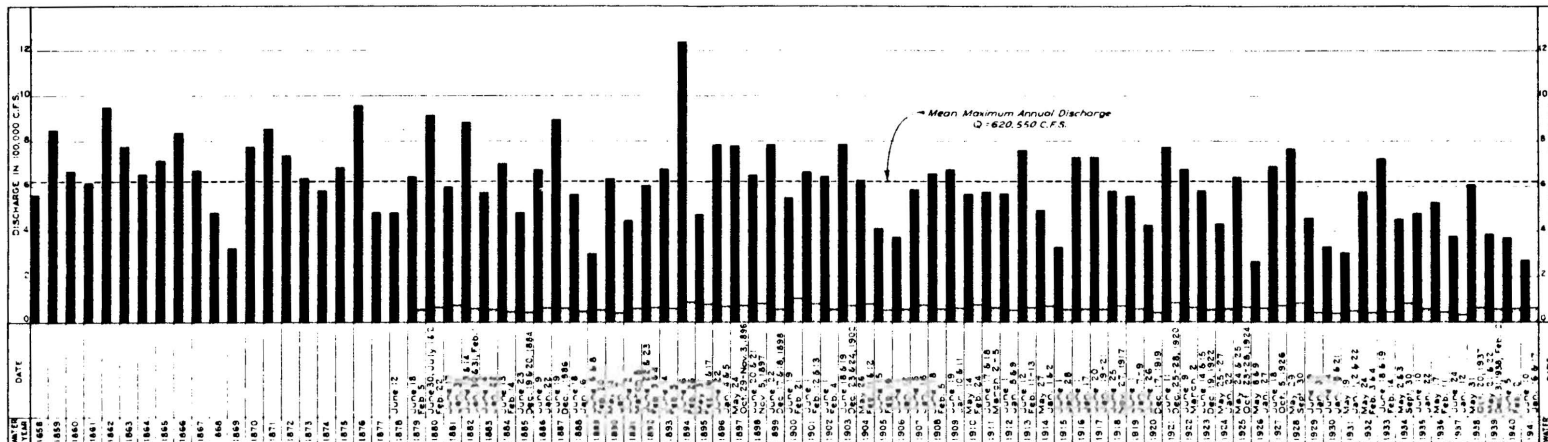
Note:
 Operation of up-stream reservoirs in the interest of flood control since 1948, has effected reduction of approximately 40,000 to 400,000 c.f.s. in maximum of surges at The Dalles.
 Minimum annual mean daily Q's plotted thus * **

COLUMBIA RIVER, WASHINGTON-OREGON
SUMMARY HYDROGRAPHS
 COLUMBIA RIVER AT THE DALLES, OREGON
 DRAINAGE AREA 237,000 SQUARE MILES

SCALE AS SHOWN
 U.S. ARMY ENGINEER DISTRICT PORTLAND
 CORPS OF ENGINEERS

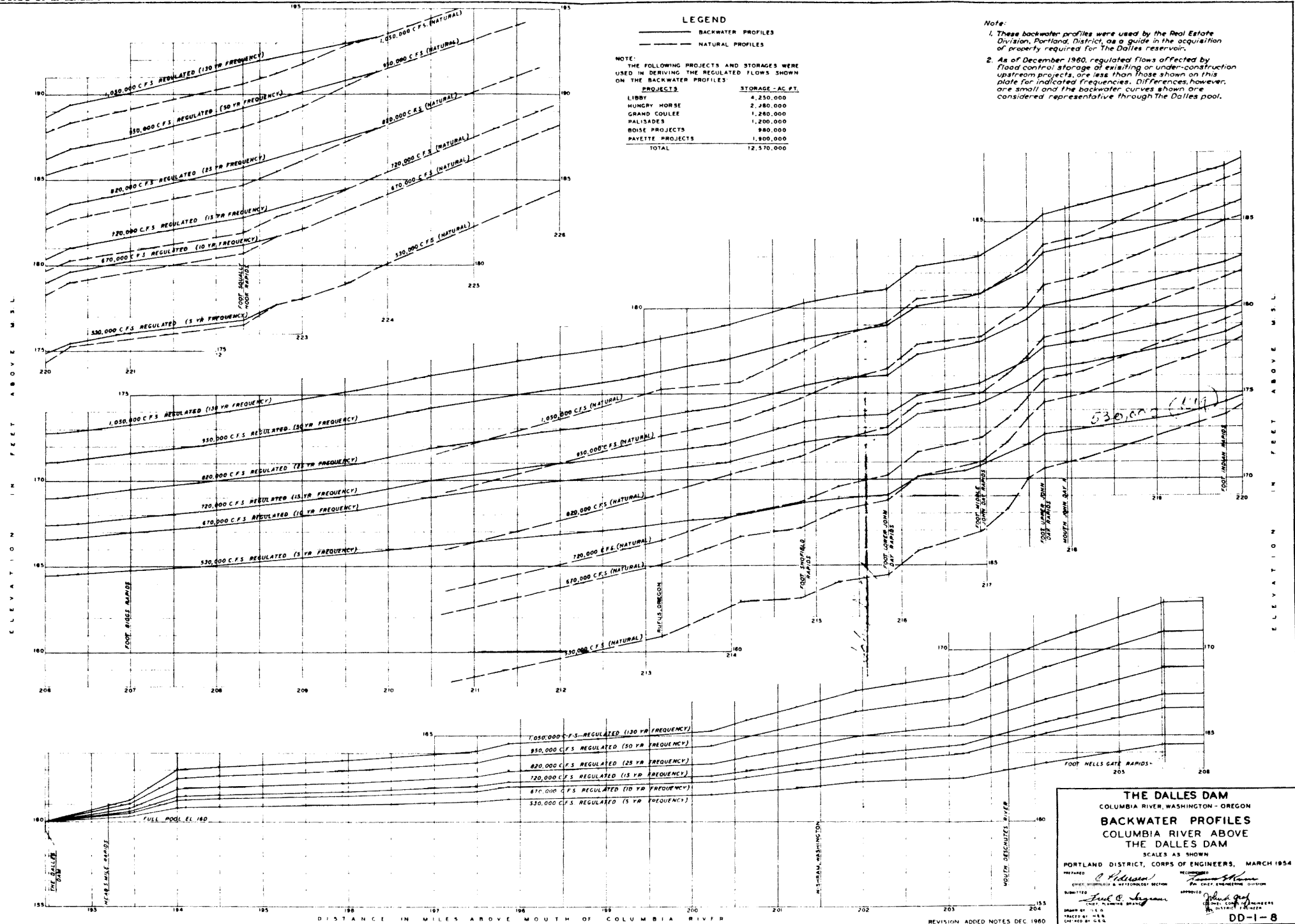
REVISIONS:
 1. 1955
 2. 1956
 3. 1957
 4. 1958
 5. 1959
 6. 1960
 7. 1961
 8. 1962
 9. 1963
 10. 1964
 11. 1965
 12. 1966
 13. 1967
 14. 1968
 15. 1969
 16. 1970
 17. 1971
 18. 1972
 19. 1973
 20. 1974
 21. 1975
 22. 1976
 23. 1977
 24. 1978
 25. 1979
 26. 1980
 27. 1981
 28. 1982
 29. 1983
 30. 1984
 31. 1985
 32. 1986
 33. 1987
 34. 1988
 35. 1989
 36. 1990
 37. 1991
 38. 1992
 39. 1993
 40. 1994
 41. 1995
 42. 1996
 43. 1997
 44. 1998
 45. 1999
 46. 2000
 47. 2001
 48. 2002
 49. 2003
 50. 2004
 51. 2005
 52. 2006
 53. 2007
 54. 2008
 55. 2009
 56. 2010
 57. 2011
 58. 2012
 59. 2013
 60. 2014
 61. 2015
 62. 2016
 63. 2017
 64. 2018
 65. 2019
 66. 2020
 67. 2021
 68. 2022
 69. 2023
 70. 2024
 71. 2025

REVISION 17 MARCH 1981



COLUMBIA RIVER, WASHINGTON-OREGON
MAXIMUM ANNUAL AND MINIMUM DAILY DISCHARGES
 COLUMBIA RIVER AT THE DALLES, OREGON

U.S. ARMY ENGINEER DISTRICT PORTLAND
 CORPS OF ENGINEERS



LEGEND

- BACKWATER PROFILES
- - - - - NATURAL PROFILES

NOTE: THE FOLLOWING PROJECTS AND STORAGES WERE USED IN DERIVING THE REGULATED FLOWS SHOWN ON THE BACKWATER PROFILES:

PROJECTS	STORAGE - AC. FT.
LIBBY	4,250,000
HUNGRY HORSE	2,280,000
GRAND COULEE	1,280,000
PALISADES	1,200,000
BOISE PROJECTS	980,000
PAYETTE PROJECTS	1,800,000
TOTAL	12,570,000

Note:
 1. These backwater profiles were used by the Real Estate Division, Portland, District, as a guide in the acquisition of property required for The Dalles reservoir.
 2. As of December 1960, regulated flows affected by flood control storage of existing or under-construction upstream projects, are less than those shown on this plate for indicated frequencies. Differences, however, are small and the backwater curves shown are considered representative through The Dalles pool.

