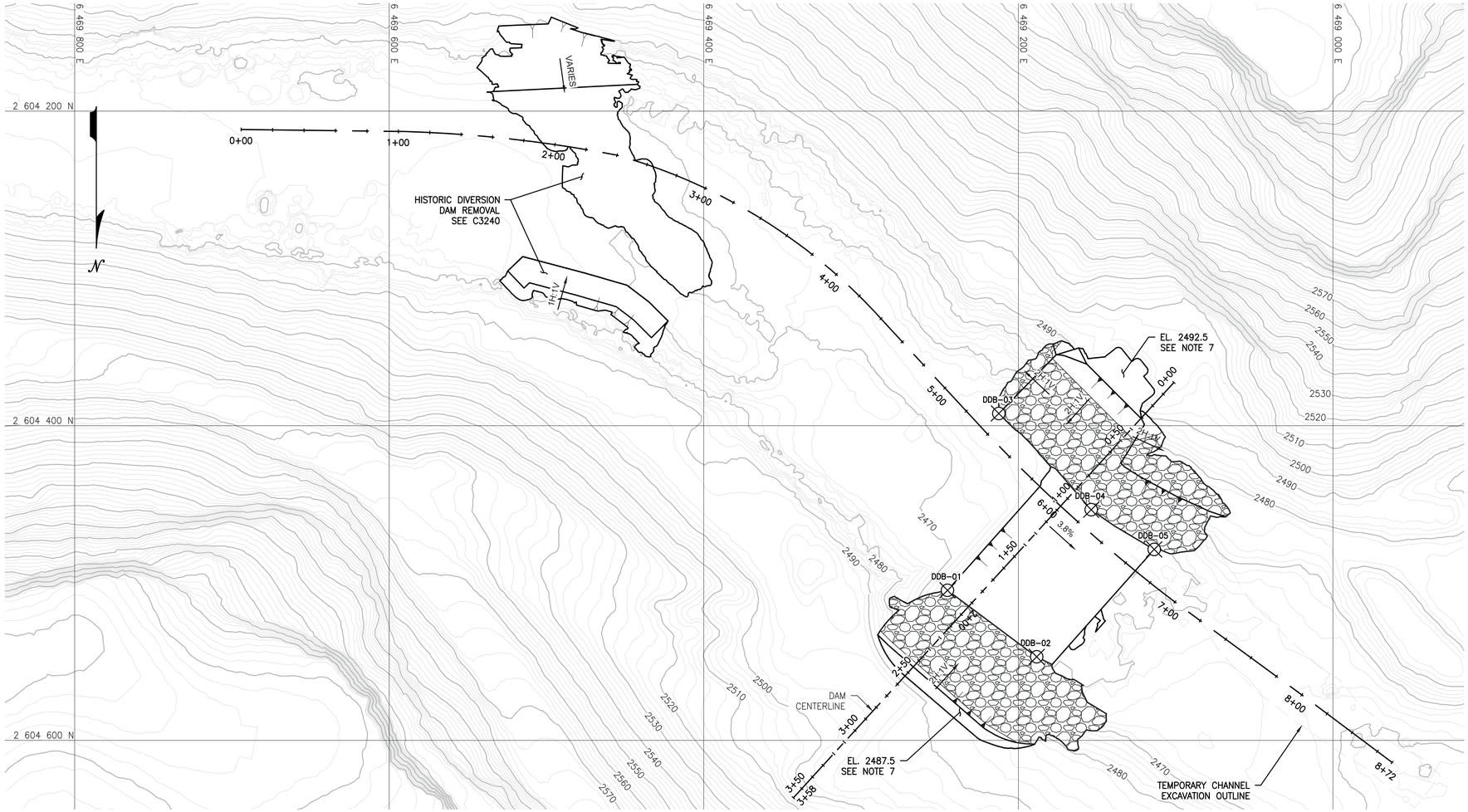
UNITED STATES OF AMERICA
BEFORE THE
FEDERAL ENERGY REGULATORY COMMISSION

Klamath River Renewal Corporation **PacifiCorp**	**Project Nos. 14803-001;** **2082-063**

AMENDED APPLICATION FOR SURRENDER OF LICENSE FOR MAJOR PROJECT AND REMOVAL OF PROJECT WORKS

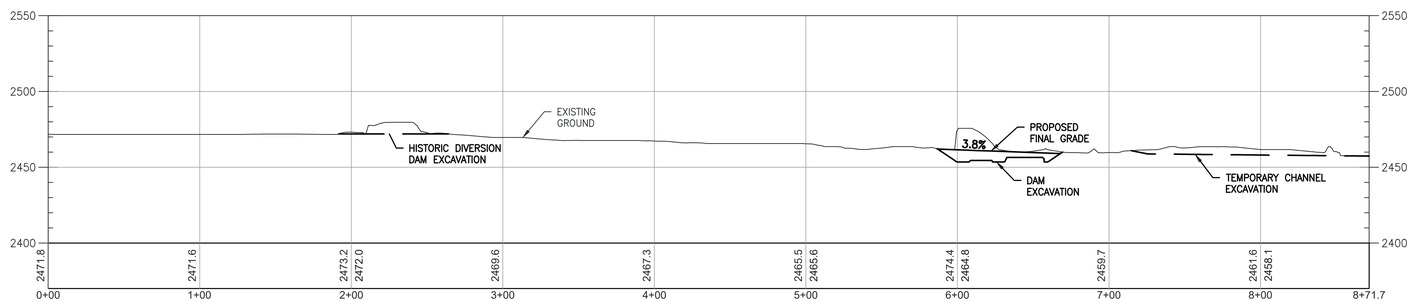
EXHIBIT K (2 of 2)
Reservoir Drawdown and Diversion Plan
(Amended December 15, 2021)

PUBLIC VERSION



PLAN

1" = 40'



PROFILE

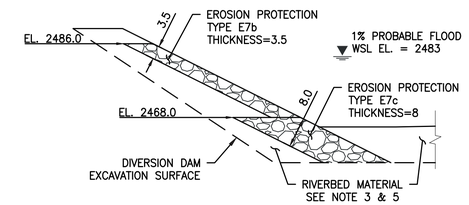
1" = 50'

FOR INFORMATION ONLY

NOTES:

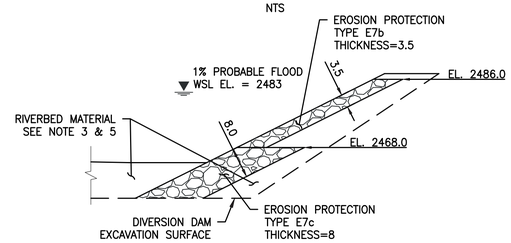
1. REFER TO GENERAL NOTES ON DRAWING G0006 FOR INFORMATION REGARDING TOPOGRAPHIC AND BATHYMETRIC DATA SOURCES.
2. THE RIVER CHANNEL SHALL BE BACKFILLED TO THE EXTENTS SHOWN WITH RIVERBED MATERIAL, EXCEPT FOR AREAS THAT ARE SPECIFIED AS EROSION PROTECTION. RIVERBED MATERIAL MAY BE INTERMIXED WITH THE CONCRETE RUBBLE STORED IN THE INTAKE STRUCTURE AT THE DISCRETION OF THE CONTRACTOR, SEE DRAWING C3232.
3. MATERIAL STOCKPILED ON THE RIGHT BANK UPSTREAM OF THE COPCO NO. 1 DAM ORIGINATES FROM THE HISTORIC COPCO NO. 1 DAM EXCAVATION AND IS ASSUMED TO BE SUITABLE FOR DIRECT PLACEMENT AS RIVERBED MATERIAL. RIVERBED MATERIAL NOT SOURCED FROM THIS AREA MUST BE WELL GRADED MATERIAL WITH AN UPPER PARTICLE SIZE OF APPROXIMATELY 36 in, AND A 15% MAXIMUM OF MATERIAL SMALLER THAN 6 in (BY VOLUME).
4. CHANNEL BACKFILL TO BE BLENDED WITH NATURAL RIVER BED AT FILL EXTENTS.
5. PRIOR TO PLACEMENT OF EROSION PROTECTION THE EXCAVATION OR PLACED SUBGRADE SURFACE SHALL BE VISUALLY FREE OF FINES TO ALLOW FOR DIRECT EROSION PROTECTION PLACEMENT.
6. EROSION PROTECTION MATERIAL SHALL BE TAMPED BY THE CONTRACTOR TO INCREASE INTERLOCK AFTER PLACEMENT.
7. SEE DRAWING C3620 FOR SURFACING REQUIREMENTS.

WORK POINTS TABLE			
WORK POINTS	EASTING	NORTHING	ELEVATION
DDB-01	6469245.0	2604504.7	2462.0
DDB-02	6469188.3	2604546.9	2459.4
DDB-03	6469212.4	2604392.2	2461.6
DDB-04	6469153.7	2604453.4	2460.7
DDB-05	6469113.6	2604478.6	2459.0



TYPICAL LEFT BANK EROSION PROTECTION DETAIL

NTS



TYPICAL RIGHT BANK EROSION PROTECTION DETAIL

NTS

LEGEND:

EROSION PROTECTION (E7b/E7c)

0 50 100 150

1" = 50'

0 40 80 120

1" = 40'

REV	DESCRIPTION	BY	CHK	APP	DATE
E	ISSUED WITH DRAFT 100% DESIGN REPORT	CAV	SY	SRM	11/13/20
D	ISSUED WITH DRAFT 100% DESIGN REPORT	CAV	SY	SRM	10/07/20
C	ISSUED WITH 90% DESIGN REPORT	CAV	NB	SRM	08/05/20
B	ISSUED WITH 60% DESIGN REPORT	CAV	NB	SRM	02/07/20
A	ISSUED WITH DRAFT 60% DESIGN REPORT	CAV	NB	SRM	12/17/19

WARNING
0 1/2 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

PREPARED BY: Knight Piésold CONSULTING; Kiewit

DESIGNED	C. VOS
DRAWN	R. PENG
REVIEWED	S. YONG
IN CHARGE	N. BISHOP
APPROVED	S. MOTTRAM

PREPARED FOR: KLAMATH RIVER RENEWAL CORPORATION

PROJECT: KLAMATH RIVER RENEWAL PROJECT

SHEET TITLE: COPCO NO. 2 FACILITY DIVERSION DAM REMOVAL CHANNEL GRADING PLAN AND PROFILE

PROJ #	VA103-640/1
DATE	11/13/2020
DWG	C3234

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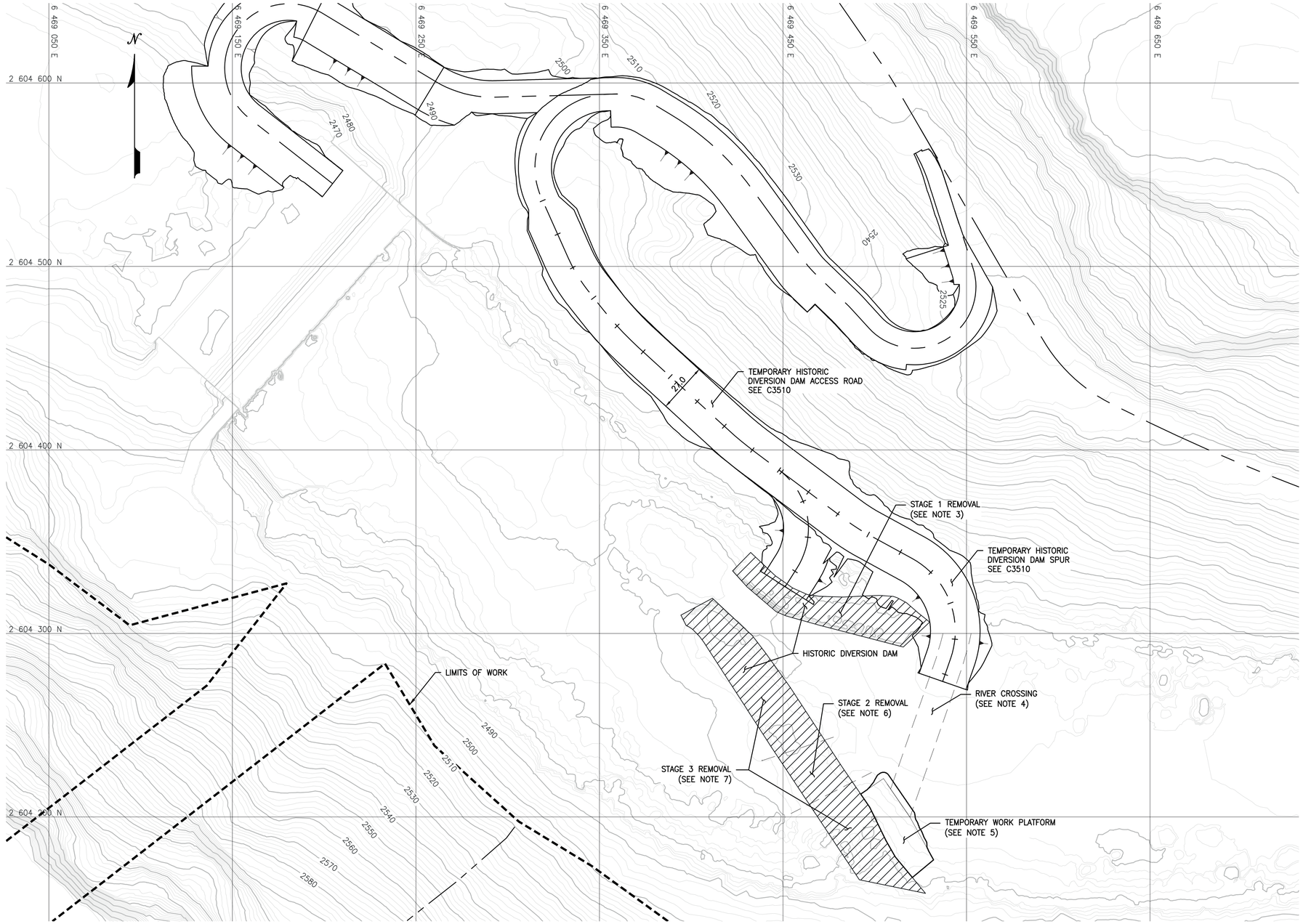

PLAN
1" = 30'

NOTES:

1. REFER TO GENERAL NOTES ON DRAWING G0006 FOR INFORMATION REGARDING TOPOGRAPHIC AND BATHYMETRIC DATA SOURCES.
2. REMOVE HISTORIC DIVERSION DAM TO SURROUNDING NATURAL RIVER GRADE.
3. STAGE 1 – REMOVE RIGHT BANK PORTION OF HISTORIC DIVERSION DAM FIRST TO WIDEN THE HISTORIC DIVERSION DAM OPENING AND LOWER THE RIVER LEVEL.
4. CONTRACTOR TO CROSS RIVER DURING LOW FLOW MONTHS. SURROUNDING MATERIAL MAY BE USED TO CREATE A PATH THROUGH THE RIVER IF DEPTH OF WATER IS TOO DEEP TO OPERATE THROUGH.
5. A TEMPORARY WORK PLATFORM SHALL BE CREATED FROM SURROUNDING MATERIAL AS REQUIRED BY THE CONTRACTOR.
6. STAGE 2 – THE PORTION OF THE HISTORIC DIVERSION DAM THAT BLOCKS THE NATURAL LOW POINT IN THE RIVERBED SHALL BE REMOVED TO PROVIDE AN ALTERNATIVE FLOW PATH FOR THE RIVER.
7. STAGE 3 – THE REMAINDER OF THE HISTORIC DIVERSION DAM SHALL BE REMOVED USING THE CONTRACTORS PREFERRED SEQUENCE AND HANDLING METHODOLOGY.
8. SEE CALIFORNIA OREGON POWER COMPANY COPCO NO. 2 DEVELOPMENT HISTORIC DRAWING E–3290 (DATED 05/27/24) FOR HISTORIC DIVERSION DAM DETAILS.

LEGEND:

DEMOLITION / REMOVAL

LIMITS OF WORK

0 30 60 90
1" = 30'

FOR INFORMATION ONLY

REV	DESCRIPTION	BY	CHK	APP	DATE
E	ISSUED WITH DRAFT 100% DESIGN REPORT	CAV	SY	SRM	11/13/20
D	ISSUED WITH DRAFT 100% DESIGN REPORT	CAV	SY	SRM	10/07/20
C	ISSUED WITH 90% DESIGN REPORT	CAV	NB	SRM	08/05/20
B	ISSUED WITH 60% DESIGN REPORT	CAV	NB	SRM	02/07/20
A	ISSUED WITH DRAFT 60% DESIGN REPORT	CAV	NB	SRM	12/17/19

WARNING
0 1/2 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

PREPARED BY: Knight Piésold CONSULTING; Kiewit

DESIGNED	C. VOS
DRAWN	P. PETKOVIC
REVIEWED	S. YONG
IN CHARGE	N. BISHOP
APPROVED	S. MOTTRAM

PREPARED FOR: KLAMATH RIVER RENEWAL CORPORATION

PROJECT: KLAMATH RIVER RENEWAL PROJECT
PROJ # VA103-640/1
DATE 11/13/2020
SHEET TITLE: COPCO NO. 2 FACILITY HISTORIC DIVERSION DAM REMOVAL PLAN AND REMOVAL NOTES
DWG C3240

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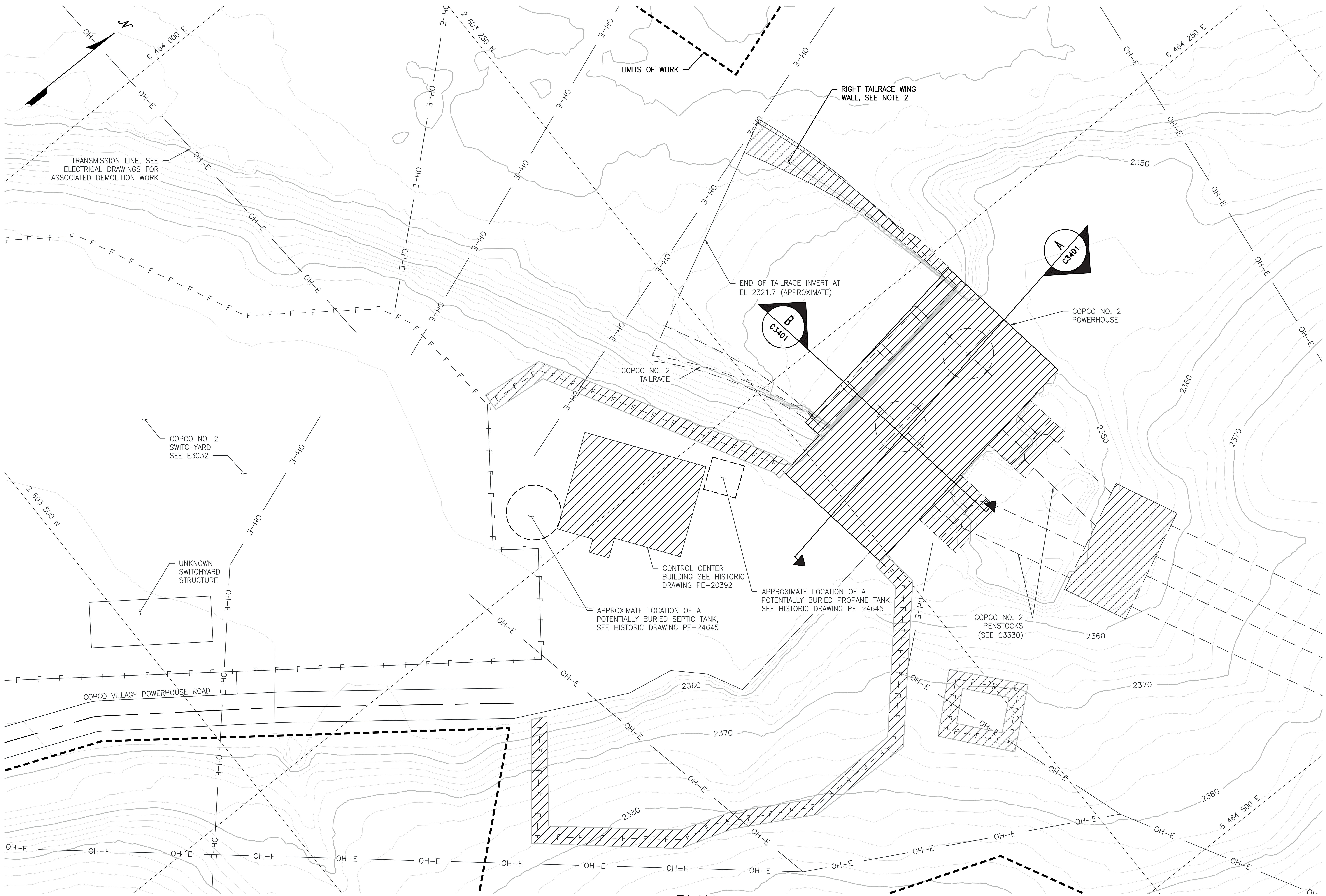

PLAN

1" = 20'

NOTES:

1. REFER TO GENERAL NOTES ON DRAWING G0006 FOR INFORMATION REGARDING TOPOGRAPHIC AND BATHYMETRIC DATA SOURCES.
2. RIGHT TAILRACE WING WALL TO BE REMOVED AND PLACED INTO TAILRACE. SEE DRAWING C3332 FOR EXCAVATION DETAILS.
3. TRANSMISSION LINES AND PART OF THE COPCO NO. 2 SWITCHYARD WILL BE SELECTIVELY REMOVED. SEE ELECTRICAL DRAWINGS FOR ASSOCIATED DEMOLITION WORK.