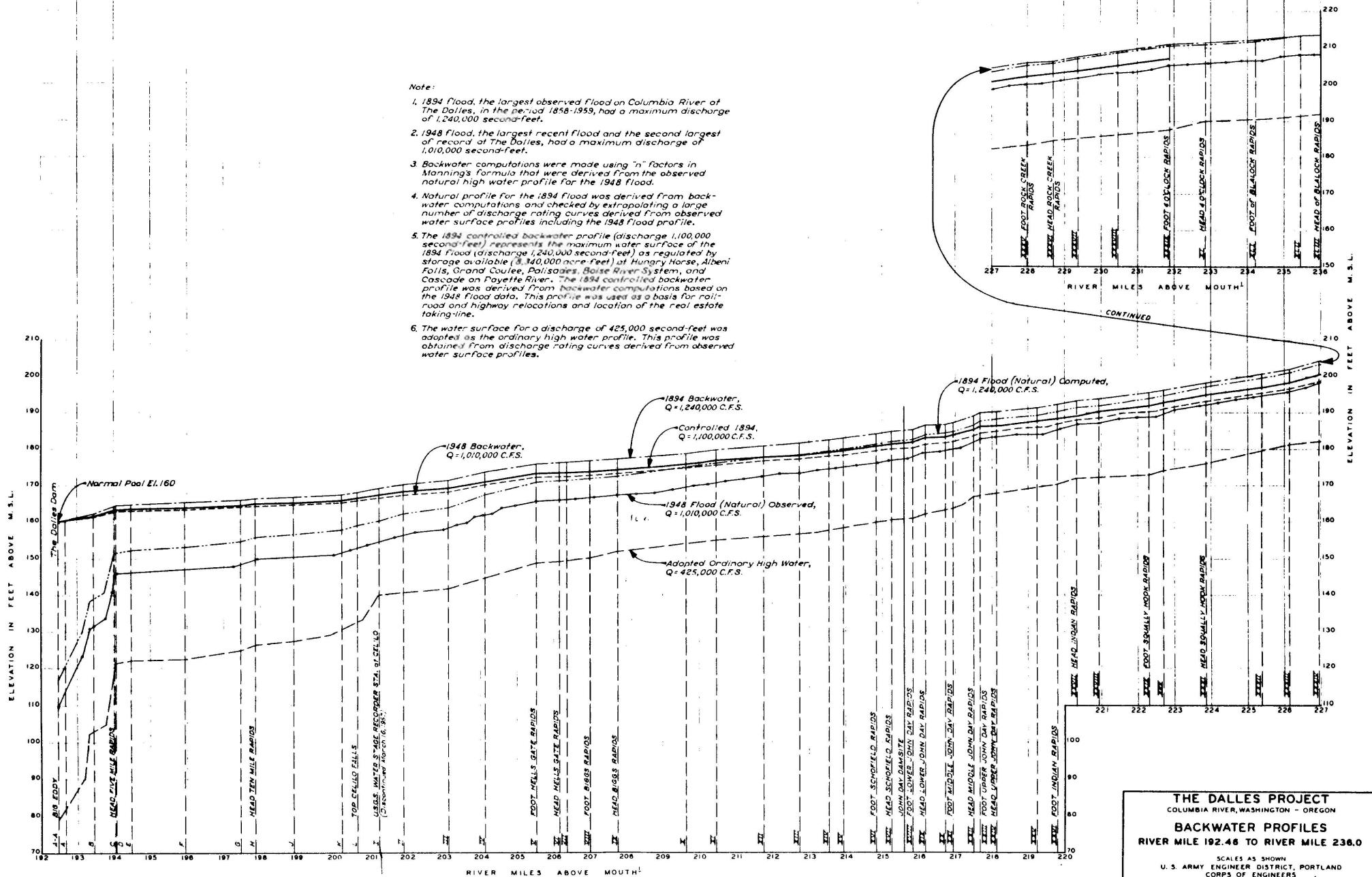
THE DALLES DAM
 COLUMBIA RIVER, WASHINGTON - OREGON
BACKWATER PROFILES
 COLUMBIA RIVER ABOVE
 THE DALLES DAM
 SCALES AS SHOWN

PORTLAND DISTRICT, CORPS OF ENGINEERS, MARCH 1954

PREPARED BY *[Signature]* CHECKED BY *[Signature]*
 DRAWN BY *[Signature]* IN CHARGE OF SECTION
 SUBMITTED BY *[Signature]* FOR THE DISTRICT ENGINEER
 APPROVED BY *[Signature]* DISTRICT ENGINEER

REVISIONS ADDED NOTES DEC 1960

DD-1-8
 PLATE 12



Note:

1. 1894 Flood, the largest observed flood on Columbia River at The Dalles, in the period 1858-1959, had a maximum discharge of 1,240,000 second-feet.
2. 1948 Flood, the largest recent flood and the second largest of record at The Dalles, had a maximum discharge of 1,010,000 second-feet.
3. Backwater computations were made using "n" factors in Manning's formula that were derived from the observed natural high water profile for the 1948 flood.
4. Natural profile for the 1894 flood was derived from backwater computations and checked by extrapolating a large number of discharge rating curves derived from observed water surface profiles including the 1948 flood profile.
5. The 1894 controlled backwater profile (discharge 1,100,000 second-feet) represents the maximum water surface of the 1894 flood (discharge 1,240,000 second-feet) as regulated by storage available (3,340,000 acre-feet) at Hungry Horse, Albeni Falls, Grand Coulee, Polispades, Boise River System, and Cascade on Payette River. The 1894 controlled backwater profile was derived from backwater computations based on the 1948 flood data. This profile was used as a basis for railroad and highway relocations and location of the real estate taking-line.
6. The water surface for a discharge of 425,000 second-feet was adapted as the ordinary high water profile. This profile was obtained from discharge rating curves derived from observed water surface profiles.

¹ River miles above 201 are official river miles above the mouth. Between Big Eddy and river mile 201 the miles on this sheet are measured along the thalweg of the river whereas the official mileage is along Celilo Canal.