LEGEND:

- DEMOLITION / REMOVAL
- LIMITS OF WORK

FOR INFORMATION ONLY

0 20 40 60

1" = 20'

REV	DESCRIPTION	BY	CHK	APP	DATE
G	ISSUED WITH DRAFT 100% DESIGN REPORT	CAV	SY	SRM	11/13/20
F	ISSUED WITH 100% DESIGN REPORT	CAV	SY	SRM	10/07/20
E	ISSUED WITH 90% DESIGN REPORT	CAV	NB	SRM	08/05/20
D	ISSUED WITH 60% DESIGN REPORT	CAV	NB	SRM	02/17/20
C	ISSUED WITH DRAFT 60% DESIGN REPORT	CAV	NB	SRM	12/17/19

WARNING

0 1/2 1

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PREPARED BY: Knight Piésold CONSULTING / Kiewit

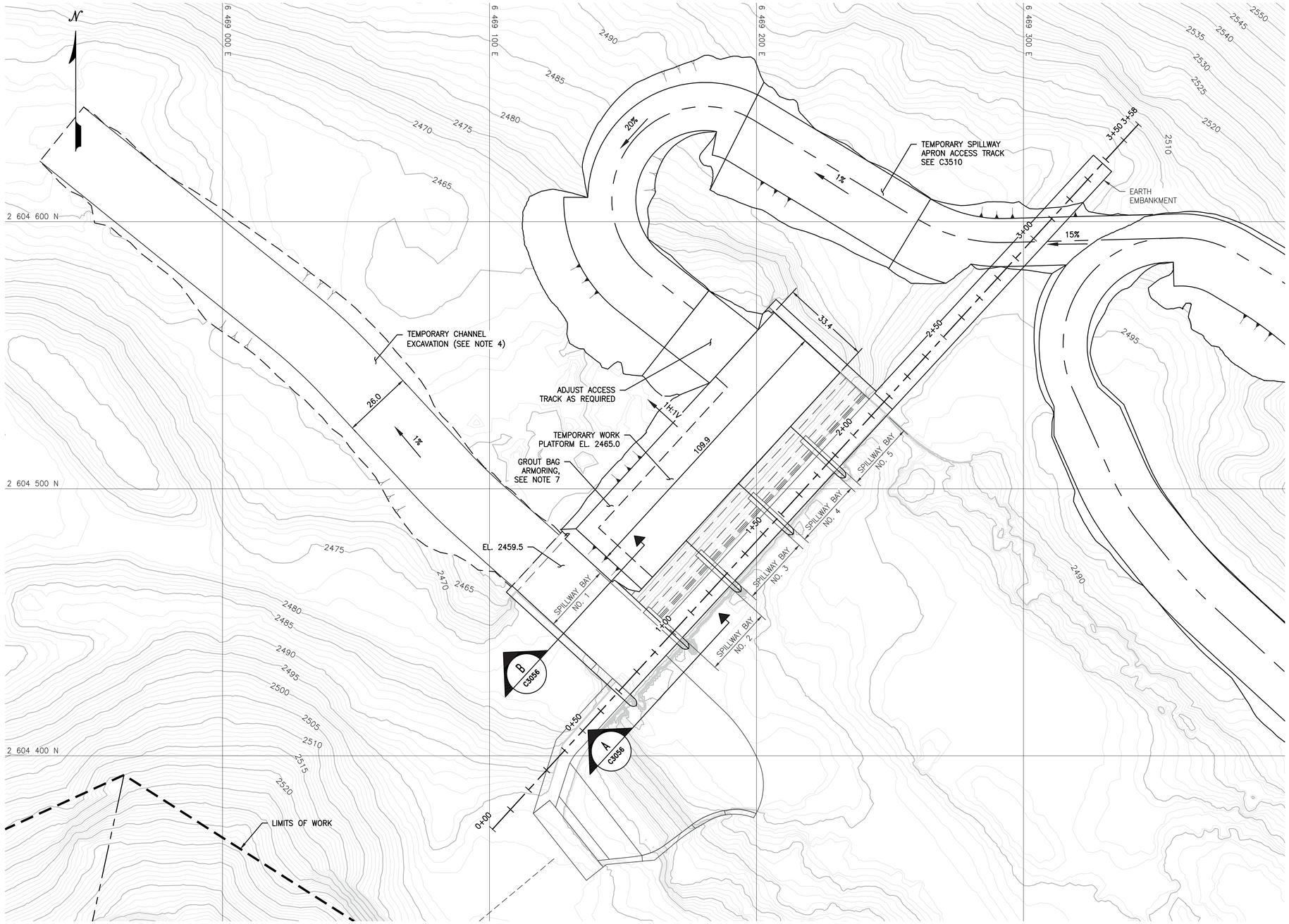
DESIGNED	C. VOS
DRAWN	R. PENG
REVIEWED	S. YONG
IN CHARGE	N. BISHOP
APPROVED	S. MOTTRAM

PREPARED FOR: KLAMATH RIVER RENEWAL CORPORATION

PROJECT: KLAMATH RIVER RENEWAL PROJECT

SHEET TITLE: COPCO NO. 2 FACILITY POWERHOUSE DEMOLITION GENERAL ARRANGEMENT - PLAN

PROJ #	VA103-640/1
DATE	11/13/2020
DWG	C3400



PLAN

SCALE 1" = 20'

NOTES:

1. REFER TO GENERAL NOTES ON DRAWING G0006 FOR INFORMATION REGARDING TOPOGRAPHIC AND BATHYMETRIC DATA SOURCES.
2. LOCATION AND ELEVATION OF EXISTING STRUCTURES TO BE CONFIRMED PRIOR TO DEMOLITION.
3. DAM OUTLINE BASED ON THE CALIFORNIA OREGON POWER COMPANY COPCO 2 DEVELOPMENT HISTORIC DRAWING F-3930 (DATED 05/25/1925).
4. TEMPORARY CHANNEL EXCAVATION DESIGNED TO REDUCE THE RIVER ELEVATION ADJACENT TO THE WORK PLATFORM TO BE CONSTRUCTED AT THE CONTRACTOR'S DISCRETION. WORK PLATFORM MAY NEED TO BE RAISED TO PROVIDE A DRY WORKING SURFACE IN THE EVENT THE TEMPORARY CHANNEL EXCAVATION IS NOT CONSTRUCTED.
5. TEMPORARY CHANNEL EXCAVATION MUST BE BACKFILLED IF EXCAVATED.
6. TEMPORARY WORK PLATFORM TO BE EXCAVATED AS REQUIRED.
7. WORK PLATFORM TO BE ARMORED USING GROUT BAGS OR SIMILAR APPROVED BY ENGINEER.
8. SEE DRAWING C3056 FOR ANTICIPATED WATER LEVELS ALONG SPILLWAY BAY NO. 1 WITH THE TEMPORARY WORK PLATFORM AND TEMPORARY CHANNEL EXCAVATION IN PLACE.

LEGEND:

- - - - - - LIMITS OF WORK

FOR INFORMATION ONLY

0 20 40 60

1" = 20'

REV	DESCRIPTION	BY	CHK	APP	DATE
E	ISSUED WITH DRAFT 100% DESIGN REPORT	CAV	SY	SRM	11/13/20
D	ISSUED WITH DRAFT 100% DESIGN REPORT	CAV	SY	SRM	10/07/20
C	ISSUED WITH 90% DESIGN REPORT	CAV	NB	SRM	08/05/20
B	ISSUED WTIH 60% DESIGN REPORT	CAV	NB	SRM	02/07/20
A	ISSUED WITH DRAFT 60% DESIGN REPORT	CAV	NB	SRM	12/17/19

WARNING
0 1/2 1
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PREPARED BY: Knight Piésold CONSULTING; Kiewit

DESIGNED	C. VOS
DRAWN	R. PENG
REVIEWED	S. YONG
IN CHARGE	N. BISHOP
APPROVED	S. MOTTRAM

PREPARED FOR: KLAMATH RIVER RENEWAL CORPORATION

PROJECT: KLAMATH RIVER RENEWAL PROJECT

SHEET TITLE: COPCO NO. 2 FACILITY
CONSTRUCTION ACCESS - TEMPORARY SPILLWAY APRON ACCESS TRACK AND WORK PLATFORM

PROJ #	VA103-640/1
DATE	11/13/2020
DWG	C3520

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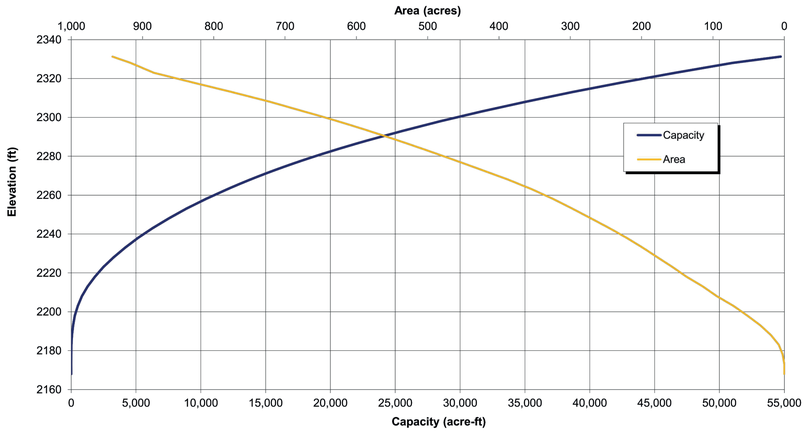

FIGURE 1 – RESERVOIR DEPTH AREA CAPACITY CURVE

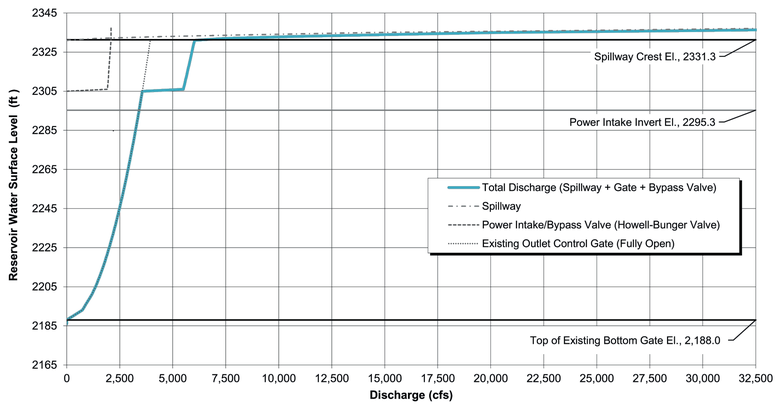

FIGURE 2 – RESERVOIR DRAWDOWN RATING CURVE

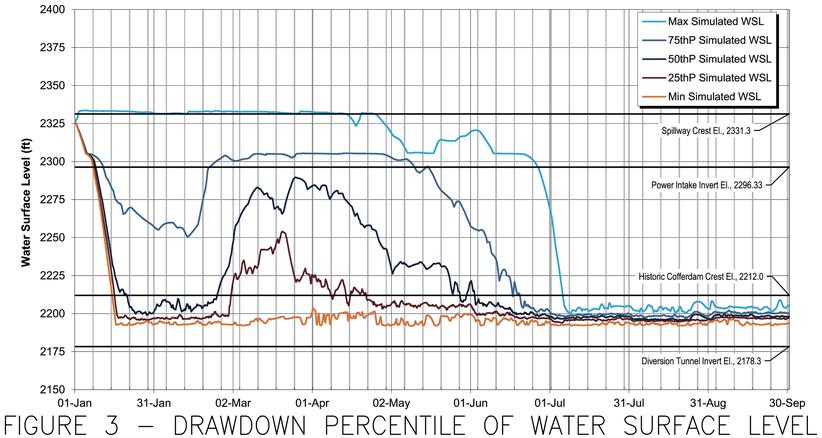

FIGURE 3 – DRAWDOWN PERCENTILE OF WATER SURFACE LEVEL

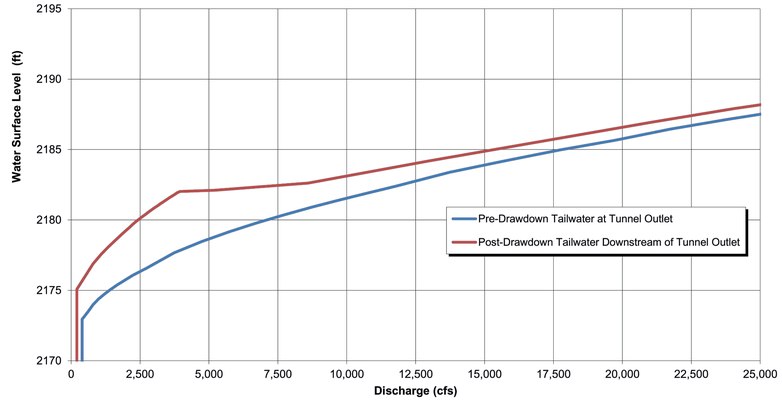

FIGURE 4 – TAILWATER RATING CURVE PRE–DRAWDOWN AND POST–DRAWDOWN

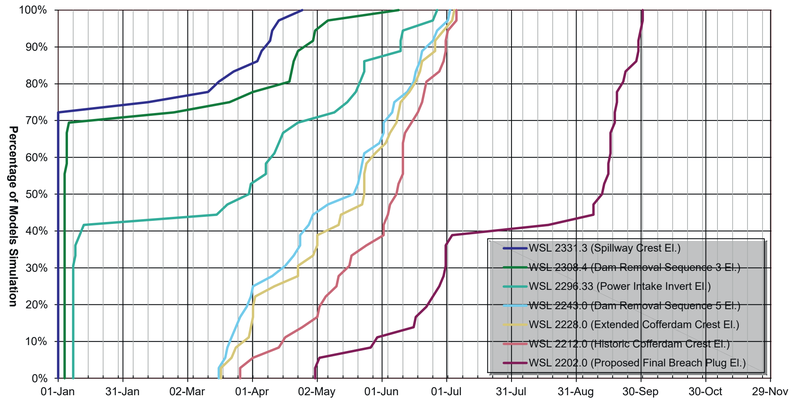

FIGURE 5 – SUSTAINED RESERVOIR DRAWDOWN AT SELECTED ELEVATIONS OVER PERIOD OF RECORD MODEL RUNS BY DATE

NOTES:

1. FOR RESERVOIR DRAWDOWN OPERATIONS NOTES SEE DRAWING C4200.
2. RESERVOIR STORAGE AREA CAPACITY CURVE (FIGURE 1) IS BASED ON THE 2018 BATHYMETRIC SURVEY.
3. DISCHARGE CAPACITIES OF THE SPILLWAY, POWER INTAKE/BY–PASS VALVE (HOWELL–BUNGER VALVE) AND THE EXISTING OUTLET CONTROL GATE ON FIGURE 2 ARE FOR FREE DISCHARGE CONDITIONS.
4. DISCHARGE RATING CURVES ON FIGURE 2 ARE FOR WATER LEVELS IMMEDIATELY UPSTREAM OF THE DAM.
5. PRE–DRAWDOWN TAILWATER SURFACE LEVELS ON FIGURE 3 ARE FOR WATER LEVELS AT THE TUNNEL ACCESS ROAD IMMEDIATELY DOWNSTREAM OF THE DIVERSION TUNNEL OUTLET.
6. POST–DRAWDOWN TAILWATER SURFACE LEVELS ON FIGURE 3 ARE FOR WATER LEVELS DOWNSTREAM OF THE DIVERSION TUNNEL OUTLET AT THE TOE PROTECTION BERM.
7. RESERVOIR WATER LEVELS SHOWN IN FIGURE 4 ARE THE RESERVOIR WATER SURFACE LEVEL MODEL RUN RESULTING PERCENTILES IMMEDIATELY UPSTREAM OF THE DAM USING THE DRAWDOWN MODEL. THE PERCENTILES ARE CALCULATED BASED ON THE ENTIRE 36 YEAR RECORD OF 2019 JOINT BIOLOGICAL OPINION FLOWS FOR THE USBR'S KLAMATH PROJECT. THE RESERVOIR WATER LEVELS ARE SIMULATED USING THE RESERVOIR DRAWDOWN OPERATIONS ON DRAWING C4200. WATER LEVELS CAN BE OUTSIDE OF THESE VALUES DEPENDING ON THE HYDROLOGICAL CONDITIONS DURING THE DRAWDOWN YEAR.
8. THE CURVES SHOWN ON FIGURE 5 REPRESENT THE PERCENTAGE OF MODEL SIMULATIONS AT WHICH RESERVOIR DRAWDOWN WATER SURFACE LEVELS ARE SUSTAINED BELOW SELECTED ELEVATIONS BASED ON THE DRAWDOWN MODEL USING THE ENTIRE 36 YEAR RECORD OF 2019 JOINT BIOLOGICAL OPINION FLOWS FOR THE USBR'S KLAMATH PROJECT. THE ACTUAL DATE A WATER SURFACE LEVEL IS SUSTAINED AT A CERTAIN ELEVATION CAN BE DIFFERENT THAN SHOWN DEPENDING ON THE HYDROLOGICAL CONDITIONS DURING THE DRAWDOWN YEAR AND THE DRAWDOWN SEQUENCING SHOWN ON DRAWINGS C4203 TO C4209.

FOR INFORMATION ONLY

REV	DESCRIPTION	BY	CHK	APP	DATE
E	ISSUED WITH 100% DESIGN REPORT	KTW	HE	SRM	11/13/20
D	ISSUED WITH 100% DESIGN REPORT	KTW	NB	SRM	10/07/20
C	ISSUED WITH 90% DESIGN REPORT	KTW	NB	SRM	08/05/20
B	ISSUED WITH 60% DESIGN REPORT	KTW	NB	SRM	02/07/20
A	ISSUED WITH DRAFT 60% DESIGN REPORT	KTW	NB	SRM	12/18/19

WARNING
0 1/2 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

PREPARED BY: Knight Piésold CONSULTING; Kiewit

DESIGNED	K. WECHSELBERGER
DRAWN	R. PENG
REVIEWED	H. ELWIN
IN CHARGE	N. BISHOP
APPROVED	S. MOTTRAM

PREPARED FOR: KLAMATH RIVER RENEWAL CORPORATION

PROJECT: KLAMATH RIVER RENEWAL PROJECT
SHEET TITLE: IRON GATE FACILITY
HYDROLOGIC AND HYDRAULIC INFORMATION
DRAWDOWN - FIGURES

PROJ #	VA103-640/1
DATE	11/13/2020
DWG	C4050

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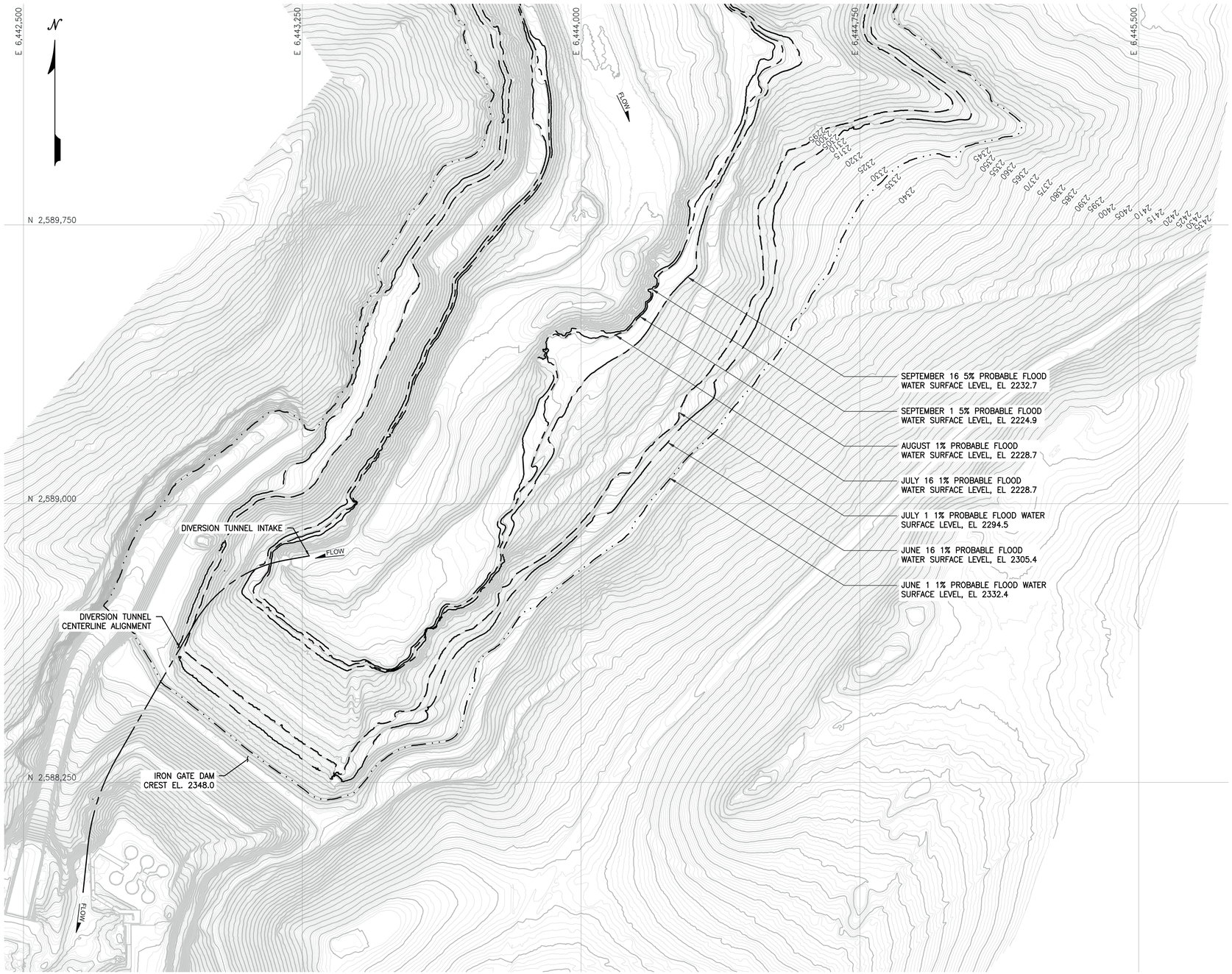

PLAN
1" = 150'

NOTES:

1. ALL COORDINATES ARE NAD83 HARN ZONE 1.
2. ALL DIMENSIONS AND ELEVATIONS ARE SHOWN IN FEET UNLESS NOTED OTHERWISE.
3. WATER SURFACE LEVELS SHOWN INDICATE THE STEADY-STATE WATER SURFACE LEVELS IN THE RESERVOIR SUBJECT TO A PROBABLE FLOOD AND CONSIDERING THE DISCHARGE CAPACITY OF THE DIVERSION TUNNEL WITH THE EXISTING UPPER GATE FULLY OPEN.
4. HYDROLOGIC DATA ARE PRESENTED IN DETAIL FOR ALL MONTHS IN TABLE 1 ON DRAWING C4055.

FOR INFORMATION ONLY

0 150 300 450
1" = 150'

REV	DESCRIPTION	BY	CHK	APP	DATE
E	ISSUED WITH 100% DESIGN REPORT	KTW	HE	SRM	11/13/20
D	ISSUED WITH 100% DESIGN REPORT	KTW	NB	SRM	10/07/20
C	ISSUED WITH 90% DESIGN REPORT	KTW	NB	SRM	08/05/20
B	ISSUED WITH 60% DESIGN REPORT	KTW	NB	SRM	02/07/20
A	ISSUED WITH DRAFT 60% DESIGN REPORT	KTW	NB	SRM	12/18/19

WARNING
0 1/2 1
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IN CHARGE	N. BISHOP
APPROVED	S. MOTTRAM

PREPARED FOR
KLAMATH RIVER RENEWAL CORPORATION

PROJECT
KLAMATH RIVER RENEWAL PROJECT

PROJ # VA103-640/1
DATE 11/13/2020

SHEET TITLE
IRON GATE FACILITY
HYDROLOGIC AND HYDRAULIC INFORMATION - DRAWDOWN WATER SURFACE FLOOD LEVELS - RESERVOIR PLAN

DWG C4051

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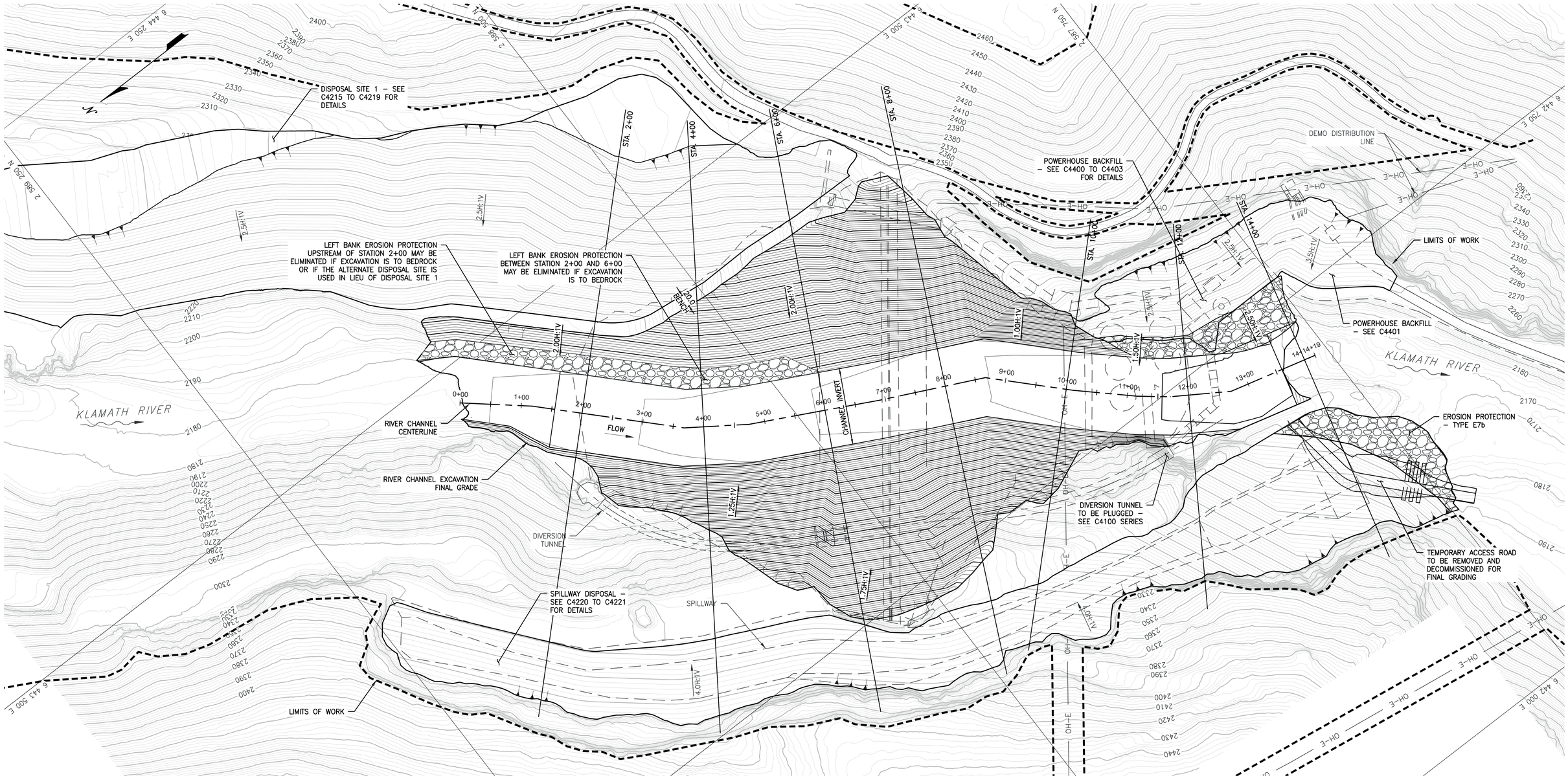
PUBLIC VERSION

CRITICAL ENERGY/ELECTRIC INFRASTRUCTURE INFORMATION

(CEII)

REDACTED

DESIGN SHEET C4203-C4209: COPCO NO. 1 EMBANKMENT REMOVAL



PLAN
1" = 80'

NOTES:

1. REFER TO GENERAL NOTES ON G0006 FOR INFORMATION REGARDING TOPOGRAPHIC AND BATHYMETRIC DATA SOURCES.
2. CONTOUR INTERVALS ARE 2 ft.
3. ALL CORE ZONE MATERIAL (ZONE III) SHALL BE EXCAVATED TO BEDROCK. ALL OTHER EXCAVATED SURFACE SHALL BE TO BEDROCK OR EXCAVATION EXTENTS SHOWN HERE.
4. FOR FINAL GRADE SURFACE TREATMENT, SEE DRAWING SERIES C4600.
5. NO EROSION PROTECTION REQUIRED WHERE EXCAVATION IS TO BEDROCK.

0 80 160 320
1" = 80'

FOR INFORMATION ONLY

REV	DESCRIPTION	BY	CHK	APP	DATE
E	ISSUED WITH 100% DESIGN REPORT	KTW	SY	SRM	11/13/20
D	ISSUED WITH DRAFT 100% DESIGN REPORT	KTW	SY	SRM	10/07/20
C	ISSUED WITH 90% DESIGN REPORT	KTW	SY	SRM	08/05/20
B	ISSUED WITH 60% DESIGN REPORT	KTW	SY	SRM	02/07/20
A	ISSUED WITH DRAFT 60% DESIGN REPORT	KTW	SY	SRM	12/18/19

WARNING
0 1/2 1
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PREPARED BY
Knight Piésold CONSULTING
Kiewit

DESIGNED	K. WECHSELBERGER
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REVIEWED	S. YONG
IN CHARGE	N. BISHOP
APPROVED	S. MOTTRAM

PREPARED FOR
KLAMATH RIVER RENEWAL CORPORATION

PROJECT
KLAMATH RIVER RENEWAL PROJECT

SHEET TITLE
IRON GATE FACILITY
EMBANKMENT REMOVAL
GRADING GENERAL ARRANGEMENT PLAN

PROJ #	VA103-640/1
DATE	11/13/2020
DWG	C4210

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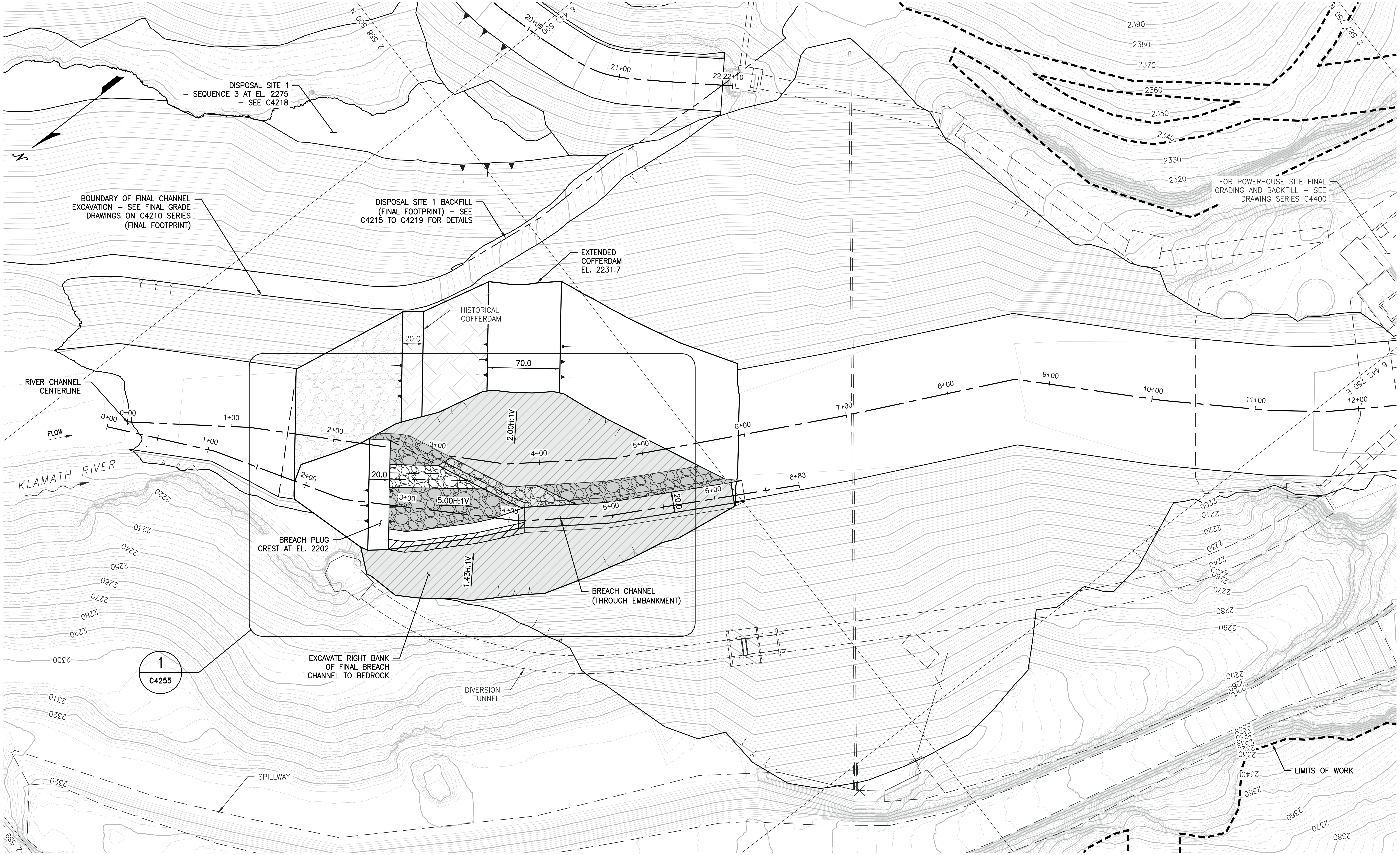


PLAN

1" = 50'

NOTES:

1. REFER TO GENERAL NOTES ON G0006 FOR INFORMATION REGARDING TOPOGRAPHIC AND BATHYMETRIC DATA SOURCES.
2. CONTOUR INTERVALS ARE 2 ft.
3. EMBANKMENT REMOVAL STAGES ARE DEFINED AS THE MAXIMUM EXTENT OF WORK AND ASSOCIATED CUT VOLUME PRIOR TO RELEVANT DATE.
4. EXISTING EMBANKMENT ZONE EXTENTS ARE APPROXIMATE AND SHOWN TO ASSIST CONSTRUCTION PLANNING ONLY. REFER TO HISTORICAL DRAWINGS FOR MORE DETAIL.