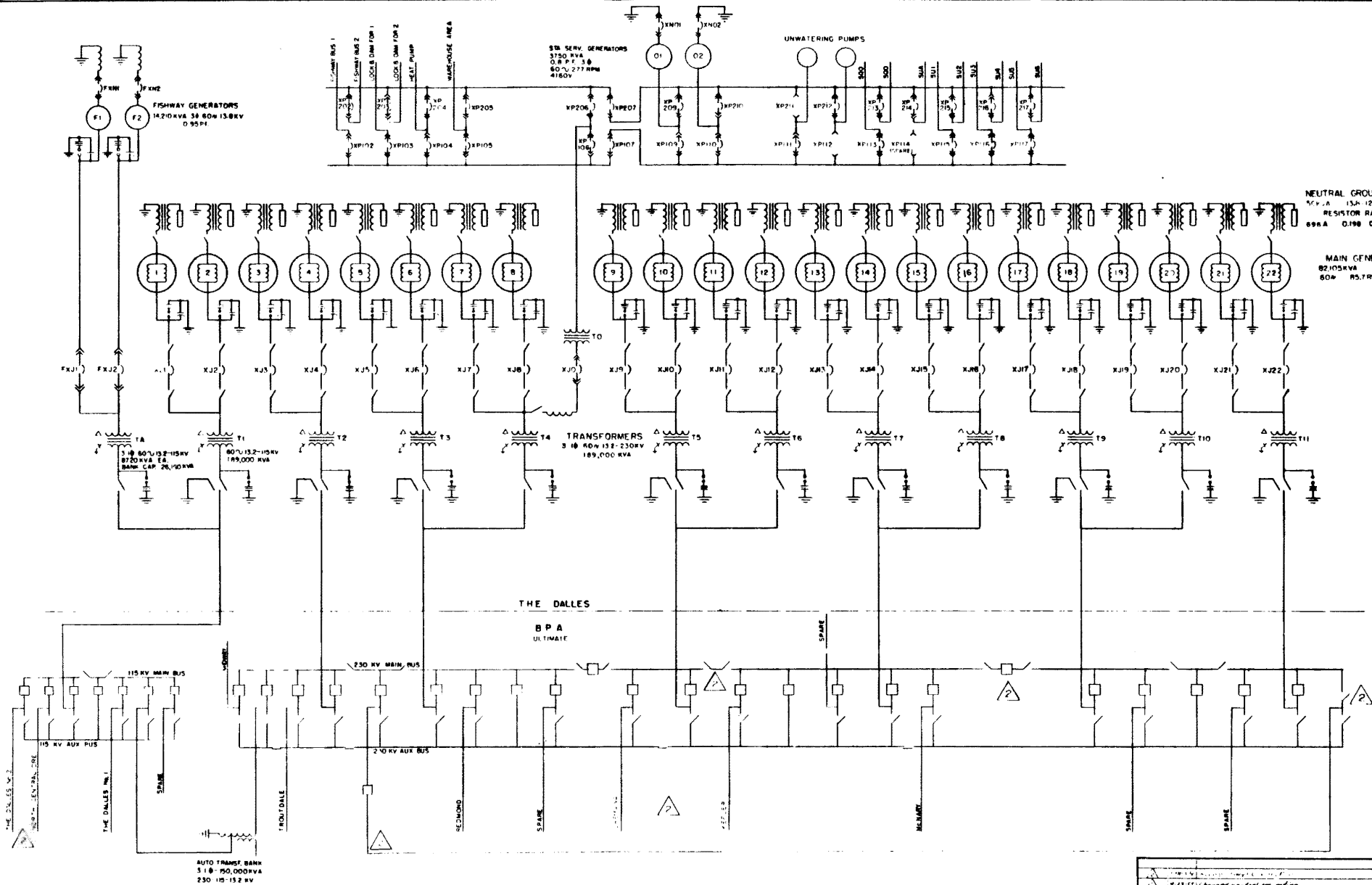
THE DALLES PROJECT
COLUMBIA RIVER, WASHINGTON - OREGON

BACKWATER PROFILES
RIVER MILE 192.46 TO RIVER MILE 236.0

SCALES AS SHOWN
U. S. ARMY ENGINEER DISTRICT, PORTLAND
CORPS OF ENGINEERS

<p>PREPARED BY: <i>[Signature]</i></p> <p>CHIEF, HYDROLOGICAL & METEOROLOGICAL SECTION</p> <p>SUBMITTED BY: <i>[Signature]</i></p> <p>CHIEF, PLANNING BRANCH</p> <p>DRAWN BY: <i>[Signature]</i></p> <p>CHECKED BY: <i>[Signature]</i></p>	<p>RECOMMENDED BY: <i>[Signature]</i></p> <p>CHIEF, ENGINEERING DIVISION</p> <p>APPROVED BY: <i>[Signature]</i></p> <p>CHIEF, CORPS OF ENGINEERS</p>
--	--

DD-20-26/2



REFERENCE DRAWINGS
 DDP 3-6-92(1) UNWATERING UNIT ONE LINE DIAGRAM
 DDP 3-6-92(2) UNIT ONE LINE DIAGRAM

CORPS OF ENGINEERS, U. S. ARMY NORTH PACIFIC DIVISION, PORTLAND, OREGON	
THE DALLES DAM COLUMBIA RIVER, WASHINGTON AND OREGON POWERHOUSE ELECTRICAL MAIN ONE LINE DIAGRAM	
DESIGNED BY: <i>ROB</i> DRAWN BY: <i>ROB</i> CHECKED BY: <i>JPE</i> PREPARED BY: <i>[Signature]</i> REVIEWED BY: <i>[Signature]</i> DATE: <i>7/20/51</i>	SCALE: AS SHOWN SPEC. NO.: REVISIONS: NO. DATE BY 1 7/20/51 [Signature]
DDP 3-6-92(1)	

APPENDIXES

<u>Number</u>	<u>Title</u>
A	Memorandum of Agreement between the Corps of Engineers and the Bonneville Power Administration for Operation of The Dalles Dam Project
B	Provisions Governing the Use, Administration and Navigation of The Dalles Dam Navigation Lock and Approach Channels
C	Public Notice, For Radio Transmitter Silence, Bonneville Dam Area
D	Public Notice, Closure of Columbia River Locks
E	Public Notice, Bonneville Dam Reservoir Drawdown
F	Public Notice, Operation of The Dalles and Bonneville Dam Reservoirs
G	Standard Forms
	1. NPD RF 12
	2. NPD RF 55 (Rev.)
	3. NPP 56a
	4. RCS NPPGW-52
	5. NPD RF 252
	6. NPP 252 (Rev.)
	7. Federal Power Commission No. 4

OPERATING ARRANGEMENT
BETWEEN THE
CORPS OF ENGINEERS AND THE BONNEVILLE POWER ADMINISTRATION

For Operation of The Dalles Dam Project,
Columbia River, Washington and Oregon

This Operating Arrangement, made this _____ day of _____, 1960, is pursuant to Article 10 of the Memorandum of Understanding dated October 8, 1956, between the Corps of Engineers and the Bonneville Power Administration.

For simplification, the following terminology will be used hereinafter when referring to names and positions used in this Arrangement:

"Division Engineer" - will mean Division Engineer of North Pacific Division, Corps of Engineers.

"District Engineer" - will mean the District Engineer of the Portland, Oregon District of the Corps of Engineers.

"The Dalles Dam" - will mean the dam, powerhouse, fishways, locks and appurtenant works installed and operated by the Corps of Engineers, Department of the Army, near The Dalles, Oregon.

"Project Engineer" - will mean the Engineer in charge of The Dalles Dam.

"Plant Superintendent" - will mean the representative of the Corps of Engineers in charge of the operation of The Dalles Dam powerhouse and appurtenant works, or his authorized representative.

"Administration" - will mean the Bonneville Power Administration.

"Administrator" - will mean the Administrator of the Bonneville Power Administration or his authorized representative.

"Chief of Operations" - will mean the Chief of the Branch of System Operations and Power Resources of the Bonneville Power Administration or his authorized representative.

"System Dispatcher" - will mean the Chief of the Dispatching Section of the Bonneville Power Administration or his authorized representative.

"Pool level or elevation" - will mean the elevation above mean sea level of the water surface as measured at the forebay gage, located in the pool between the station service unit bay and main unit No. 9.

I. GENERAL

(a) In order to provide flexible operation, modification of agreed procedures now in force covering certain functions such as voltage schedules, switching orders, emergency transmission line operations and communication will be arranged between the System Dispatcher and the Plant Superintendent, subject to the limitations in the following Sections II through VIII, inclusive.

II. VOLTAGE

(a) The operating voltage of generators shall not exceed 14,400 volts and of the 115 kv and 230 kv busses, shall not exceed 130 kv and 250 kv, respectively.

III. LOADING

(a) The hourly peak load on generators 1 to 14 inclusive shall not exceed 90 megawatts per machine. Hourly peak load shall be construed to mean the average output over a period of one hour. The temperatures, however, shall not exceed what are considered by the District Engineer to be safe operating temperatures, namely 95° C on the generators and 85° C on the transformers. The normal loading

on these generators will vary with the available head but shall not exceed their rated overload capacity of 90 megawatts per machine.

(b) The output of the two fish water-supply units is generally available. However, the output of these two units is regulated by the volume of water required in the fish attraction system and is not subject to dispatching office control. Normally the loading will be limited to 13.5 megawatts per machine.

IV. OPERATION OF THE DALLES POOL

(a) The Dalles pool shall normally be maintained at a nominal elevation of 160 feet above mean sea level. During the period when the nominal elevation of the pool is elevation 160, The Dalles plant will be used at times for load factor operation and the pool may fluctuate between limits of from elevation 155.0 to elevation 160.0. Load studies indicate that under extreme conditions the total permissible drawdown may be required during a 24-hour period. However, when changes of more than one foot per day are anticipated, a courtesy notice will be given to navigation interests and such users as the Maryhill Ferry. Arrangements for such drawdown shall be made as far in advance as practicable. The rate of recovery of pool elevation will be limited by a minimum discharge below the Bonneville plant of 43,000 c.f.s.

(b) During Periods of High River Flow. - Regulation of The Dalles reservoir during the spring freshet will be to maintain a pool

elevation of 160 feet at the forebay gage until the flow in the river exceeds about 1,220,000 second-feet (the spillway capacity at that elevation is about 1,050,000 second-feet and the powerhouse flow is about 170,000 second-feet for 14 units). For greater flows the spillway gates will be raised clear of the water surface and the pool will rise as required for passing the inflow. For a flow of 2,290,000 second-feet, which is the spillway design flood, the powerhouse may not be operative and the pool elevation will be approximately 177 feet, a distance of 150 feet upstream from the spillway, and approximately 183 feet one mile upstream at Big Eddy. The estimated elevation at the forebay gage for this condition would be about 130 feet.

V. SYSTEM OPERATION

(a) The Dalles plant will be available for scheduled base load operation, scheduled peaking operation and/or frequency control. Such scheduling shall be done through North Pacific Division.

(b) The Dalles power plant will be available for frequency control at the option of the System Dispatcher unless plant or pool conditions make such action inadvisable. In this latter case the Administration will be so notified by the Project Engineer.

(c) Changes in established schedules should be made by mutual agreement between the System Dispatcher and the Plant Superintendent.

(d) The physical arrangement of the connections between the powerhouse and Administration's Big Eddy Substation are such as to require a definite coordinated operating procedure. The following has

been agreed upon as the most satisfactory arrangement to provide maximum equipment protection and fastest restoration of service. It is part of the standing operating orders for both the powerhouse and substation. In the event a powerhouse-Big Eddy line trips the following applies:

1. The powerhouse operators will open the unit breakers of the affected line or lines.
2. The powerhouse will then notify the substation that the line may be charged.
3. Big Eddy substation, with approval of the System Dispatcher, will charge the line and notify the powerhouse that they are ready for the units to be restored to service.
4. The powerhouse will then synchronize the units to the system and load as per dispatching request.

The foregoing is for normal routine operation and it is understood that deviations may be necessary under abnormal conditions.

VI. ROUTINE MAINTENANCE OF EQUIPMENT

(a) Periodic routine maintenance work on generating, transforming, switching equipment and dam facilities at The Dalles Dam, which will in any way limit its generating or power delivery capability, will be performed, as required by the District Engineer and to the extent practicable, when system load commitments and operating conditions are least affected. Periodic maintenance outages of extended duration will be coordinated with maintenance schedules by the Division

Engineer, who will in turn establish the schedules in cooperation with the Administrator.

(b) Minor maintenance work requiring outages of short duration will be arranged by the Plant Superintendent and the System Dispatcher. As a rule, such outages will be confined to periods when the power situation is not critical and the repairs may be completed in the working day.

VII. EMERGENCY OPERATION

(a) During power system emergencies the full capability of The Dalles plant is available to the System Dispatcher at any time. Maximum and minimum pool elevations must be complied with and load and temperature limits of operating equipment will apply. An emergency is defined as an infrequent occurrence, such as a plant or transmission outage adversely affecting system operation, but shall not include normal errors in estimating loads or resources.

(b) When emergencies occur at The Dalles plant which, in the judgment of the Plant Superintendent, make it necessary to remove generators and/or apparatus pertinent thereto from service, and which affect normal operation or the plant capability, the Plant Superintendent will immediately advise the System Dispatcher of the nature of the emergency and the estimated time required to restore normal conditions.

VIII. USE OF HOUSE GENERATORS

(a) The use of station service generators will be limited to such duties as will not lessen their ability to maintain a reliable supply for station power, independent of external disturbances. For normal operation, one station service generator will be paralleled with the station service transformer with each carrying a portion of the project loads. The second station service unit will be on stand-by service, arranged to start up in event of loss of power supply to the station service system.

IX. RELAYING OF TRANSMISSION LINES AND EQUIPMENT

(a) Relay settings for any transmission line or other transmission equipment which will have a direct effect upon the interconnected system operation shall be determined by the Administrator.

(b) All work involved in setting the relays and determining their adequacy shall be done cooperatively by the Relay Engineers of both parties.

(c) The System Dispatcher shall be informed concerning any relay operation. Information to be furnished shall include the time, line, breakers, relay type, phase, zone and any other similar or related information. He shall also be kept informed at all times of the presence of any unusual condition in connection with the protective equipment.

(d) Copies of any automatic oscillograms obtained at The Dalles Dam during system trouble which may give information about the operation of the Administration's equipment will be sent to the Administrator. Similar records obtained by the Administration's oscillographs which give information about powerhouse equipment will be transmitted to the Project Engineer. These records will be prepared and transmitted within a reasonable time of the occurrence of the trouble.

X. TERM

(a) This Operating Arrangement, and any revisions or additions mutually acceptable, which in the future may be found necessary or desirable, shall become effective when signed by the Bonneville Power Administrator and by the Division Engineer, North Pacific Division, for the Corps of Engineers, Department of the Army, and shall continue in effect for such time as the said Memorandum of Understanding of October 5, 1956 shall remain in effect.

BONNEVILLE POWER ADMINISTRATION

By _____
Administrator

CORPS OF ENGINEERS
DEPARTMENT OF THE ARMY

By _____
Division Engineer

APPENDIX B

NAVIGATION - THE DALLES LOCKS

Sec. 207.705 The Dalles Dam Navigation Lock and Approach Channels, Columbia River, Wash.; use, administration and navigation. (a) General. The lock and its approach channels, and all its appurtenances, shall be in charge of the District Engineer, Corps of Engineers, United States Army, in charge of the locality. His representative at The Dalles Dam shall be the Project Engineer who shall customarily give orders and instructions to the lock master and assistant lock masters in charge of the lock. Hereinafter, the term "lock master" shall be used to designate the lock official in immediate charge of the lock at any given time. In case of emergency and on all routine work in connection with the operation of the lock, the lock master shall have authority to take such steps as may be immediately necessary without waiting for instructions from the Project Engineer.

(b) Immediate control. The lock master shall be charged with the immediate control and management of the lock, and of the area set aside as the lock area, including the lock approach channels. He shall see that all laws, rules and regulations for the use of the lock and lock area are duly complied with, to which end he is authorized to give all necessary orders and directions in accordance therewith, both to employees of the Government and to any and every person within the limits of the lock or lock area, whether navigating the lock or not. It shall be the duty of the Project Engineer to establish lines of succession for the men operating the lock on all shifts in order that in case of absence or accident to the designated lock master, one of his assistants will immediately assume the position of lock master.

(c) Authority of lock master. No one shall cause any movement of any vessel, boat, or other floating thing in the lock or approaches except by or under the direction of the lock master or his assistants.

(d) Signals. (1) Sound. All craft desiring lockage shall signal by two long and two short blasts of the whistle, delivered at a distance of one-half mile from the lock. When the lock is ready for entrance, notice will be given by one long blast. Permission to leave the lock will be given by one short blast.

(2) Visual. Lights are located outside each lock gate and will be used in conjunction with the sound signals. When a green light is on, the lock is ready for entrance and vessels may enter under full control. When a red light is on, the lock cannot be made ready immediately and the vessel shall stand clear.

(3) Radio. The lock is equipped with two-way radio operating on frequencies of 2182 and 2784 kc. These frequencies will be monitored by the lock master. Vessels equipped with two-way radio may communicate with the crew operating the lock, but communications or signals so received will only augment and not replace the sound and visual signals.

(e) Permissible dimensions of boats. The lock chamber is 86 feet wide by 675 feet long in the clear. Single tows aggregating 650 feet in length will be permitted to lock through without disassembly. At normal pool elevation of 160 feet above m.s.l., the depth of water over the upstream miter gate sill will be 20 feet. The downstream miter gate sill has an elevation of 54.5 feet above m.s.l. The depth of water over the downstream miter gate sill will depend upon the flow in the river but will usually exceed fifteen feet. Gauges reading in elevation above m.s.l. are located on the north wall of the lock adjacent to each lock gate and at the end of the approach channel immediately downstream of the downstream gate. A boat must not attempt to enter the lock if its beam and length are greater than above indicated, or if its draft exceeds the depth indicated by reference to the gauges, with due allowance for clearance.

(f) Precedence at lock. Ordinarily the boat arriving before all others at the lock will be locked through first; however, depending upon whether the lock is full or empty, this precedence may be modified at the discretion of the lock master if boats are approaching from the opposite direction and are within reasonable distance of the lock at the time of the approach by the first boat. When several boats are to pass precedence shall be given as follows:

First: Boats and craft owned by the United States and engaged upon river and harbor improvement work.

Second: Freight and towboats.

Third: Rafts.

Fourth: Passenger boats.

Fifth: Small vessels and pleasure boats.

(g) Loss of turn. Boats that fail to enter the lock with reasonable promptness, after being authorized to do so, shall lose their turn.

(h) Multiple lockage. The lock master shall decide whether one or more vessels may be locked through at the same time.