LEGEND:

- DEMOLITION / REMOVAL
- (E) EARTHFILL
- (E) RIPRAP
- CORE MATERIAL (ZONE III)
- EROSION PROTECTION (E7b)
- EROSION PROTECTION (E7c)

FOR INFORMATION ONLY

0 80 160 240
1" = 80'

REV	DESCRIPTION	BY	CHK	APP	DATE
C	ISSUED WITH 100% DESIGN REPORT	KTW	HE	SRM	11/13/20
B	ISSUED WITH DRAFT 100% DESIGN REPORT	KTW	HE	SRM	10/07/20
A	ISSUED WITH 90% DESIGN REPORT	KTW	HE	SRM	08/05/20

WARNING
0 1/2 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

PREPARED BY: Knight Piésold CONSULTING / Kiewit

DESIGNED	K. WECHSELBERGER
DRAWN	A. TSENG
REVIEWED	H. ELWIN
IN CHARGE	N. BISHOP
APPROVED	S. MOTTRAM

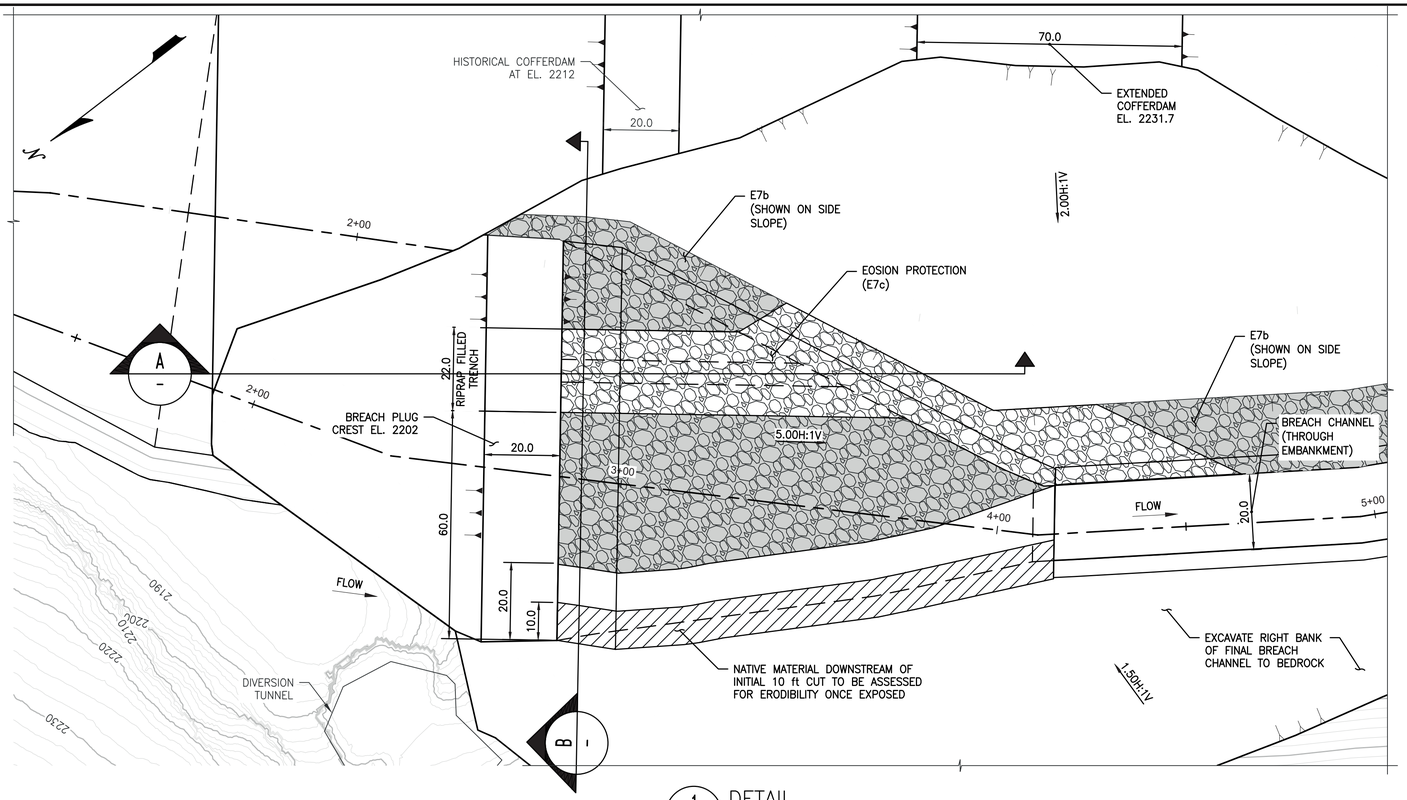
PREPARED FOR: KLAMATH RIVER RENEWAL CORPORATION

PROJECT: KLAMATH RIVER RENEWAL PROJECT

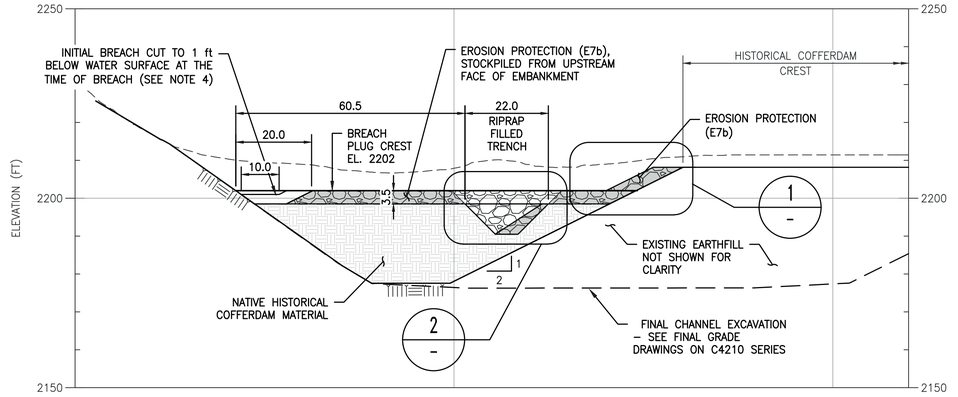
SHEET TITLE: IRON GATE FACILITY EMBANKMENT REMOVAL FINAL BREACH PLAN

PROJ #: VA103-640/1
DATE: 11/13/2020
DWG: C4250

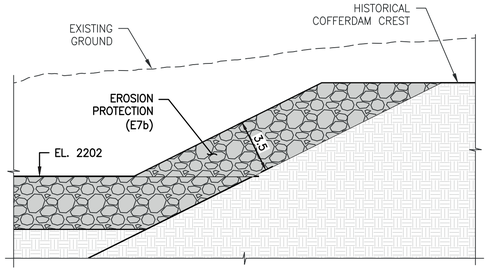
abseng Nov 12, 2020 - 11:05am



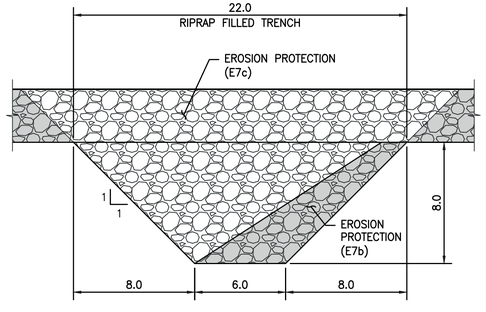
1 / C4250 DETAIL
1" = 20'



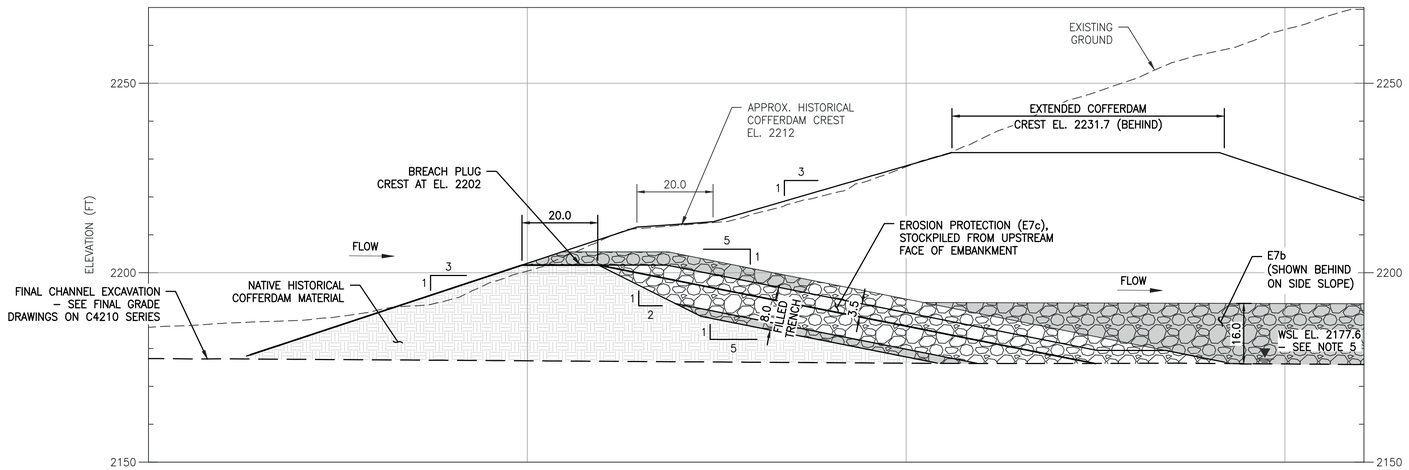
B / – SECTION
1" = 20'



1 / – DETAIL
1" = 5'



2 / – DETAIL
1" = 5'



A / – SECTION
1" = 20'

LEGEND:

- (E) EARTHFILL
- EROSION PROTECTION (E7c)
- EROSION PROTECTION (E7b)
- DEMOLITION / REMOVAL
- BEDDING (E8)

NOTES:

1. REFER TO GENERAL NOTES ON G0006 FOR INFORMATION REGARDING TOPOGRAPHIC AND BATHYMETRIC DATA SOURCES.
2. CONTOUR INTERVALS ARE 2 ft.
3. LIFTS SHALL BE EXCAVATED FROM RIGHT BANK TO LEFT BANK.
4. THE INITIAL BREACH CUT SHALL BE 1ft BELOW THE WATER SURFACE AT THE TIME OF BREACH. FOLLOWING THE INITIAL CUT, FURTHER MECHANICAL BREACH FACILITATION, IF REQUIRED SHALL BE ACHIEVED FROM A HISTORICAL ROCK BENCH ON THE RIGHT ABUTMENT.
5. FOLLOWING THE REMOVAL OF THE TOE PROTECTION BERM UPSTREAM OF THE POWERHOUSE IMMEDIATELY PRIOR TO BREACH THE MEAN MONTHLY TAILWATER LEVEL CONSISTENT WITH INFLOWS DURING THE BREACH WINDOW IS ESTIMATED AT EL. 2177.6 ft. FOR TAILWATER LEVELS ASSOCIATED WITH OTHER RETURN PERIOD INTERVALS SEE SHEET C4055.

0 20 40 60
1" = 20'

FOR INFORMATION ONLY

REV	DESCRIPTION	BY	CHK	APP	DATE
B	ISSUED WITH 100% DESIGN REPORT	KTW	HE	SRM	11/13/20
A	ISSUED WITH DRAFT 100% DESIGN REPORT	KTW	HE	SRM	10/07/20

WARNING
0 1/2 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

PREPARED BY: Knight Piésold CONSULTING; Kiewit

DESIGNED	K. WECHSELBERGER
DRAWN	A. TSENG
REVIEWED	H. ELWIN
IN CHARGE	N. BISHOP
APPROVED	S. MOTTRAM

PREPARED FOR: KLAMATH RIVER RENEWAL CORPORATION

PROJECT: KLAMATH RIVER RENEWAL PROJECT
PROJ # VA103-640/1
DATE 11/13/2020
SHEET TITLE: IRON GATE FACILITY EMBANKMENT REMOVAL FINAL BREACH - BREACH PLUG DETAILS
DWG C4255

atseng Nov 12, 2020 - 12:17hm
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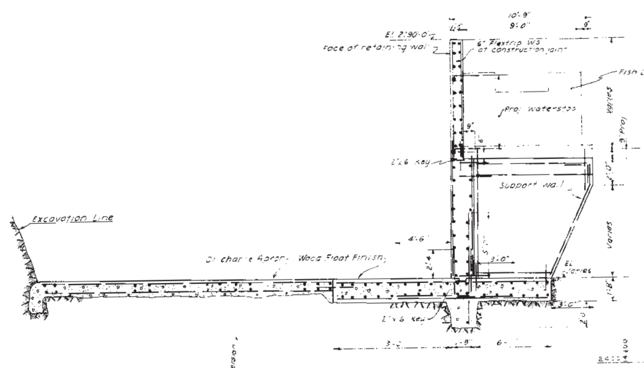
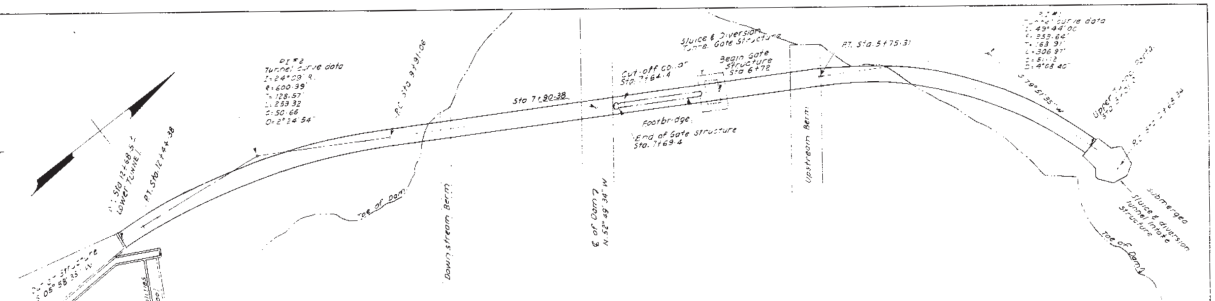
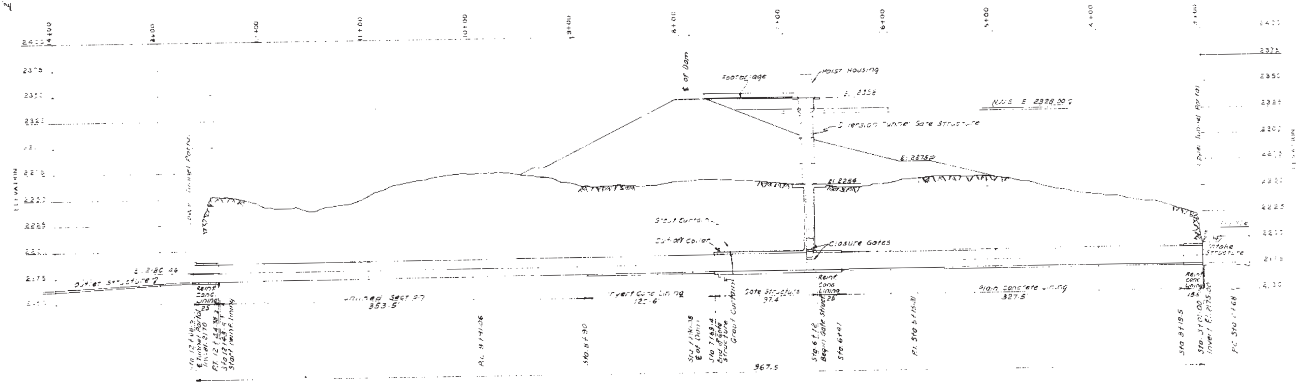


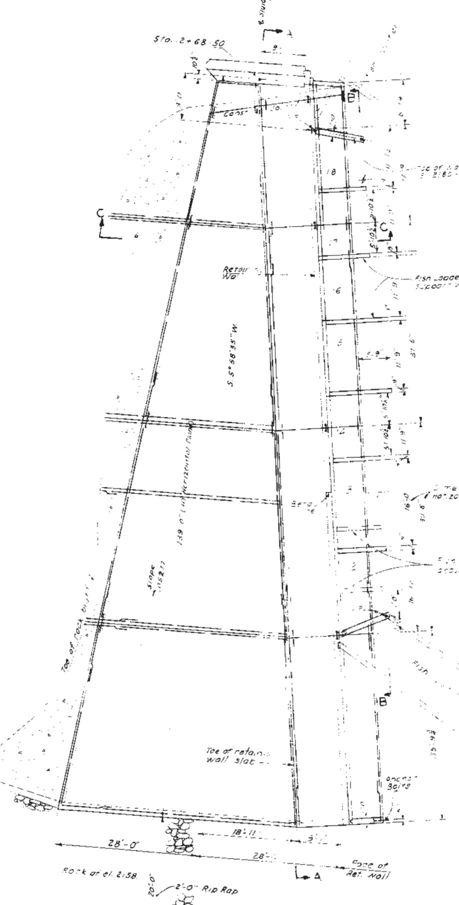
SECTION C-C
SCALE 1/4"=1'-0"



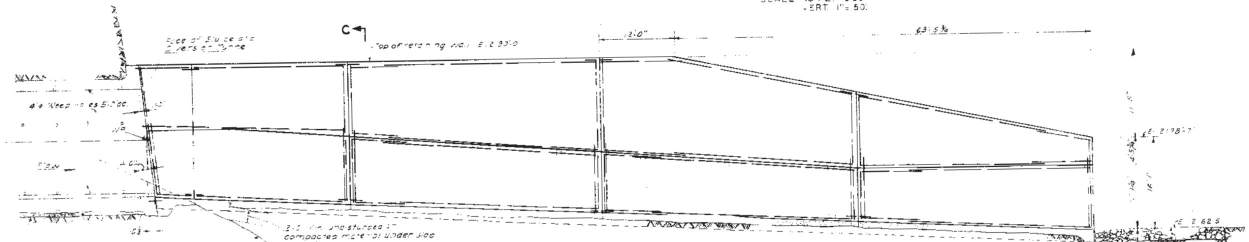
TUNNEL PLAN
SCALE 1"=50'



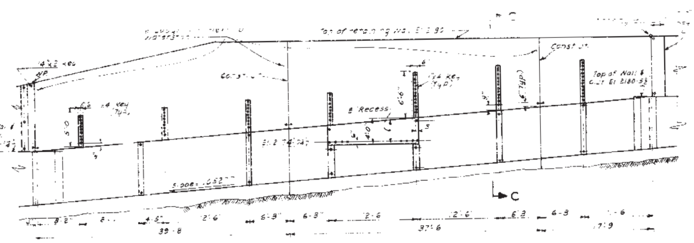
PROFILE ALONG ℄ OF TUNNEL
SCALE: HORIZ. 1"=50'
VERT. 1"=50'



PLAN



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



ELEVATION B-B
SCALE: 1/8"=1'-0"

ELEVATIONS ARE REFERRED TO U.S.G.S. DATUM.

THIS MAP IS A PART OF THE APPLICATION FOR AN AMENDMENT OF LICENSE MADE BY THE UNDERSIGNED THIS 25TH DAY OF MAY, 1962.

PACIFIC POWER & LIGHT COMPANY

BY ______________
VICE PRESIDENT

PACIFIC POWER & LIGHT COMPANY — PORTLAND, OREGON
APPLICATION FOR AMENDMENT OF LICENSE
PROJECT NO. 2082
KLAMATH BASIN PROJECT
IRON GATE DEVELOPMENT
SLUICE & DIVERSION TUNNEL - PLAN & PROFILE
OUTLET STRUCTURE PLAN, ELEVATIONS & SECTION
SCALE: AS NOTED

G-8862 SH. 1

Source: Northwest Hydraulic Consultants Drawdown Model Report for the Klamath River Renewal Project in Appendix G of the 100% Design Report (Knight Piésold, 2020b).

Drawdown Plots for J.C. Boyle Reservoir

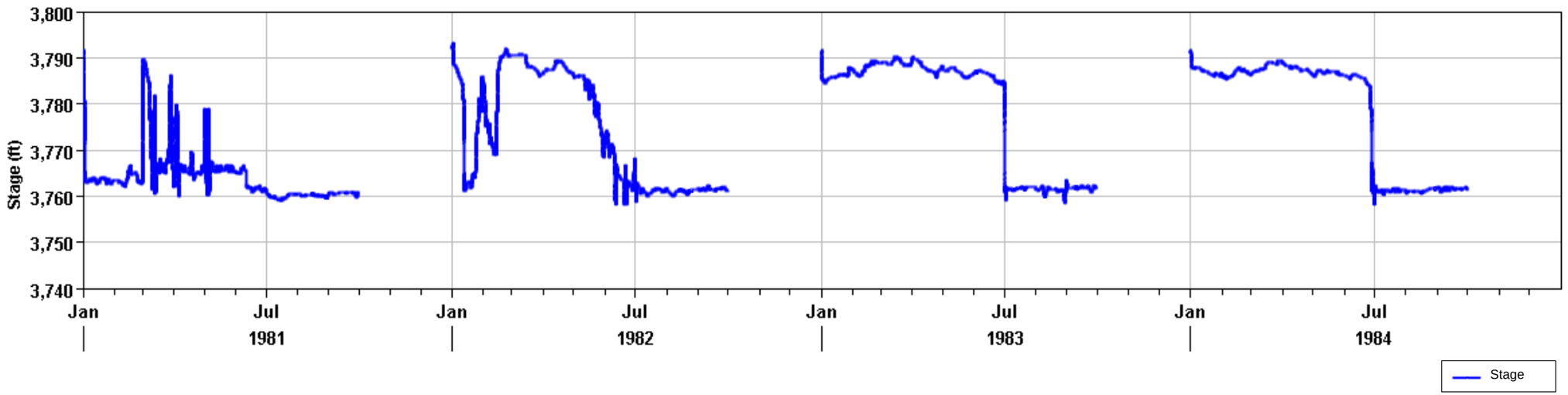


Figure 1: J.C. Boyle Drawdown Stage for years 1981 through 1984

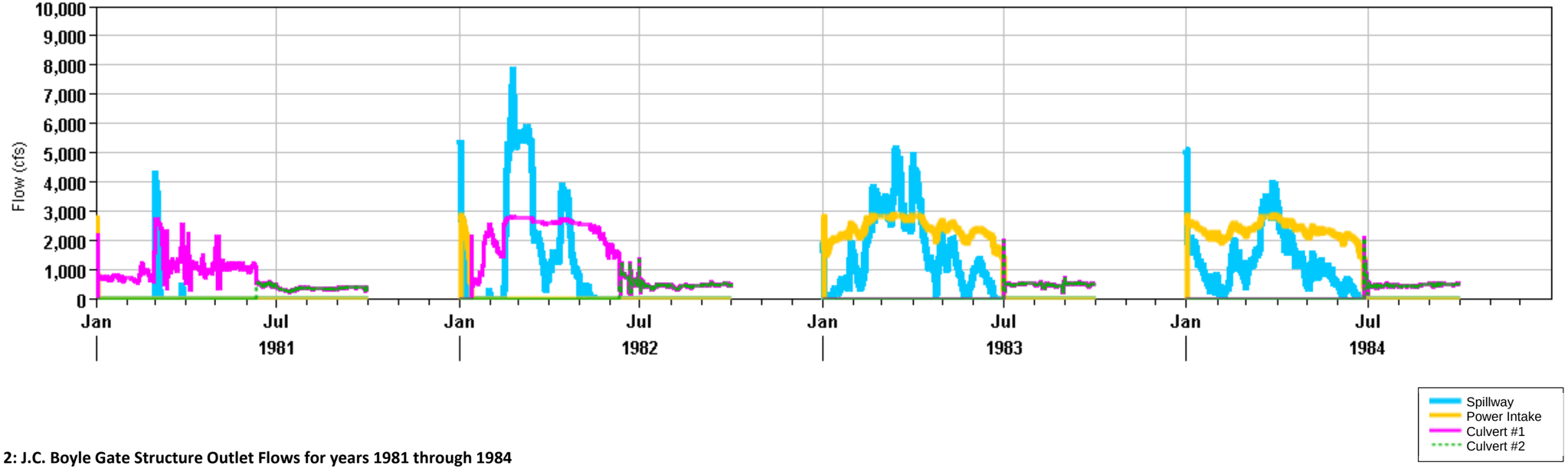


Figure 2: J.C. Boyle Gate Structure Outlet Flows for years 1981 through 1984

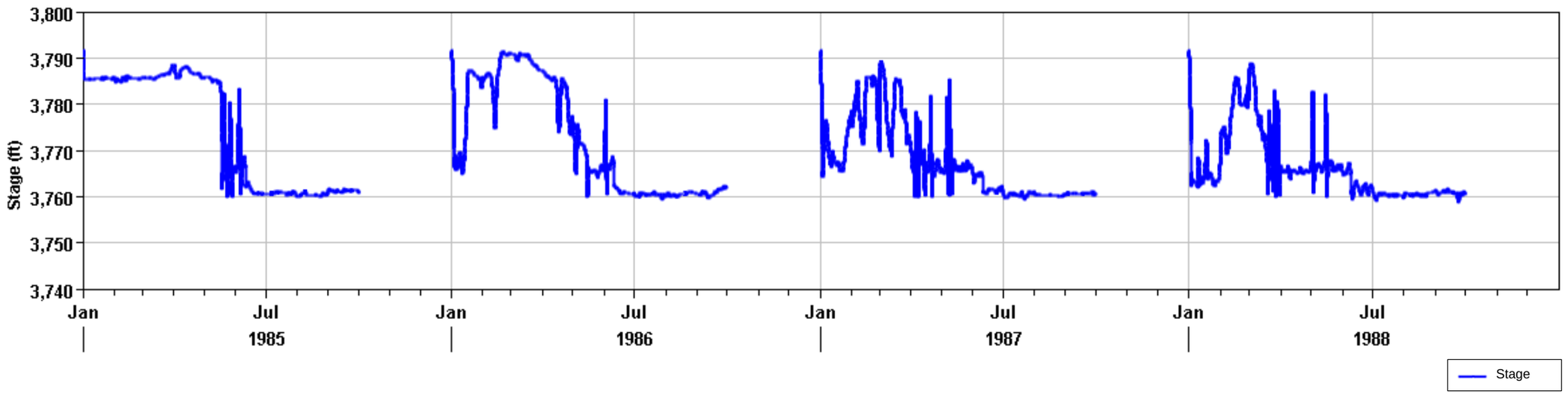


Figure 3: J.C. Boyle Drawdown Stage for years 1985 through 1988

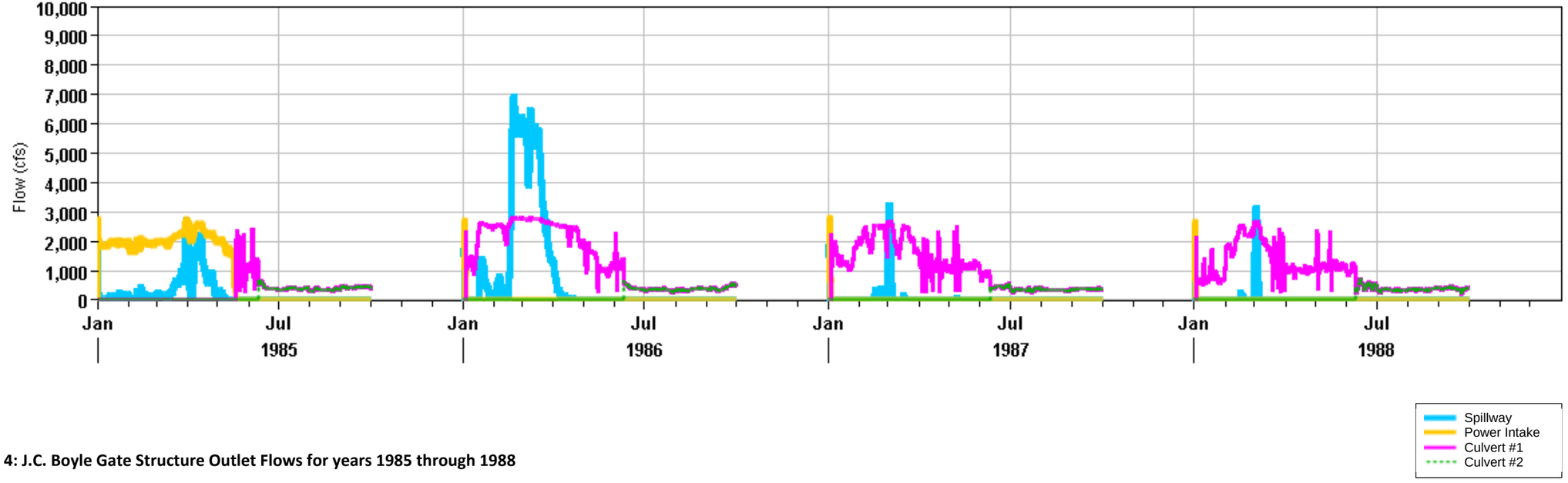


Figure 4: J.C. Boyle Gate Structure Outlet Flows for years 1985 through 1988

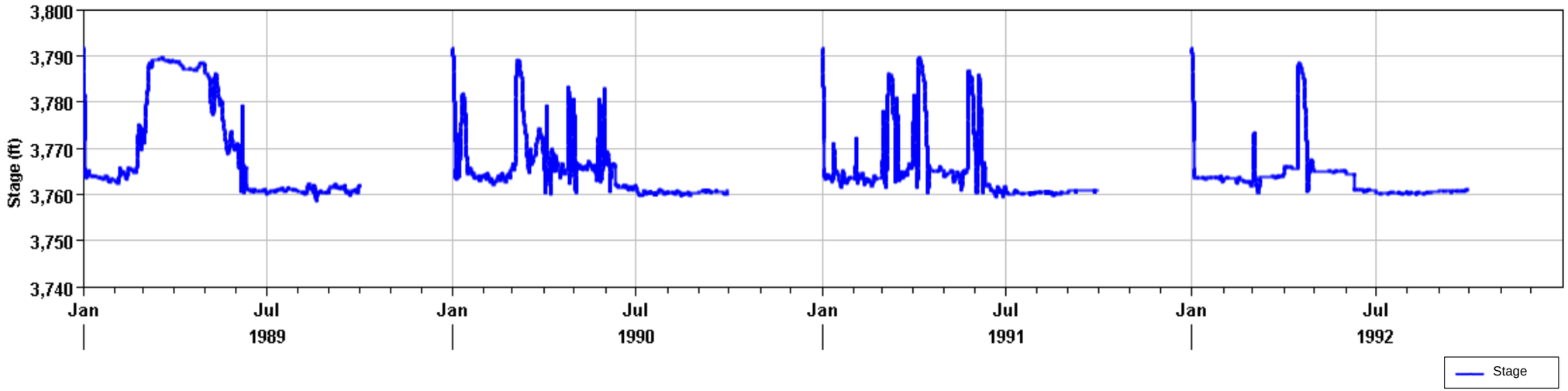


Figure 5: J.C. Boyle Drawdown Stage for years 1989 through 1992

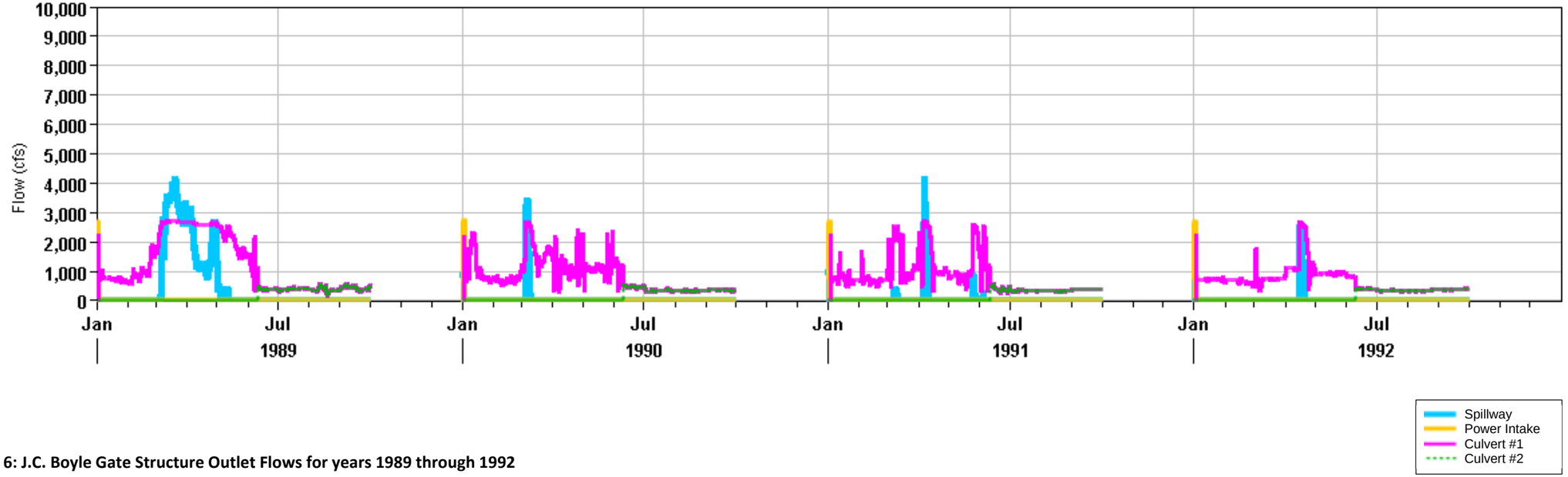


Figure 6: J.C. Boyle Gate Structure Outlet Flows for years 1989 through 1992

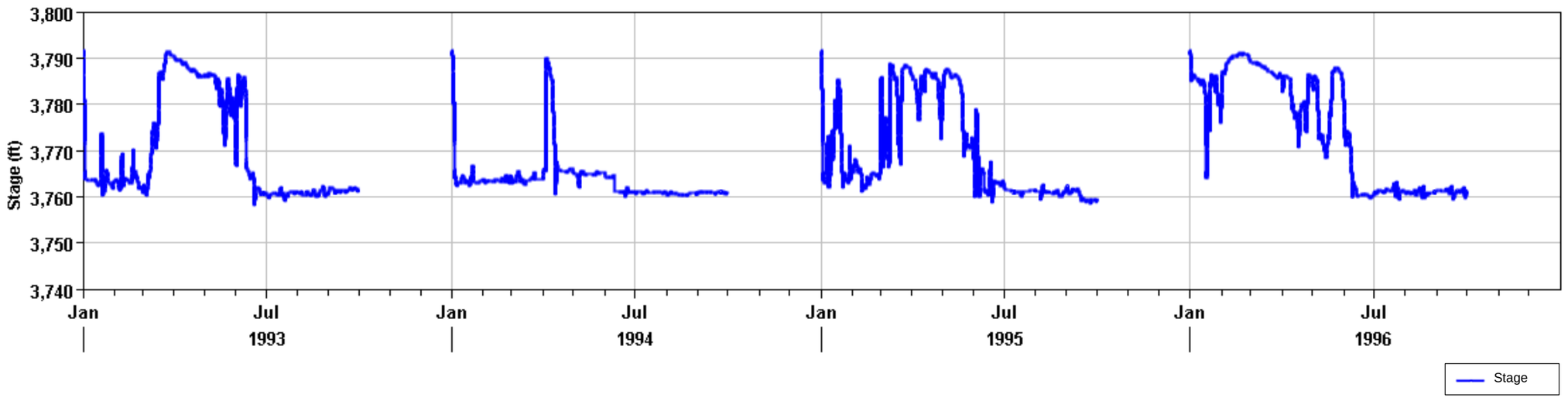


Figure 7: J.C. Boyle Drawdown Stage for years 1993 through 1996

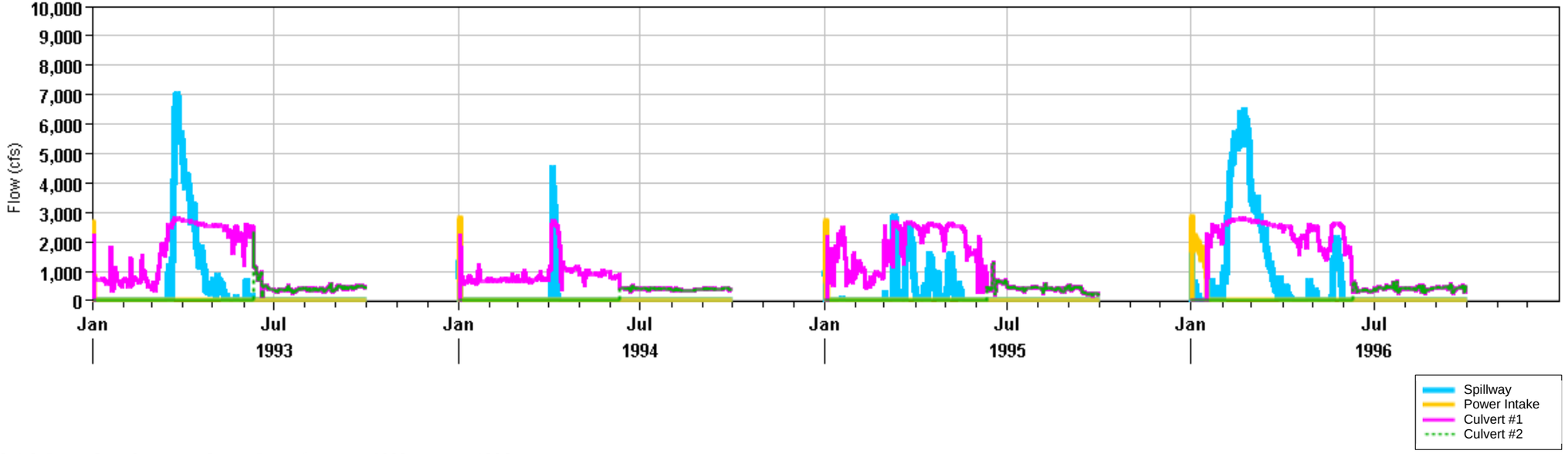


Figure 8: J.C. Boyle Gate Structure Outlet Flows for years 1993 through 1996

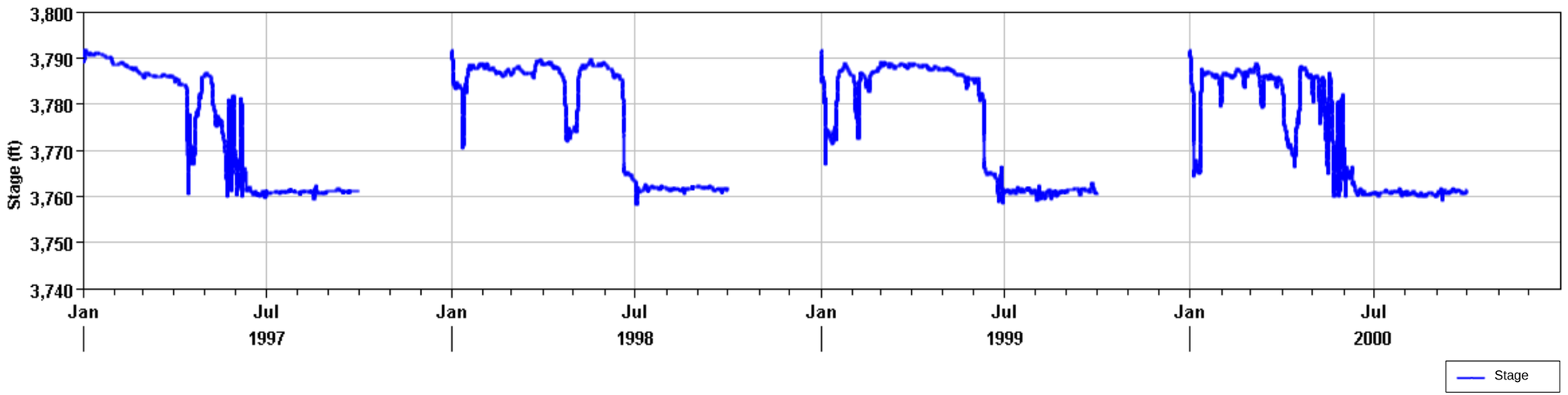


Figure 9: J.C. Boyle Drawdown Stage for years 1997 through 2000