(i) Speed. Vessels shall not be raced or crowded alongside another in the approach channels. When entering the lock, speed shall be reduced to a minimum consistent with safe navigation. As a general rule, when a number of vessels are entering the lock, the following vessel shall remain at least 200 feet astern of the vessel ahead.

(j) Lockage of small boats. In general the lockage of pleasure boats, skiffs, fishing boats, and other small craft will be coordinated with the lockage of commercial craft other than barges handling petroleum products or highly hazardous materials. If no combined lockage can be scheduled within a reasonable time not to exceed one hour after the arrival of the small craft at the lock, separate lockage will be made for such small craft.

(k) Mooring in lock. All boats, rafts and other craft when in the locks shall be moored by head and spring lines and such other lines as may be necessary to the fastenings provided for that purpose, and the lines shall not be let go until the signal is given for the vessel to leave the lock.

(l) Mooring in approaches prohibited. The mooring or anchoring of boats or other craft in the approaches to the lock where such mooring will interfere with navigation of the lock is prohibited. Rafts to be passed through the lock shall be moored in such a manner as not to interfere with the navigation of the lock or its approaches, and if the raft is to be divided into sections for locking, the sections shall be brought into the lock as directed by the lock master. After passing through the lock, the sections shall be reassembled at such a distance from the entrance as not to obstruct or interfere with navigation of the lock and approaches.

(m) Waiting for lockage. Boats and tows waiting downstream of the dam for lockage shall wait in the clear downstream of the navigation lock approach channel, or, contingent upon prior radio clearance of the lock master, may at their own risk lie inside the approach channel alongside the offshore guard wall provided that a 100-foot wide open channel is maintained between the boat or tow and the guide wall on the Washington shore side. Vessels waiting upstream of the dam for lockage may lay to against the offshore guide wall provided they remain not less than 400 feet upstream of the upstream lock gate; or contingent upon prior radio clearance by the lock master they may tie to the upstream guide wall on the Washington shore. In either event, a clear channel not less than 100 feet wide shall be kept open to accommodate passing traffic.

(n) Delay in lock. Boats or barges must not obstruct navigation by unnecessary delay in entering or leaving the lock.

(o) Damage to lock or other structures. The regulations contained in this section shall not affect the liability of the owners and operators of vessels for any damage by their operations to the lock or other structures. They must use great care not to strike any part of the lock, any gate or appurtenance thereto, or machinery for operating the gates, or the walls protecting the banks of the approach channels. All boats

with metal nosings or projecting irons, or rough surfaces that would be liable to damage the gates or lock walls, will not be permitted to enter the lock unless provided with suitable buffers and fenders.

(p) Tows. Persons in charge of a vessel towing a second vessel or barge by lines, shall take the second vessel or barge alongside at a distance of at least 500 feet from the lock gate which the vessel is approaching and keep it alongside until at least 500 feet clear of the gate at the end from which it is passing.

(q) Crew to move craft. The masters in charge of tows and the persons in charge of rafts and other craft must provide a sufficient number of men to move barges, rafts and other craft into and out of the lock easily and promptly.

(r) Handling valves, gates, bridges, and machinery. No person, unless authorized by the lock master shall open or close any bridge, gate, valve, or operate any machinery in connection with the lock, but the lock master may call for assistance from the master of any boat using the lock, should such aid be necessary, and when rendering such assistance the men so employed shall be strictly under the orders of the lock master. Masters of boats refusing to give assistance when it is requested of them may be denied the use of the lock by the lock master.

(s) Landing of freight. No one shall land freight or baggage on or over the walls of the lock so as in any way to delay or interfere with navigation or the operations of the lock; and freight and baggage consigned to The Dalles project shall be landed only at such places as are designated by the lock master or his assistants.

(t) Refuse in lock. No material of any kind shall be thrown or discharged into the lock, and no materials of any kind shall be deposited in the lock area.

(u) Statistics. On each passage through the lock, masters or pursers of vessels shall make to the lock master such written statement of passengers, freight, and registered tonnage and other information as are indicated on forms furnished such masters or pursers by the lock master.

(v) Persistent violation of regulations. If the owner or master of any boat persistently violates these regulations after due notice of the same, the boat or master may be refused lockage by the lock master at the time of violation or subsequent thereto if deemed necessary in the opinion of the lock master to protect the Government property and works in the vicinity of the lock.

(w) Restricted areas. (1) All waters described in subparagraphs (2) and (3) of this paragraph are restricted to all boats except those of the United States Coast Guard and Corps of Engineers.

(2) All downstream waters other than those of the Navigation Lock Downstream Approach Channel which lie between the Wasco County Bridge and the project axis including those waters between the powerhouse and the Oregon shore.

(3) All upstream waters other than those of the Navigation Lock Upstream Approach Channel which lie between the project axis and a line projected from the upstream end of the Navigation Lock Guide Wall to the junction of the concrete structure with the earth fill section of dam near the upstream end of the powerhouse.

* * * *

These rules and regulations, for The Dalles Dam Navigation Lock and approach channels in the Columbia River, will be in full force and effect thirty days after their publication in the Federal Register. They were published in the Federal Register April 2, 1957; public notice of their approval were sent to all known interested parties on April 10, 1957; they have been posted at The Dalles Dam and at the post offices at:

Oregon

Astoria
Clatskanie
Rainier
St. Helens
Hood River
The Dalles

Washington

Cathlamet
Kelso
Longview
Vancouver
Camas
Washougal
Stevenson
Maryhill
Pasco
Kennewick

APPENDIX C

U. S. ARMY ENGINEER DISTRICT, PORTLAND
CORPS OF ENGINEERS
628 Pittock Block
Portland 5, Oregon

C O P Y

NPPKE

6 November 1959

PUBLIC NOTICE

FOR RADIO TRANSMITTER SILENCE
BONNEVILLE DAM AREA

Notice is hereby given that drilling and blasting operations are being performed in the Columbia River downstream from the entrance to the navigation lock at Bonneville Dam.

To prevent premature explosion due to radio activity, all craft are requested to not transmit on their radios within 3,000 feet of the downstream entrance to the navigation lock during the hours of 8:00 a.m. to 4:30 p.m., Monday through Friday, from the date of this notice through 30 November 1959.

/s/ W. L. Winegar

W. L. WINEGAR
Colonel, Corps of Engineers
District Engineer

APPENDIX C

APPENDIX D

U. S. ARMY ENGINEER DIVISION, NORTH PACIFIC
CORPS OF ENGINEERS
210 Custom House
Portland 9, Oregon

NPDKO

7 October 1959

C O P Y

PUBLIC NOTICE

CLOSURE OF COLUMBIA RIVER LOCKS

Reference is made to the Public Notice dated 15 July 1959 giving advance notice to all interested parties of closure periods for the Columbia River locks for essential repairs and maintenance and stating that further information would be furnished in a subsequent notice.

The closure of the Columbia River locks will be made in accordance with the following schedule:

<u>Lock</u>	<u>Closure Period</u>	
	<u>To Start</u>	<u>To End</u>
Bonneville	8:00 AM 19 October 1959	Midnight 1 November 1959
The Dalles	8:00 AM 19 October 1959	Midnight 1 November 1959
McNary	8:00 AM 21 October 1959	4:30 PM 28 October 1959

/s/ Allen F. Clark, Jr.

ALLEN F. CLARK, JR.
Brigadier General, USA
Division Engineer

APPENDIX D

APPENDIX E

U. S. ARMY ENGINEER DISTRICT, PORTLAND
CORPS OF ENGINEERS
628 Pittock Block
Portland 5, Oregon

NPPKE

6 January 1959

C O P Y

PUBLIC NOTICE

BONNEVILLE DAM RESERVOIR DRAWDOWN

Notice is hereby given that the Bonneville Dam Reservoir will be lowered to a pool elevation of 68 feet m.s.l. beginning at 8:00 A.M. Thursday, 8 January 1959, and returned to elevation 73 by about 8:00 P.M. Sunday, 11 January 1959.

Drawdown will begin from a pool elevation of 73 feet m.s.l. and cause the pool to drop at a rate of about one-tenth foot per hour until the reservoir reaches 68 feet m.s.l. at about 8:00 A.M. Saturday, 10 January 1959. Discharge from Bonneville Dam during this period will approximate 150,000 cubic feet per second.

The Bonneville reservoir will be held at elevation 68 feet m.s.l. until 4:00 A.M. Sunday, 11 January 1959. Discharge from the dam will be actual river flow of about 125,000 cubic feet per second during this period.

The pool will then be raised at a rate of about three-tenths foot per hour to return the reservoir to elevation 73 at about 8:00 P.M. Sunday, 11 January 1959. Discharge from Bonneville Dam will be reduced to approximately 43,000 cubic feet per second during the period the pool is being raised.