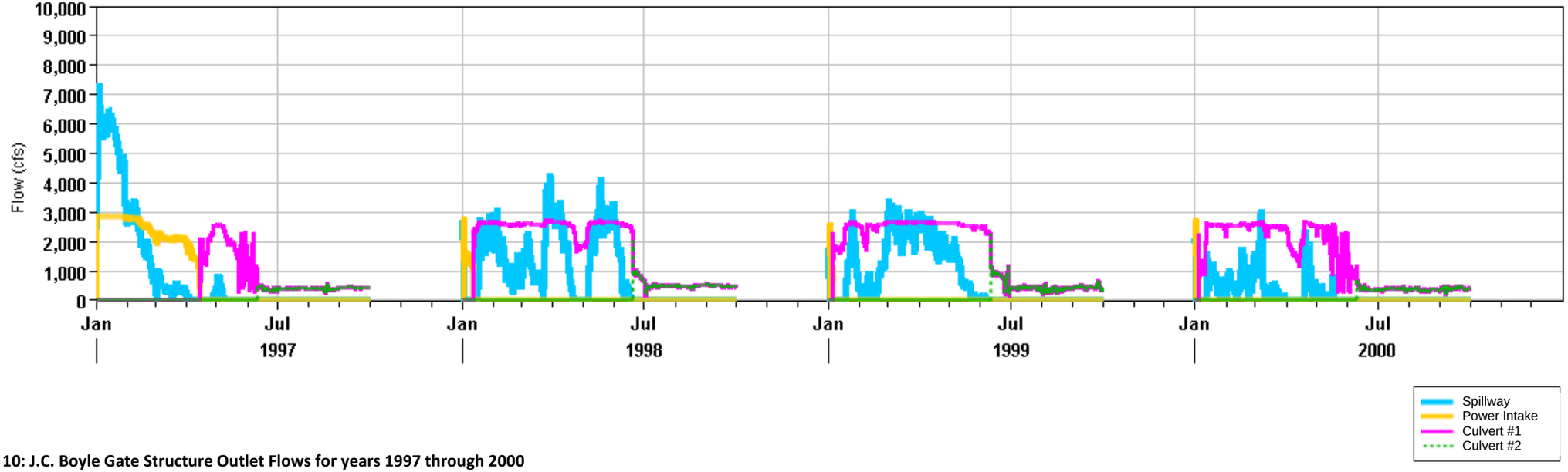


Figure 10: J.C. Boyle Gate Structure Outlet Flows for years 1997 through 2000

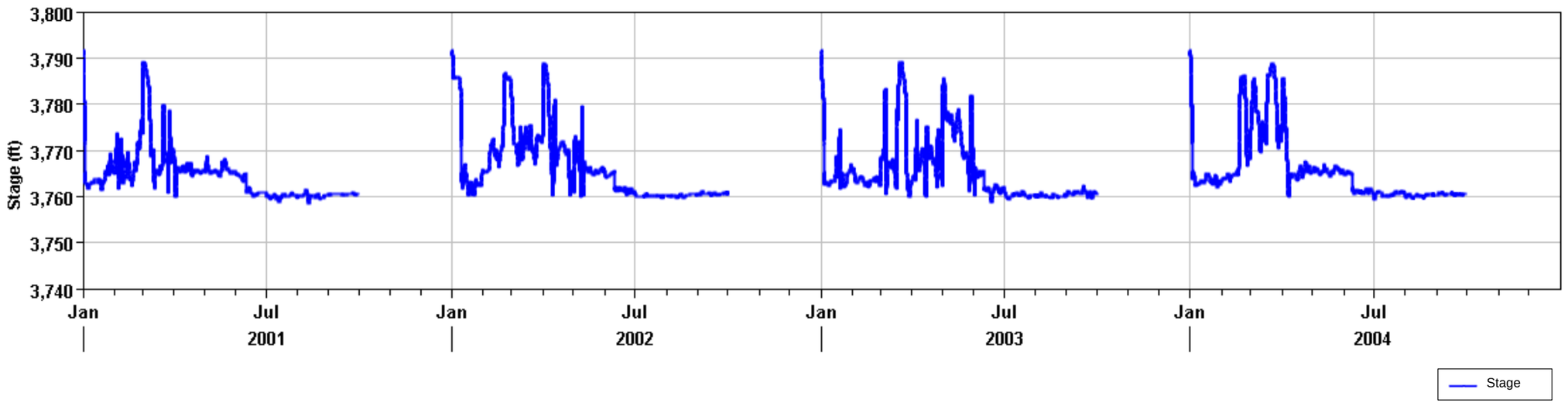


Figure 11: J.C. Boyle Drawdown Stage for years 2001 through 2004

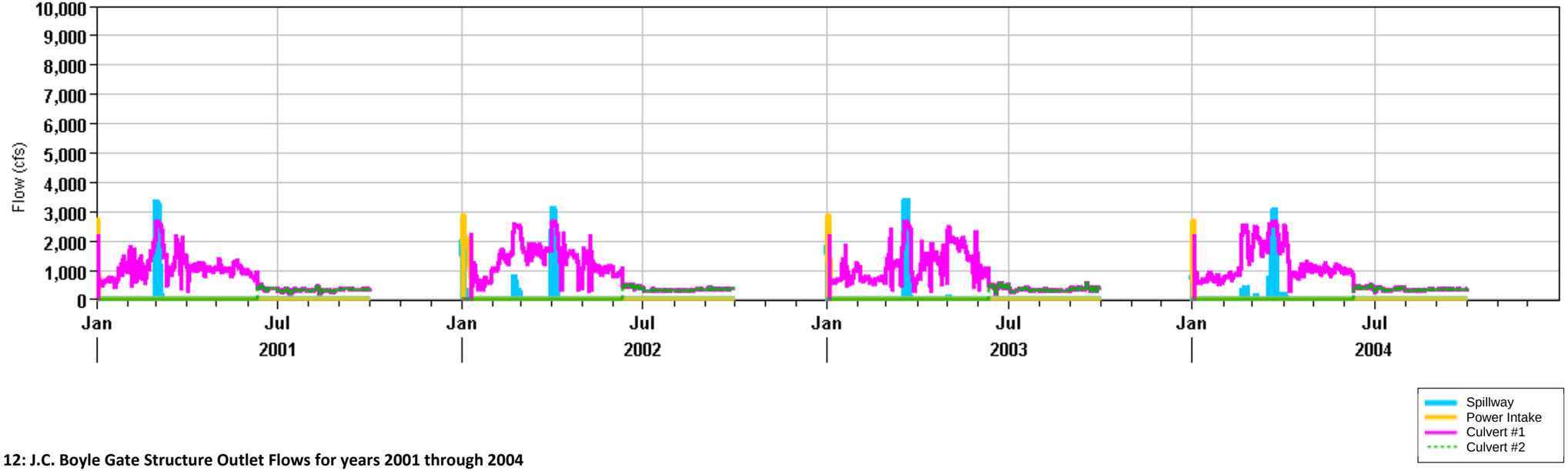


Figure 12: J.C. Boyle Gate Structure Outlet Flows for years 2001 through 2004

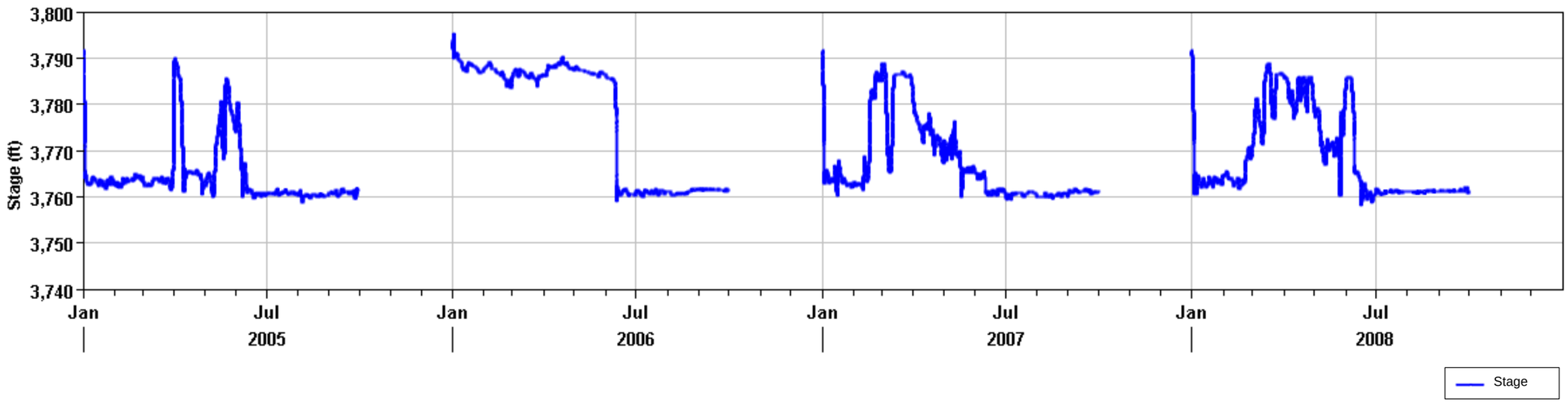


Figure 13: J.C. Boyle Drawdown Stage for years 2005 through 2008

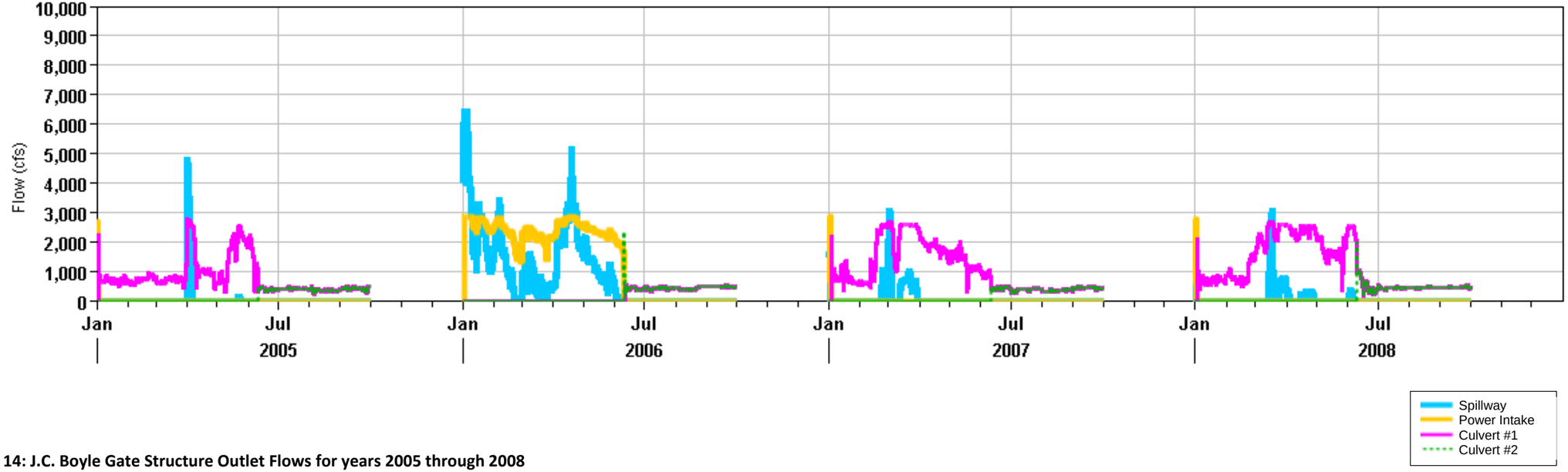


Figure 14: J.C. Boyle Gate Structure Outlet Flows for years 2005 through 2008

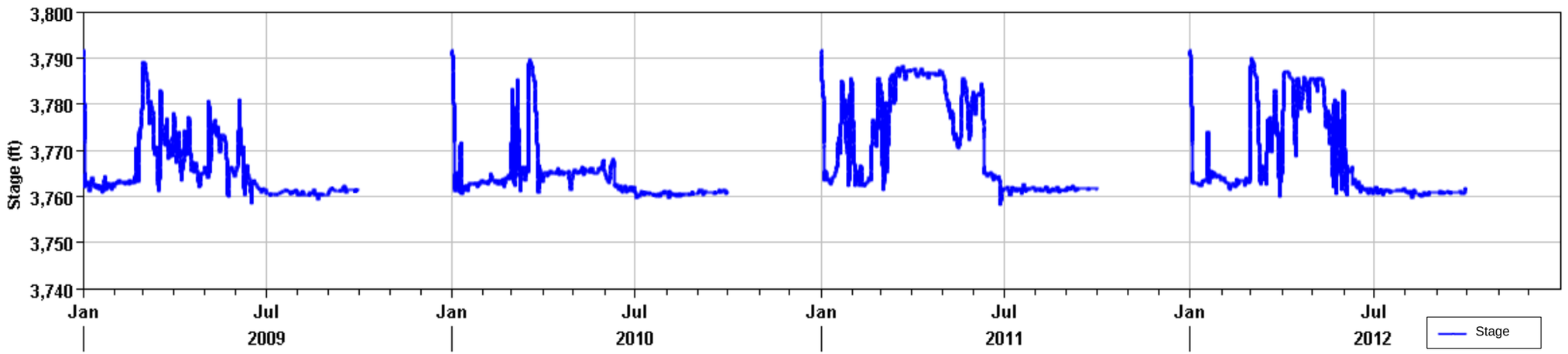


Figure 15: J.C. Boyle Drawdown Stage for years 2009 through 2012

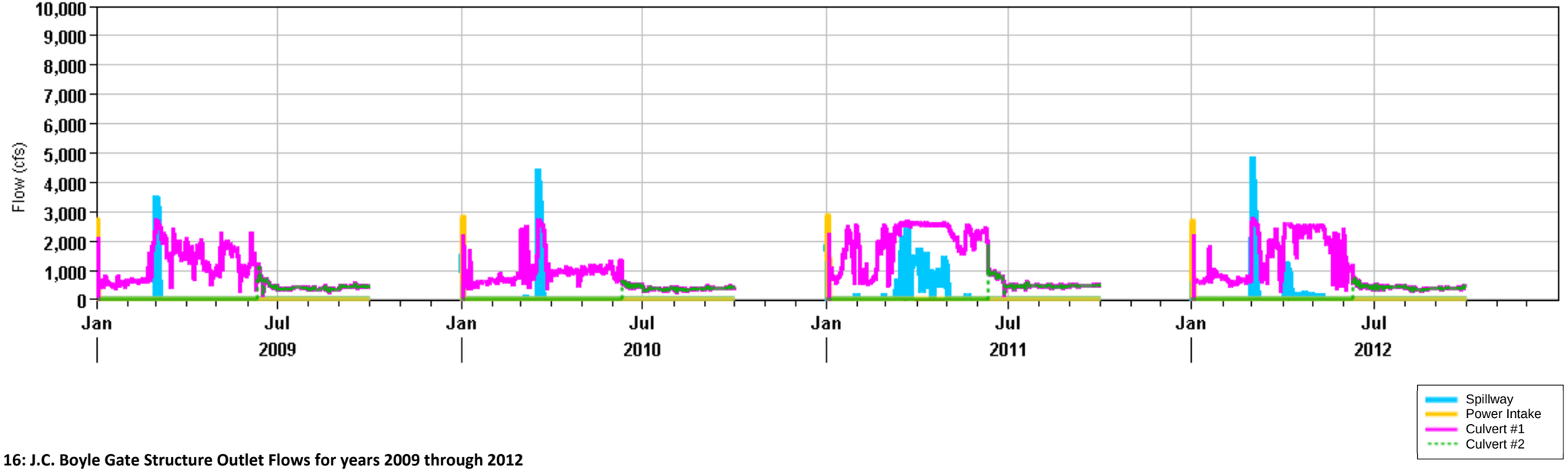


Figure 16: J.C. Boyle Gate Structure Outlet Flows for years 2009 through 2012

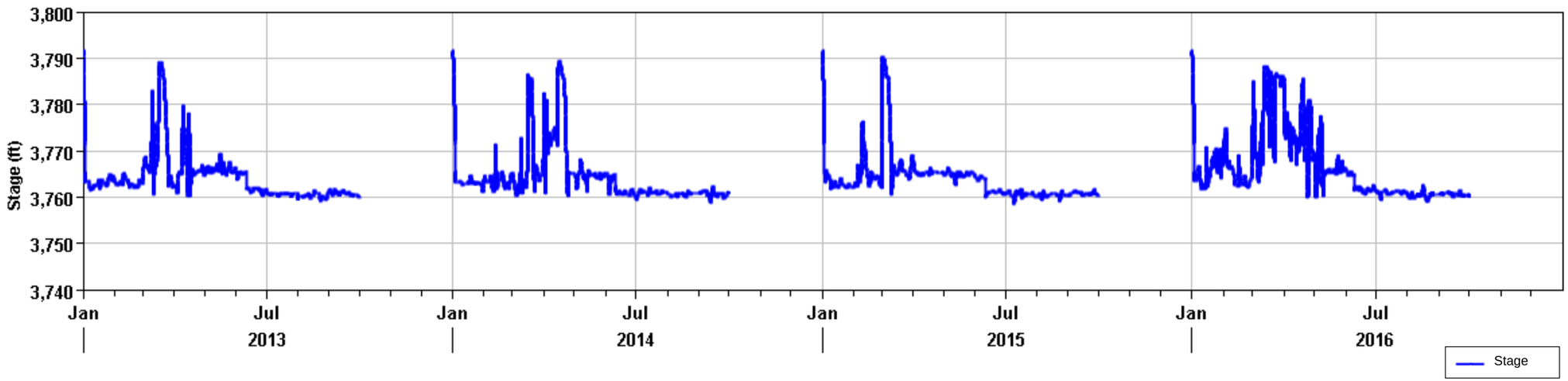


Figure 17: J.C. Boyle Drawdown Stage for years 2013 through 2016

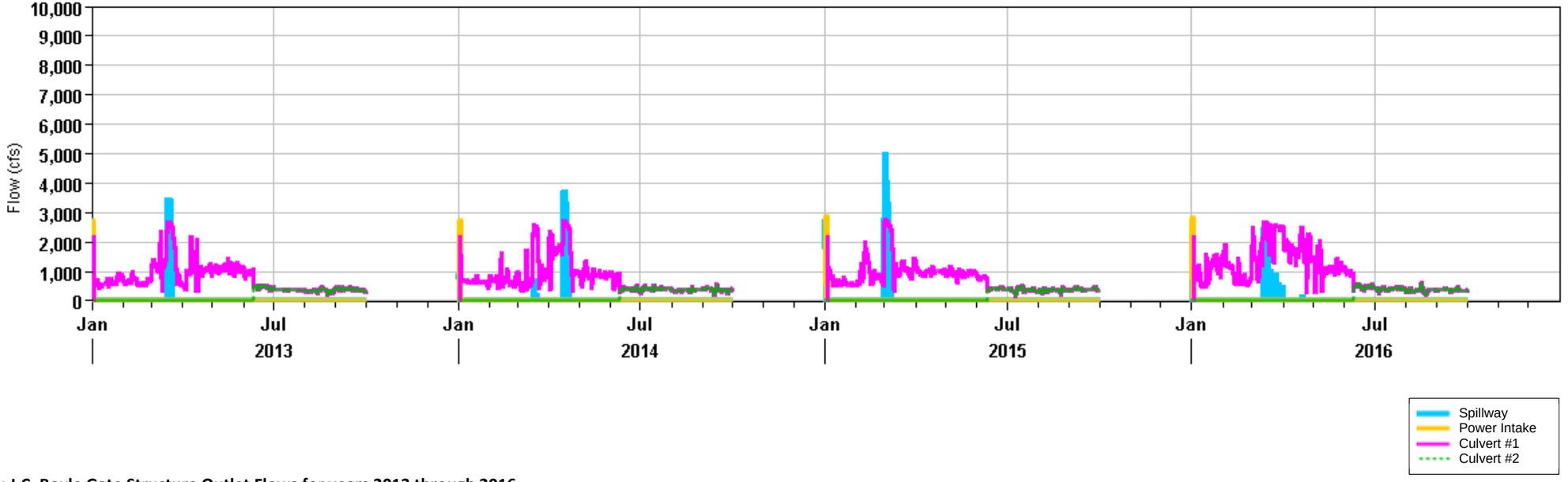


Figure 18: J.C. Boyle Gate Structure Outlet Flows for years 2013 through 2016