/s/ R. W. de Lancey

for W. L. WINEGAR
Colonel, Corps of Engineers
District Engineer

APPENDIX E

APPENDIX F

U. S. ARMY ENGINEER DISTRICT, PORTLAND
CORPS OF ENGINEERS
628 Pittock Block
Portland 5, Oregon

NPPVE

September 4, 1957

C O P Y

PUBLIC NOTICE

OPERATION OF THE DALLES AND BONNEVILLE DAM RESERVOIRS

Notice is hereby given that the normal maximum pool elevations of The Dalles and Bonneville Dam reservoirs are respectively 160 feet m.s.l. and 74 feet m.s.l. The normal minimum pool elevations are respectively 155 feet m.s.l. and 70 feet m.s.l. These are elevations at the dams, and will be exceeded in the reservoirs by amounts dependent upon river flows and distances above the dams.

Operating policy is to hold actual pool levels as closely as feasible to the normal maximum levels of 160 and 74, not exceeding these elevations, and not falling at any time below the minimum elevations of 155 and 70.

Due to the requirements of peaking operations at McNary, The Dalles, and Bonneville power plants, some daily variations between the normal minimum and maximum elevations will occur during much of the year. The variations will tend to be greater during low-water periods when the generation of power is critical. Because of more extensive development in the Bonneville pool, operations will generally be designed to hold it more stable than The Dalles pool. Fluctuations will be gradual, not exceeding a few tenths of a foot per hour.

During freshets, The Dalles reservoir can be maintained at elevation 160. The Bonneville reservoir will gradually rise from 74 at a flow of 260,000 cfs to 82.5 at 490,000 cfs, then remain constant to 800,000 cfs.

The Public Notices on this subject issued June 9, 1950, July 30, 1954 and July 1, 1957 are hereby rescinded.

/s/ Jackson Graham

JACKSON GRAHAM
Colonel, Corps of Engineers
District Engineer

APPENDIX F

APPENDIX G

STANDARD FORMS

(G-1 through G-7)

DAILY NUMBER AND CLASS OF VESSELS THROUGH _____

Month _____

Lock and Dam No. _____

River _____

Day of Month	COMMERCIAL BOATS									U. S. BOATS					Total Vessels	Total Lock- ages									
	Towboats		Barges		Log Rafts		Small Craft		Cons't. Boats		Towboats		Barges				Small Craft		Cons't. Boats		Cruiser Patrol Boats				
	U	D	U	D	U	D	U	D	U	D	U	D	U	D			U	D	U	D	U	D	U	D	
1																									
2																									
3																									
4																									
5																									
6																									
7																									
8																									
9																									
10																									
11																									
12																									
13																									
14																									
15																									
16																									
17																									
18																									
19																									
20																									
21																									
22																									
23																									
24																									
25																									
26																									
27																									
28																									
29																									
30																									
31																									
Total																									

G-1

NPD RF
SEP 51 12

To

Reports Control Symbol NPPVH - 53

DAILY OPERATION REPORT - THE DALLES DAM															Date																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
WEATHER																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																										
Character of Day					Wind					Precipitation Past 24 Hrs.					in.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
Air Temperature Past 24 Hrs.					Bar. Pressure					Water Temperature					°F.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
Max. °F. Min. °F.					Dew Point					Turbidity																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
POWERHOUSE																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																										
Station Load Today (8:00 A.M.)										MW					Generated Yesterday					MWH																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																						
															Project Use					MWH																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																						
															Delivered to B.P.A.					MWH																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																						
Station Load Yesterday - Clock Hour Peaks - (12 M. to 12 M.)															Total Load Yesterday																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
F1	MW	1	MW	5	MW	9	MW	13	MW	17	MW	21	MW	25	Maximum	M.	MW	29	MW	33	MW	37	MW	41	MW	45	MW	49	MW	53	MW	57	MW	61	MW	65	MW	69	MW	73	MW	77	MW	81	MW	85	MW	89	MW	93	MW	97	MW	101	MW	105	MW	109	MW	113	MW	117	MW	121	MW	125	MW	129	MW	133	MW	137	MW	141	MW	145	MW	149	MW	153	MW	157	MW	161	MW	165	MW	169	MW	173	MW	177	MW	181	MW	185	MW	189	MW	193	MW	197	MW	201	MW	205	MW	209	MW	213	MW	217	MW	221	MW	225	MW	229	MW	233	MW	237	MW	241	MW	245	MW	249	MW	253	MW	257	MW	261	MW	265	MW	269	MW	273	MW	277	MW	281	MW	285	MW	289	MW	293	MW	297	MW	301	MW	305	MW	309	MW	313	MW	317	MW	321	MW	325	MW	329	MW	333	MW	337	MW	341	MW	345	MW	349	MW	353	MW	357	MW	361	MW	365	MW	369	MW	373	MW	377	MW	381	MW	385	MW	389	MW	393	MW	397	MW	401	MW	405	MW	409	MW	413	MW	417	MW	421	MW	425	MW	429	MW	433	MW	437	MW	441	MW	445	MW	449	MW	453	MW	457	MW	461	MW	465	MW	469	MW	473	MW	477	MW	481	MW	485	MW	489	MW	493	MW	497	MW	501	MW	505	MW	509	MW	513	MW	517	MW	521	MW	525	MW	529	MW	533	MW	537	MW	541	MW	545	MW	549	MW	553	MW	557	MW	561	MW	565	MW	569	MW	573	MW	577	MW	581	MW	585	MW	589	MW	593	MW	597	MW	601	MW	605	MW	609	MW	613	MW	617	MW	621	MW	625	MW	629	MW	633	MW	637	MW	641	MW	645	MW	649	MW	653	MW	657	MW	661	MW	665	MW	669	MW	673	MW	677	MW	681	MW	685	MW	689	MW	693	MW	697	MW	701	MW	705	MW	709	MW	713	MW	717	MW	721	MW	725	MW	729	MW	733	MW	737	MW	741	MW	745	MW	749	MW	753	MW	757	MW	761	MW	765	MW	769	MW	773	MW	777	MW	781	MW	785	MW	789	MW	793	MW	797	MW	801	MW	805	MW	809	MW	813	MW	817	MW	821	MW	825	MW	829	MW	833	MW	837	MW	841	MW	845	MW	849	MW	853	MW	857	MW	861	MW	865	MW	869	MW	873	MW	877	MW	881	MW	885	MW	889	MW	893	MW	897	MW	901	MW	905	MW	909	MW	913	MW	917	MW	921	MW	925	MW	929	MW	933	MW	937	MW	941	MW	945	MW	949	MW	953	MW	957	MW	961	MW	965	MW	969	MW	973	MW	977	MW	981	MW	985	MW	989	MW	993	MW	997	MW	1001	MW	1005	MW	1009	MW	1013	MW	1017	MW	1021	MW	1025	MW	1029	MW	1033	MW	1037	MW	1041	MW	1045	MW	1049	MW	1053	MW	1057	MW	1061	MW	1065	MW	1069	MW	1073	MW	1077	MW	1081	MW	1085	MW	1089	MW	1093	MW	1097	MW	1101	MW	1105	MW	1109	MW	1113	MW	1117	MW	1121	MW	1125	MW	1129	MW	1133	MW	1137	MW	1141	MW	1145	MW	1149	MW	1153	MW	1157	MW	1161	MW	1165	MW	1169	MW	1173	MW	1177	MW	1181	MW	1185	MW	1189	MW	1193	MW	1197	MW	1201	MW	1205	MW	1209	MW	1213	MW	1217	MW	1221	MW	1225	MW	1229	MW	1233	MW	1237	MW	1241	MW	1245	MW	1249	MW	1253	MW	1257	MW	1261	MW	1265	MW	1269	MW	1273	MW	1277	MW	1281	MW	1285	MW	1289	MW	1293	MW	1297	MW	1301	MW	1305	MW	1309	MW	1313	MW	1317	MW	1321	MW	1325	MW	1329	MW	1333	MW	1337	MW	1341	MW	1345	MW	1349	MW	1353	MW	1357	MW	1361	MW	1365	MW	1369	MW	1373	MW	1377	MW	1381	MW	1385	MW	1389	MW	1393	MW	1397	MW	1401	MW	1405	MW	1409	MW	1413	MW	1417	MW	1421	MW	1425	MW	1429	MW	1433	MW	1437	MW	1441	MW	1445	MW	1449	MW	1453	MW	1457	MW	1461	MW	1465	MW	1469	MW	1473	MW	1477	MW	1481	MW	1485	MW	1489	MW	1493	MW	1497	MW	1501	MW	1505	MW	1509	MW	1513	MW	1517	MW	1521	MW	1525	MW	1529	MW	1533	MW	1537	MW	1541	MW	1545	MW	1549	MW	1553	MW	1557	MW	1561	MW	1565	MW	1569	MW	1573	MW	1577	MW	1581	MW	1585	MW	1589	MW	1593	MW	1597	MW	1601	MW	1605	MW	1609	MW	1613	MW	1617	MW	1621	MW	1625	MW	1629	MW	1633	MW	1637	MW	1641	MW	1645	MW	1649	MW	1653	MW	1657	MW	1661	MW	1665	MW	1669	MW	1673	MW	1677	MW	1681	MW	1685	MW	1689	MW	1693	MW	1697	MW	1701	MW	1705	MW	1709	MW	1713	MW	1717	MW	1721	MW	1725	MW	1729	MW	1733	MW	1737	MW	1741	MW	1745	MW	1749	MW	1753	MW	1757	MW	1761	MW	1765	MW	1769	MW	1773	MW	1777	MW	1781	MW	1785	MW	1789	MW	1793	MW	1797	MW	1801	MW	1805	MW	1809	MW	1813	MW	1817	MW	1821	MW	1825	MW	1829	MW	1833	MW	1837	MW	1841	MW	1845	MW	1849	MW	1853	MW	1857	MW	1861	MW	1865	MW	1869	MW	1873	MW	1877	MW	1881	MW	1885	MW	1889	MW	1893	MW	1897	MW	1901	MW	1905	MW	1909	MW	1913	MW	1917	MW	1921	MW	1925	MW	1929	MW	1933	MW	1937	MW	1941	MW	1945	MW	1949	MW	1953	MW	1957	MW	1961	MW	1965	MW	1969	MW	1973	MW	1977	MW	1981	MW	1985	MW	1989	MW	1993	MW	1997	MW	2001	MW	2005	MW	2009	MW	2013	MW	2017	MW	2021	MW	2025	MW	2029	MW	2033	MW	2037	MW	2041	MW	2045	MW	2049	MW	2053	MW	2057	MW	2061	MW	2065	MW	2069	MW	2073	MW	2077	MW	2081	MW	2085	MW	2089	MW	2093	MW	2097	MW	2101	MW	2105	MW	2109	MW	2113	MW	2117	MW	2121	MW	2125	MW	2129	MW	2133	MW	2137	MW	2141	MW	2145	MW	2149	MW	2153	MW	2157	MW	2161	MW	2165	MW	2169	MW	2173	MW	2177	MW	2181	MW	2185	MW	2189	MW	2193	MW	2197	MW	2201	MW	2205	MW	2209	MW	2213	MW	2217	MW	2221	MW	2225	MW	2229	MW	2233	MW	2237	MW	2241	MW	2245	MW	2249	MW	2253	MW	2257	MW	2261	MW	2265	MW	2269	MW	2273	MW	2277	MW	2281	MW	2285	MW	2289	MW	2293	MW	2297	MW	2301	MW	2305	MW	2309	MW	2313	MW	2317	MW	2321	MW	2325	MW	2329	MW	2333	MW	2337	MW	2341	MW	2345	MW	2349	MW	2353	MW	2357	MW	2361	MW	2365	MW	2369	MW	2373	MW	2377	MW	2381	MW	2385	MW	2389	MW	2393	MW	2397	MW	2401	MW	2405	MW	2409	MW	2413	MW	2417	MW	2421	MW	2425	MW	2429	MW	2433	MW	2437	MW	2441	MW	2445	MW	2449	MW	2453	MW	2457	MW	2461	MW	2465	MW	2469	MW	2473	MW	2477	MW	2481	MW	2485	MW	2489	MW	2493	MW	2497	MW	2501	MW	2505	MW	2509	MW	2513	MW	2517	MW	2521	MW	2525	MW	2529	MW	2533	MW	2537	MW	2541	MW	2545	MW	2549	MW	2553	MW	2557	MW	2561	MW	2565	MW	2569	MW	2573	MW	2577	MW	2581	MW	2585	MW	2589	MW	2593	MW	2597	MW	2601	MW	2605	MW	2609	MW	2613	MW	2617	MW	2621	MW	2625	MW	2629	MW	2633	MW	2637	MW	2641	MW	2645	MW	2649	MW	2653	MW	2657	MW	2661	MW	2665	MW	2669	MW	2673	MW	2677	MW	2681	MW	2685	MW	2689	MW	2693	MW	2697	MW	2701	MW	2705	MW	2709	MW	2713	MW	2717	MW	2721	MW	2725	MW	2729	MW	2733	MW	2737	MW	2741	MW	2745	MW	2749	MW	2753	MW	2757	MW	2761	MW	2765	MW	2769	MW	2773	MW	2777	MW	2781	MW	2785	MW	2789	MW	2793	MW	2797	MW	2801	MW	2805	MW	2809	MW	2813	MW	2817	MW	2821	MW	2825	MW	2829	MW	2833	MW	2837	MW	2841	MW	2845	MW	2849	MW	2853	MW	2857	MW	2861	MW	2865	MW	2869	MW	2873	MW	2877	MW	2881	MW	2885	MW	2889	MW	2893	MW	2897	MW	2901	MW	2905	MW	2909	MW	2913	MW	2917	MW	2921	MW	2925	MW	2929	MW	2933	MW	2937	MW	2941	MW	2945	MW	2949	MW	2953	MW	2957	MW	2961	MW	2965	MW	2969	MW	2973	MW	2977	MW	2981	MW	2985	MW	2989	MW	2993	MW	2997	MW	3001	MW	3005	MW	3009	MW	3013	MW	3017	MW	3021	MW	3025	MW	3029	MW	3033	MW	3037	MW	3041	MW	3045	MW	3049	MW	3053	MW	3057	MW	3061	MW	3065	MW	3069	MW	3073	MW	3077	MW	3081	MW	3085	MW	3089	MW	3093	MW	3097	MW	3101	MW	3105	MW	3109	MW	3113	MW	3117	MW	3121	MW	3125	MW	3129	MW	3133	MW	3137	MW	3141	MW	3145	MW	3149	MW	3153	MW	3157	MW	3161	MW	3165	MW	3169	MW	3173	MW	3177	MW	3181</

U. S. ARMY ENGINEER DISTRICT, PORTLAND
Corps of Engineers
628 Pittock Block
Portland 5, Oregon

RCS NPPGW-52

REPORT ON THE PASSAGE OF FISH AT THE DALLES DAM
July 1960

1. Maximum and minimum air temperatures during the month were 106° and 52° F., respectively. River water temperature rose from about 63° to 69° F. There was no precipitation during the month. Secchi disc turbidity readings increased from about 3.6 to 4.6 feet.

2. River discharge fell irregularly from about 321,000 c.f.s. to about 176,000 c.f.s. The forebay level was generally maintained at an elevation between 159.5 and 160.0 feet m.s.l. except for 31 July when it was lowered to 156.2 feet. Tailwater elevations ranged from 84.2 to 76.7 feet in elevation.

3. The major July 1960 fish counts for The Dalles and Bonneville Dams are shown below:

<u>Species</u>	<u>The Dalles Dam</u>	<u>Bonneville Dam</u>
Chinook	22,549	19,923
Blueback	22,228	17,615
Steelhead	28,218	44,026
Shad	59,152	57,962

Other fish counted at The Dalles were: 2,361 miscellaneous trout, 10,507 carp, 10,997 chubs, 47,862 suckers, 22,701 squawfish, 136 whitefish, 4,449 shiners, 3 tench, 11 ling, 8 catfish, 124 crappies, 77 bass and 168,953 lampreys.

4. The fishlock was operated on 12 July 1960 for observation by fish agency representatives. The demonstration was successful except that fish were seen to move in and out of the lock quite readily revealing the need for a trap to retain the fish in the lock after entry. At certain times considerable jumping by salmon was also seen in the fishlock holding pool. Except as noted above the fishlock and approach channel operated very satisfactorily.

5. Installation of tarpaulin shades over the north shore fish counting station and visitors observation area made counting much easier and cut down the number of fish turning back at the counting station.

6. A carp leaped into and cracked one of the counting board hydrosopes.

7. A power load rejection caused a surge of water down the fish ladders on 26 July but it caused very little if any damage.

8. Hundreds of sea gulls were seen feeding in the water area immediately below the spillway.

9. Early in July the U. S. Fish and Wildlife Service captured a number of blueback salmon both below and above The Dalles Dam for use in fatigue studies.