Drawdown Plots for Copco No. 1 Reservoir

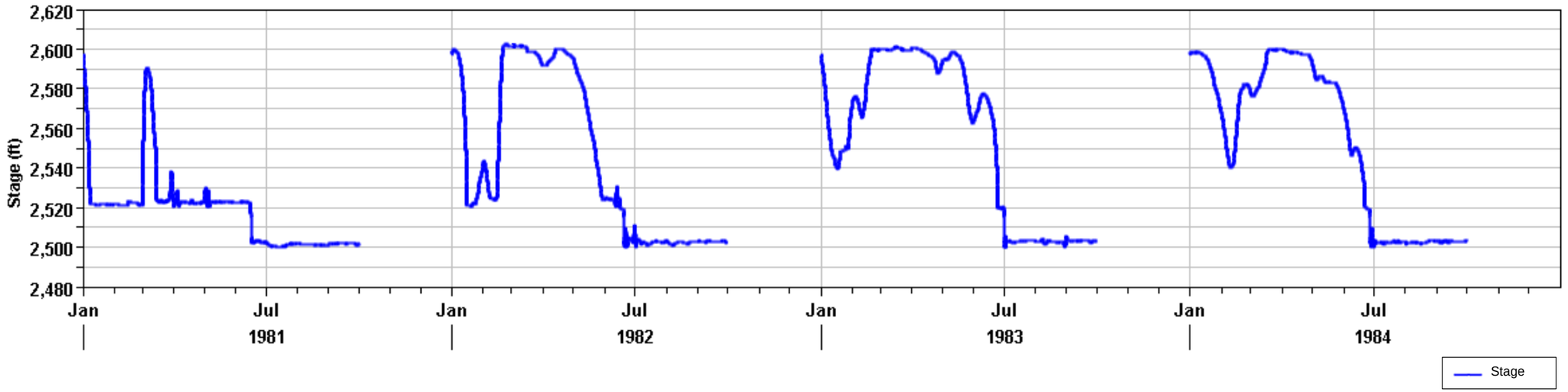


Figure 19: Copco No. 1 Drawdown Stage for years 1981 through 1984

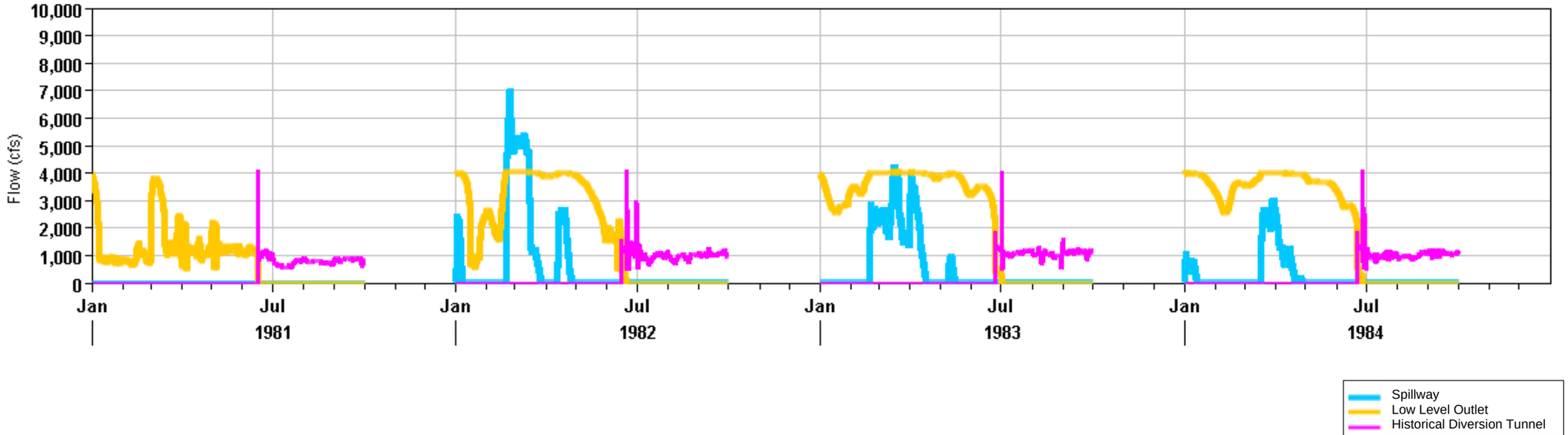


Figure 20: Copco No. 1 Gate Structure Outlet Flows for years 1981 through 1984

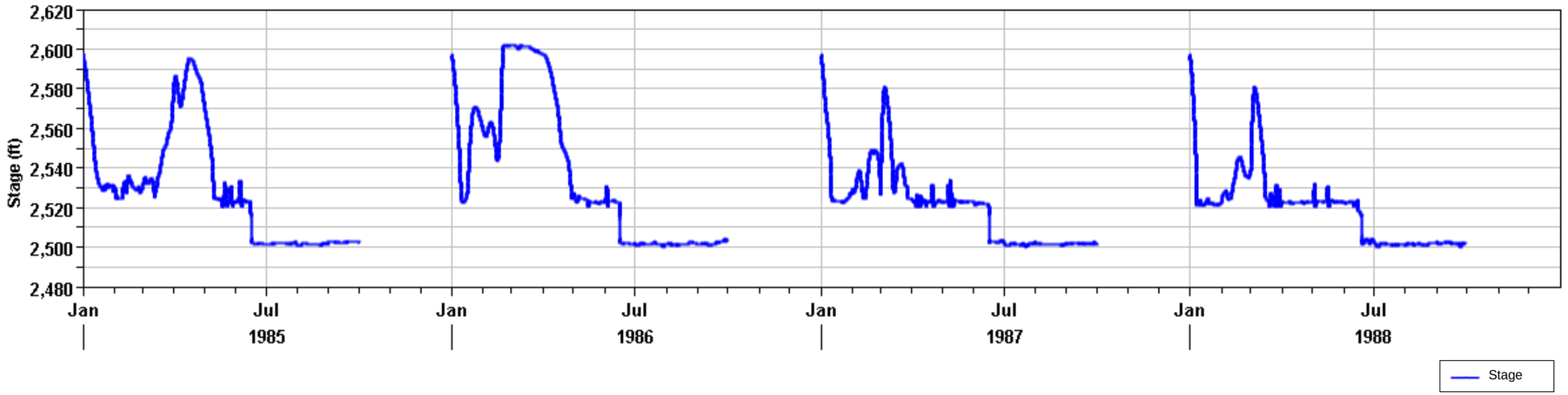


Figure 21: Copco No. 1 Drawdown Stage for years 1985 through 1988

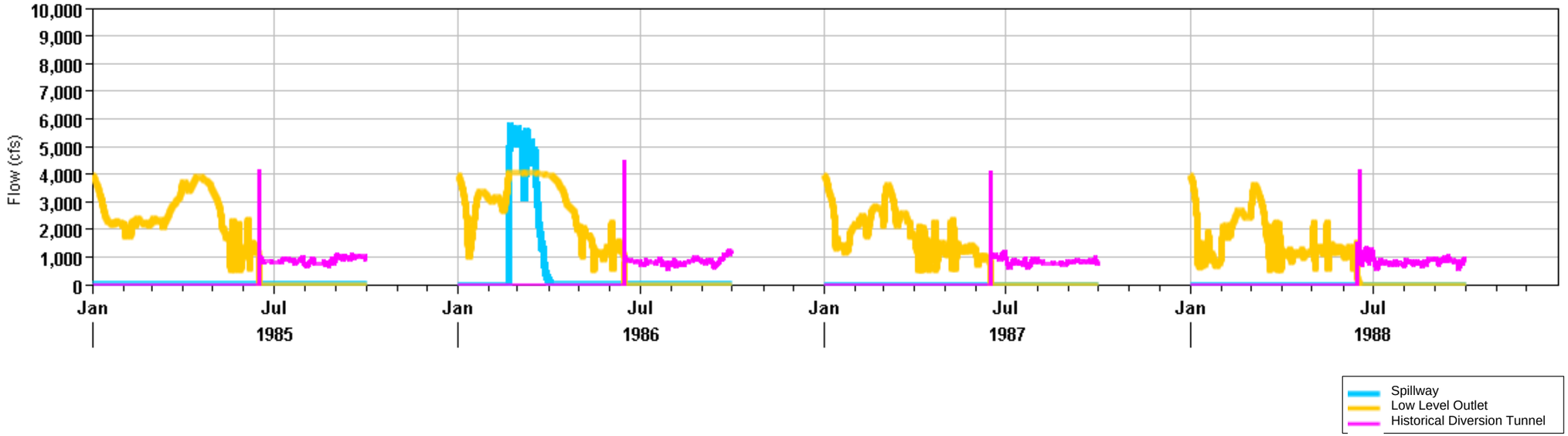


Figure 22: Copco No. 1 Gate Structure Outlet Flows for years 1985 through 1988

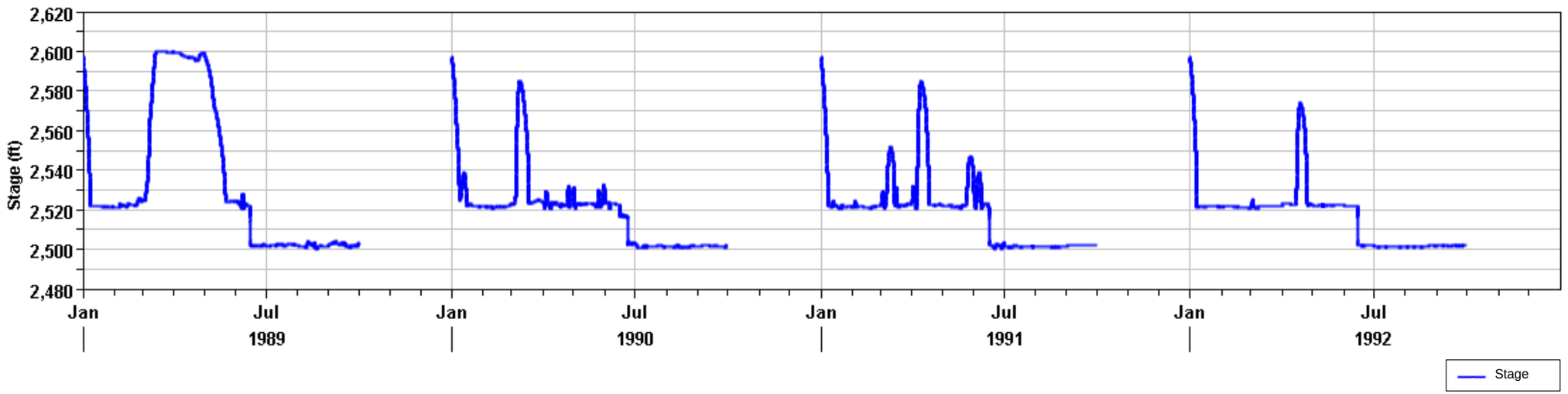


Figure 23: Copco No. 1 Drawdown Stage for years 1989 through 1992

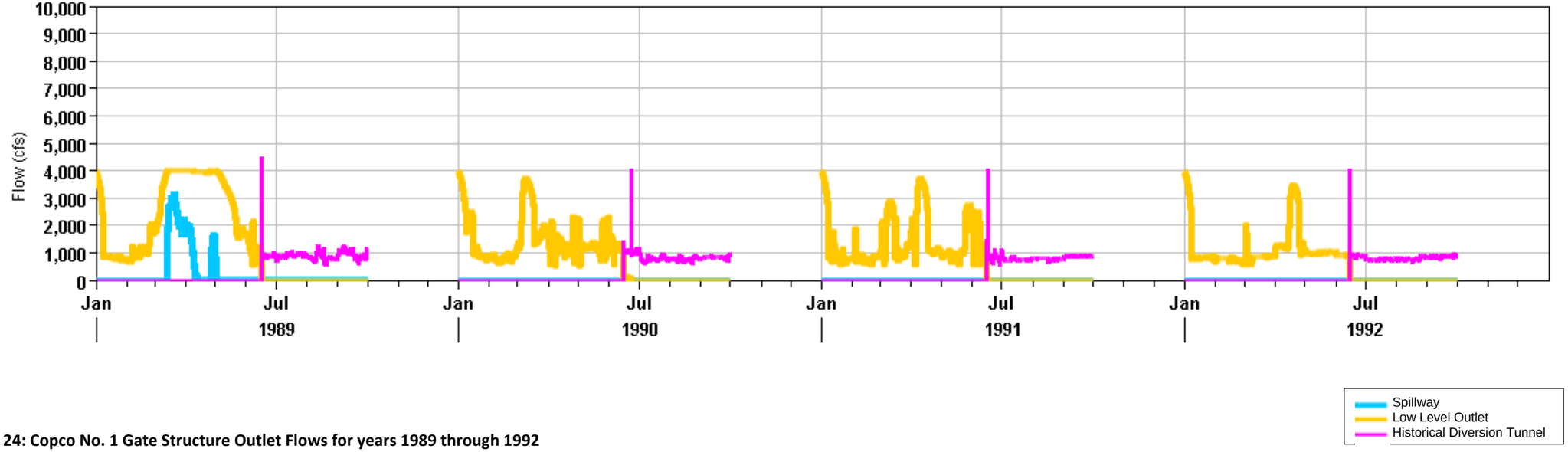


Figure 24: Copco No. 1 Gate Structure Outlet Flows for years 1989 through 1992

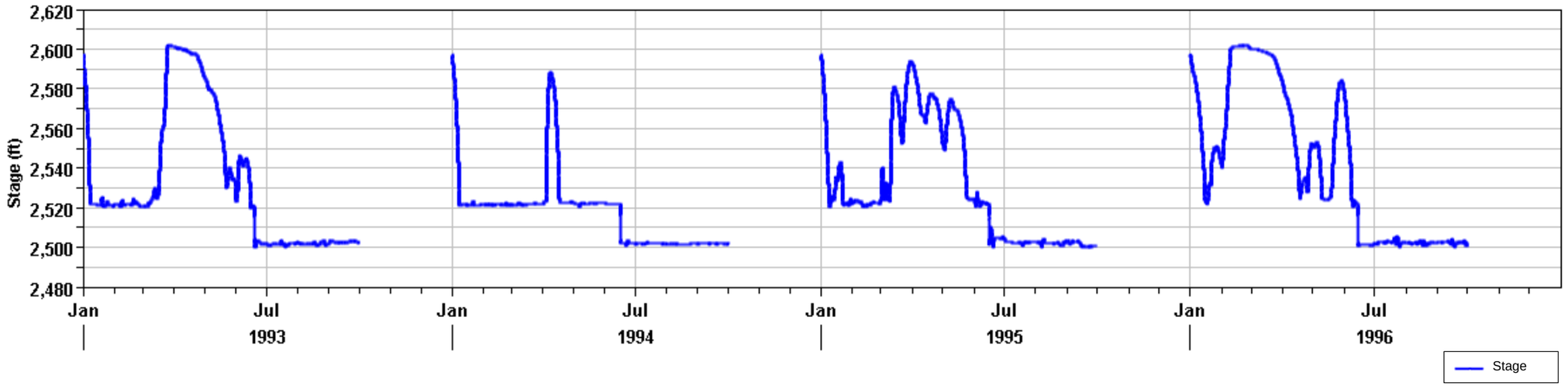


Figure 25: Copco No. 1 Drawdown Stage for years 1993 through 1996

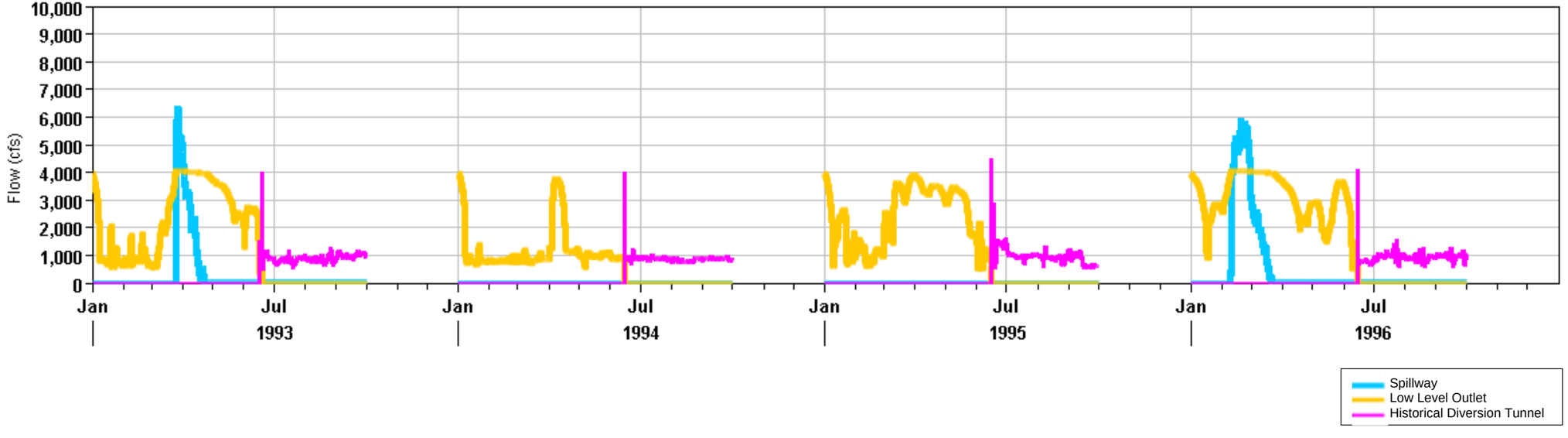


Figure 26: Copco No. 1 Gate Structure Outlet Flows for years 1993 through 1996

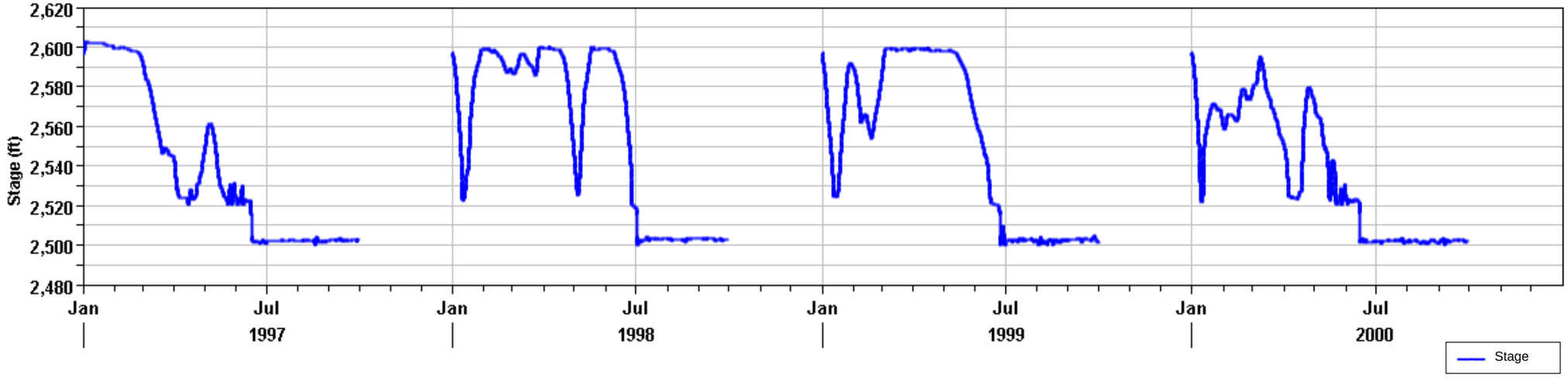