2 Incls.

1. July 1960 Weather and Fish Count Table
2. July 1960 Scrap Fish Count Table

WEATHER DATA AND FISH COUNT

July 1960

The Dalles Dam

Computed

July	Air Temp.		Water	Barometer	Weather Char. of Day	Turb- idity	Total River Dis. 8 AM.	Precip- itation	Chinook	Blue- back	Silver Chum	Hump- back	Steel head	Total
	Max	Min	Temp											
1	72	56	63	29.92	Ptly cldy	3.6	321.1	0	1,283	2,740			238	4,261
2	83	52	62	30.03	Clear	3.6	337.0	0	1,079	2,083			254	3,416
3	85	60	63	29.96	Clear	3.6	346.9	0	969	1,691			264	2,924
4	97	50	63	29.89	Clear	3.6	343.0	0	602	1,300			210	2,112
5	100	60	63	29.79	Clear	3.7	340.6	0	530	1,211			195	1,936
6	104	62	64	29.83	Clear	3.6	343.1	0	418	1,082			195	1,695
7	94	67	64	29.79	Clear	3.7	339.2	0	600	1,454			260	2,314
8	85	60	64	29.80	Clear	3.6	348.8	0	711	1,290			270	2,271
9	76	56	63	29.69	Clear	3.5	344.6	0	732	890			333	1,955
10	83	55	64	29.73	Clear	3.6	329.4	0	707	740			295	1,742
11	90	56	64	29.84	Clear	3.8	318.0	0	430	726			269	1,425
12	90	62	64	29.83	Clear	3.9	316.4	0	464	837			326	1,627
13	87	63	64	29.84	Clear	3.7	302.3	0	523	768			431	1,722
14	90	62	65	29.85	Clear	3.9	287.7	0	473	598			432	1,503
15	96	63	65	29.79	Clear	4.1	288.6	0	356	497			428	1,281
16	106	63	65	29.87	Clear	4.1	282.2	0	520	567			511	1,598
17	95	70	65	29.84	Clear	4.1	274.5	0	446	473			652	1,571
18	93	70	65	29.73	Clear	4.2	275.2	0	370	438			553	1,361
19	89	65	68	29.70	Clear	3.8	262.0	0	446	457			749	1,652
20	88	63	68	29.69	Clear	4.3	266.0	0	729	389			737	1,855
21	90	62	68	29.73	Clear	4.4	268.4	0	626	295			834	1,755
22	81	58	68	29.85	Clear	4.5	261.2	0	1,111	334			1,176	2,621
23	80	56	68	29.86	Clear	4.5	251.3	0	1,046	288			1,818	3,152
24	93	55	67	29.87	Clear	4.8	253.5	0	899	315			1,983	3,197
25	94	59	68	29.82	Clear	4.7	235.6	0	789	172			2,097	3,058
26	97	70	68	29.76	Cldy	4.0	231.0	0	919	118			1,525	2,562
27	98	69	67	29.83	Clear	4.3	200.3	0	1,126	152			2,177	3,455
28	94	64	68	29.80	Clear	4.2	242.9	0	1,127	165			3,144	4,436
29	94	64	69	29.70	Clear	4.4	210.1	0	920	52			2,005	2,977
30	84	70	69	29.65	Cldy	4.5	175.5	0	906	61			2,178	3,145
31	87	64	68	29.76	Clear	4.6	245.0	0	692	45			1,679	2,416
									22,549	22,228			28,218	72,995

G-4 (3)

SCRAPPISH COUNT

The Dalles Dam

July 1960

Computed

July	Misc. Shad	Trout	Carp	Chub	Sucker	Squawfish	White fish	Shiner	Tench	Ling	Cat- fish	Bull- head	Crappie	Bass	Lamprey	Total
1	3,828	103	312	1,094	5,769	2,090	29	227	1				27	2	452	13,932
2	3,320	151	194	730	5,109	1,692	9	199					15	3	482	11,904
3	4,934	151	203	726	4,595	2,015	35	136		5			6	4	1,240	14,050
4	3,597	143	219	646	3,471	1,445	13	126					14	1	3,464	13,139
5	2,283	66	277	872	2,644	1,249	8	199							2,513	10,111
6	2,551	74	232	592	2,718	1,280	1	177		1	1		5	5	1,710	9,347
7	2,425	49	386	802	2,281	1,322		515							3,405	11,185
8	3,189	106	407	548	1,966	1,102	3	427		2	1		5	3	2,259	10,018
9	1,698	160	325	490	1,445	1,004		325					5		1,246	6,698
10	2,249	69	274	405	1,308	824		152						3	749	6,033
11	1,516	59	337	313	1,119	802		187			1				835	5,169
12	942	58	454	454	1,461	499	5	86					2	1	702	4,664
13	1,367	114	323	480	1,592	481	3	96					3		1,121	5,580
14	2,371	79	281	281	1,091	441	6	62	1	1			9	13	763	5,399
15	2,275	31	249	104	1,066	446	6	48					1		975	5,201
16	3,479	45	738	186	1,124	512	6	40			1				1,716	7,847
17	2,865	61	648	127	929	626		67	1				1		4,162	9,487
18	1,891	54	537	130	1,061	424	1	55							5,795	9,948
19	2,169	64	545	257	850	338	1	86						5	2,539	6,854
20	1,901	54	418	301	865	535		158					5		3,528	7,765
21	1,373	86	380	224	765	381		133					8	1	3,775	7,126
22	921	91	237	163	771	323		57		1					4,420	6,984
23	1,200	75	348	170	573	300	5	45					8	1	9,992	12,717
24	591	85	257	122	451	357		76					3	6	12,701	14,649
25	1,275	49	386	93	358	362	5	68					3	6	12,165	14,770
26	563	15	305	129	435	325		79					1	6	8,060	9,918
27	627	37	241	95	273	268		42							6,187	7,770
28	589	71	202	177	373	406		118		1			3	8	13,775	15,723
29	650	55	402	108	431	272		200					5		25,080	27,203
30	380	72	242	84	449	312		110						1	25,052	26,703
31	133	34	148	94	519	268		153						3	8,090	9,447
<hr/>																
	59,152	2361	10507	10997	47,862	22,701	136	4,449	3	11	4	4	124	77	168,953	327,341

(7) 7-9

DAILY FISHWAYS REPORT - -----

Weather	Water Temperature	°F.	Date
Air Temperature: Max.	°F. Min.	°F.	Turbidity

DISCHARGE		GAGE READINGS		
(Preceding 24 Hours)		FOREBAY		TAILWATER
Powerhouse	c.f.s.	Powerhouse	ft. msl	ft. msl
Spillway	c.f.s.	Spillway	ft. msl	ft. msl
	c.f.s.			
	c.f.s.			

SPILLWAY GATE POSITIONS

Bay No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	
Latches Open (10:00 A.M.)																								

FISH COUNTED THROUGH FISHWAYS

UPSTREAM MIGRATION																								TOTAL
Chinook Salmon, Except "Jacks"																								
Chinook Salmon, "Jacks" only																								
Blueback																								
Silver Salmon																								
Chum Salmon																								
Steelhead Trout																								
SUB-TOTAL																								
Shad																								
Miscellaneous Trout																								
Carp																								
Chub																								
Sucker																								
Squawfish																								
Whitefish																								
Shiner																								
Croppie																								
Bullhead																								
Sturgeon																								
SUB-TOTAL																								
TOTAL - ALL FISH																								
Fingerlings, Downstream																								

Remarks:

TO: Multiple Purpose Projects Branch Operations Division				POWER PRODUCTION REPORT			
District: PORTLAND, OREGON				Month & Year		Reports Control Symbol NPPVK - 57	
GENERATION				DISPOSITION			
GENERATOR NUMBER	MWH	GENERATOR NUMBER	MWH	LOCATION	LOCAL USE MWH	TO MWH	
1		12		STATION			
2		13		PROJECT			
3		14		NAVIGATION LOCK			
4		15		SPILLWAY			
5		16		FISHWAY			
6				BUILDINGS AND GROUNDS			
7				TO OTHERS			
8				UNACCOUNTED AND LOSSES			
9							
10							
11							
TOTAL GENERATION				TOTALS			
CONDENSER POWER			OTHER DATA				
UNIT	MWH	SUBJECT	MWH	TIME	DATE		
1		5 Minute Peak		M.			
2		Clock Hour Peak		M.			
3		PLANT FACTOR: TOTAL GENERATION / (N.P. Rating X Total Hours in the Month)				%	
TOTAL IN-SERVICE HOURS (All Units Except House Units)							
NET GENERATION REPORTED ON FPC FORM 4 -							
Remarks:							
Distribution:				Project Engineer:		G-6	