Figure 27: Copco No. 1 Drawdown Stage for years 1997 through 2000

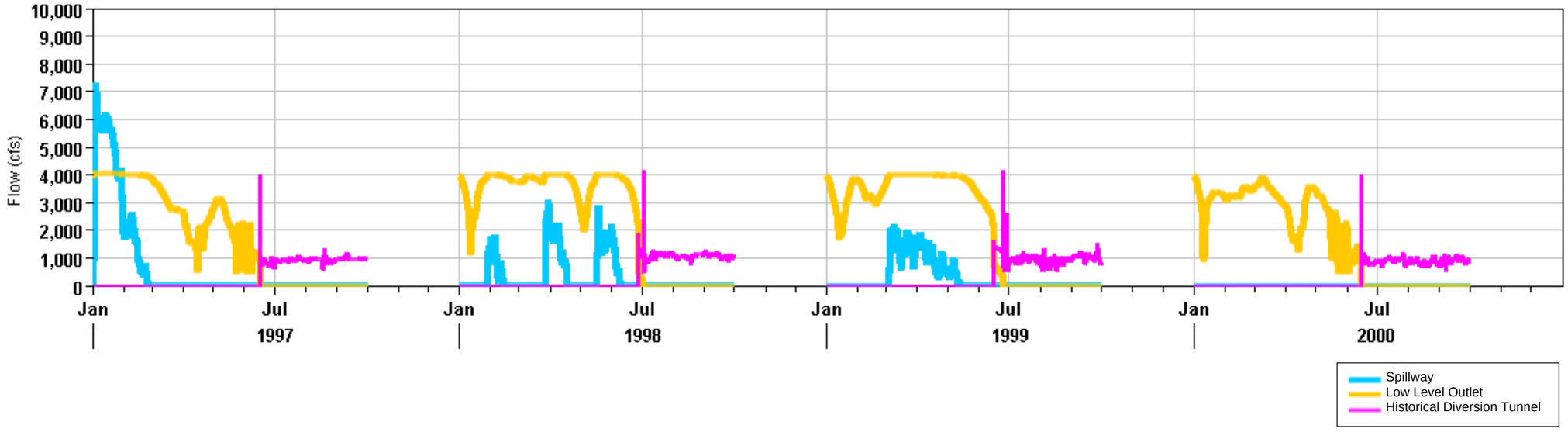


Figure 28: Copco No. 1 Gate Structure Outlet Flows for years 1997 through 2000

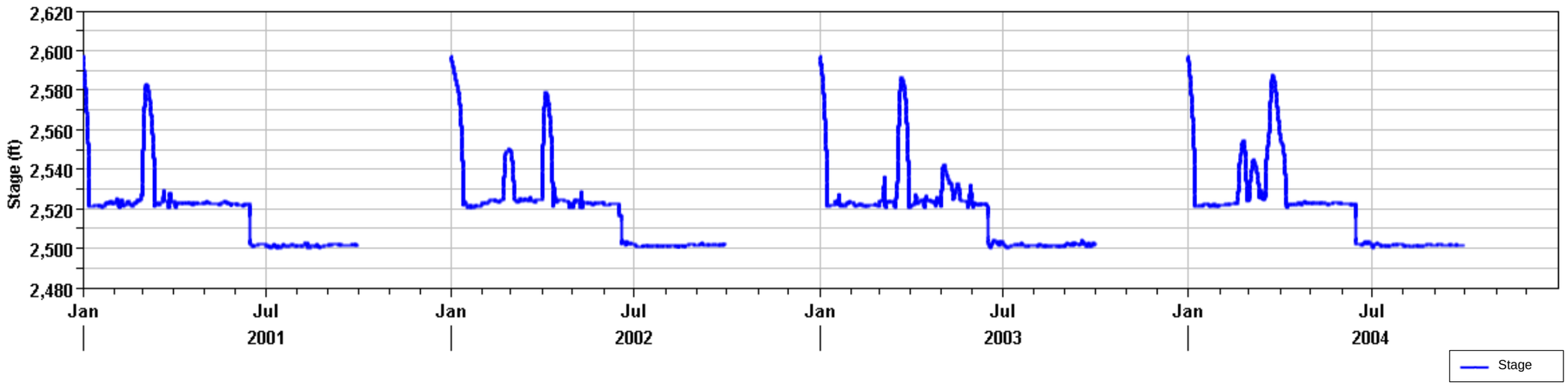


Figure 29: Copco No. 1 Drawdown Stage for years 2001 through 2004

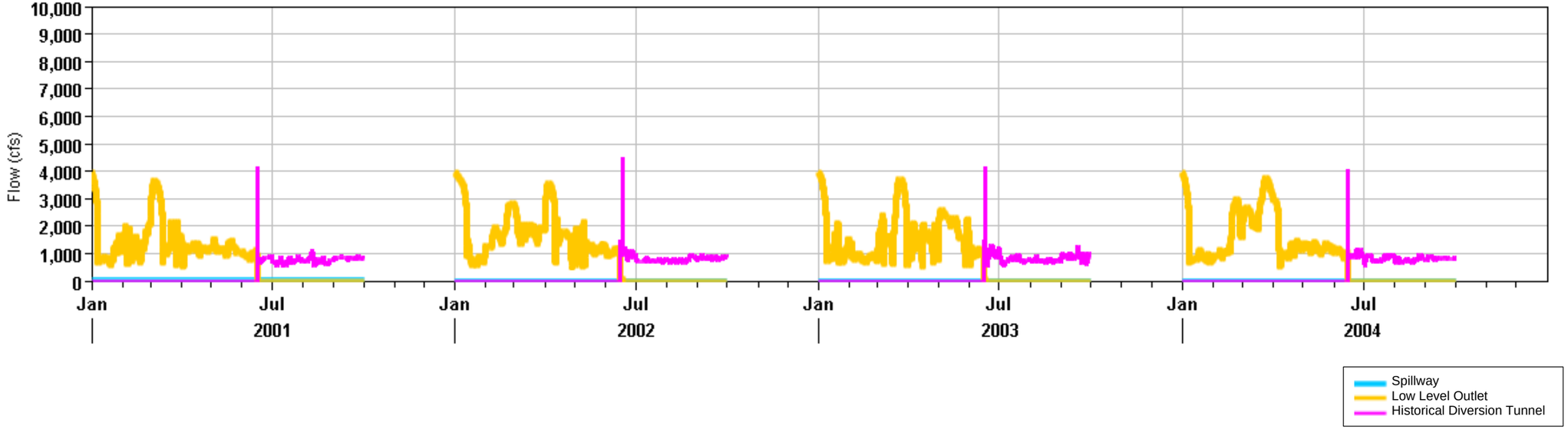


Figure 30: Copco No. 1 Gate Structure Outlet Flows for years 2001 through 2004

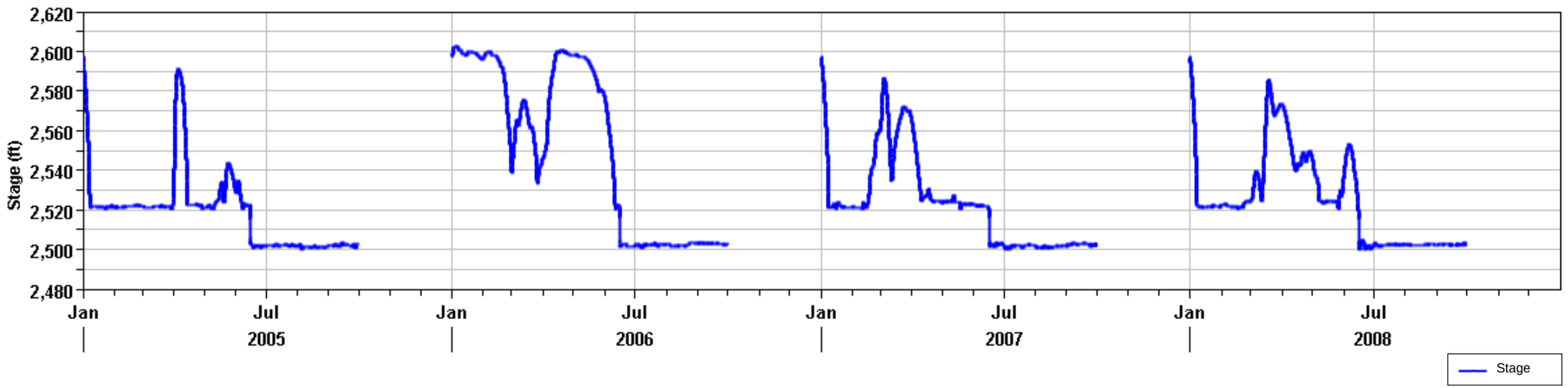


Figure 31: Copco No. 1 Drawdown Stage for years 2005 through 2008

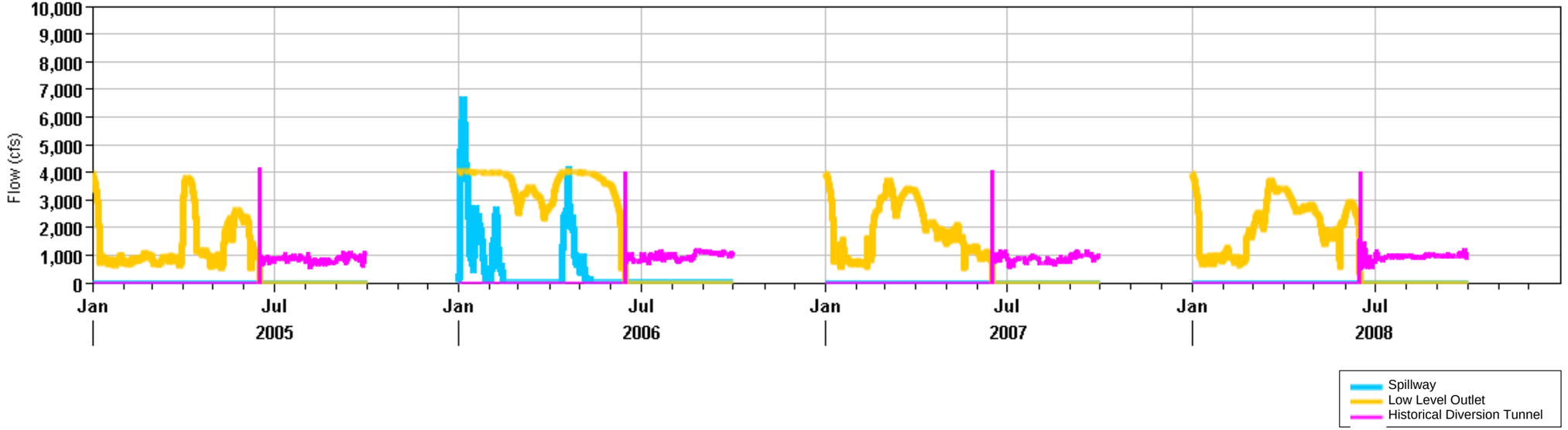


Figure 32: Copco No. 1 Gate Structure Outlet Flows for years 2005 through 2008

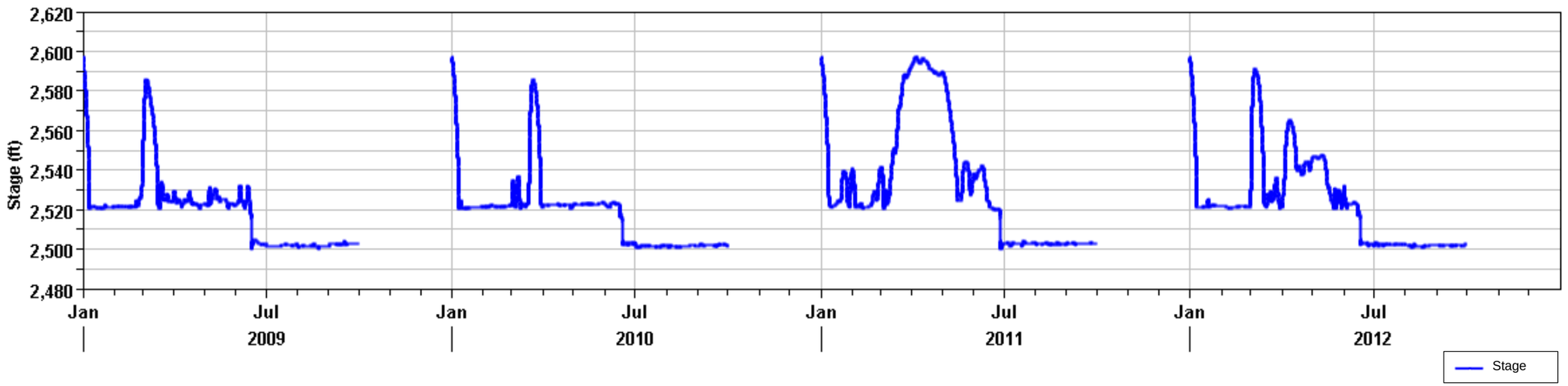


Figure 33: Copco No. 1 Drawdown Stage for years 2009 through 2012

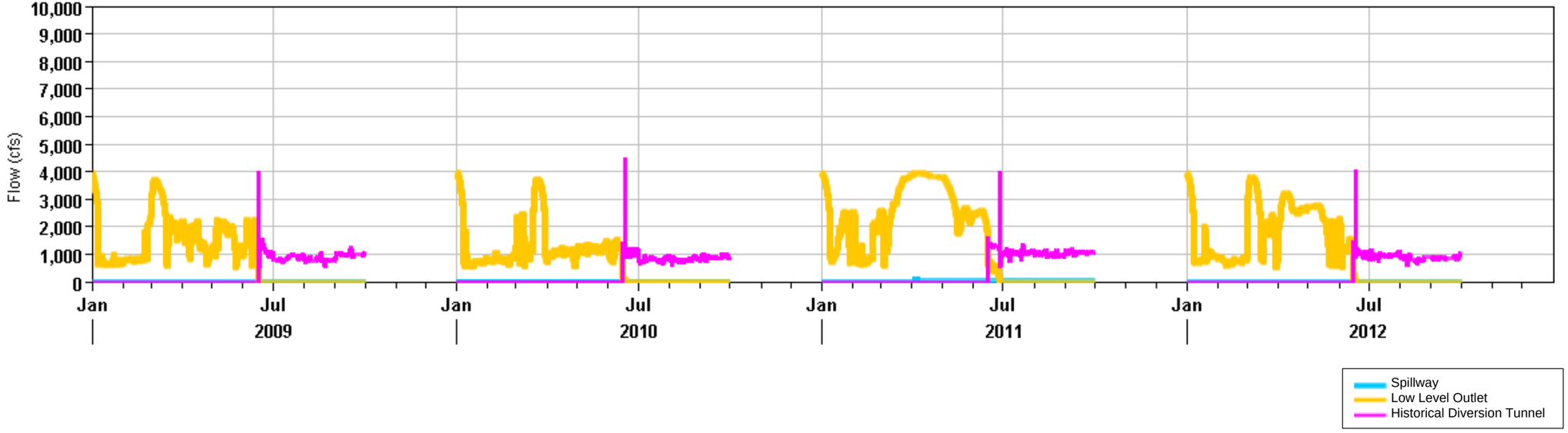


Figure 34: Copco No. 1 Gate Structure Outlet Flows for years 2009 through 2012

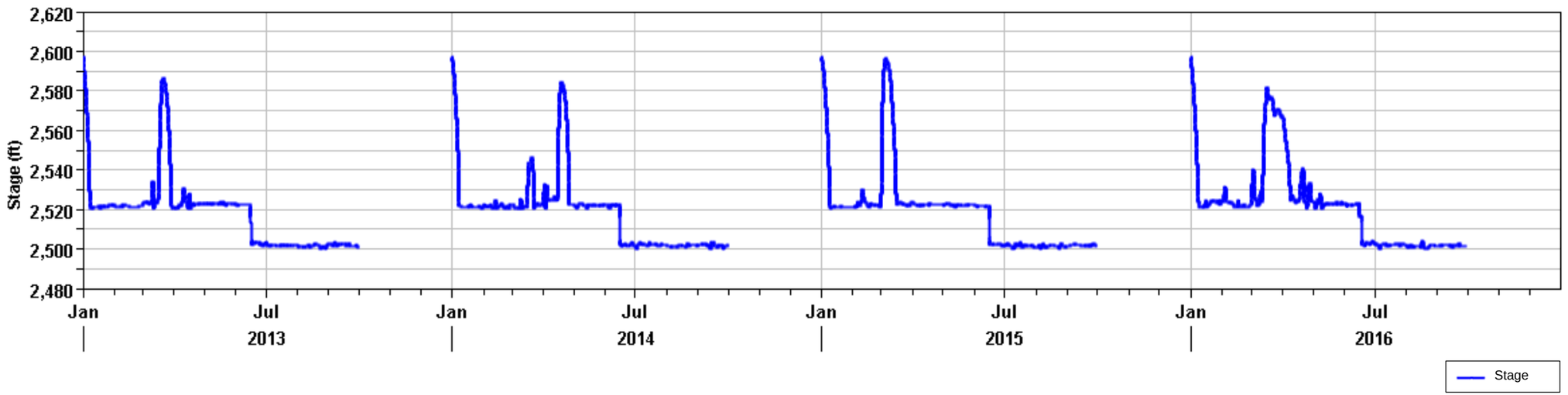


Figure 35: Copco No. 1 Drawdown Stage for years 2013 through 2016

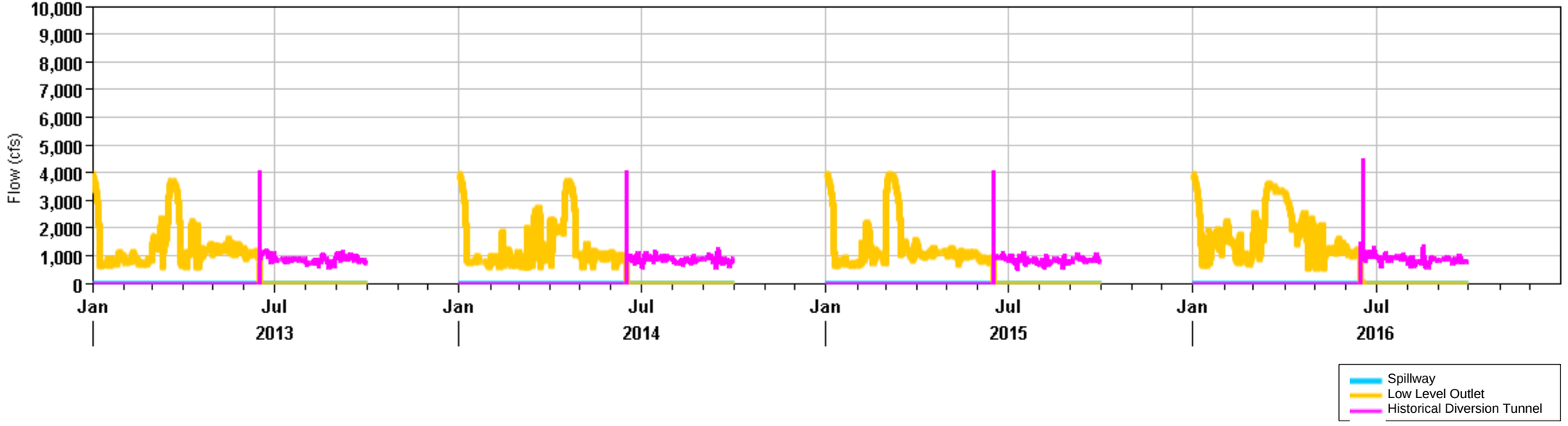


Figure 36: Copco No. 1 Gate Structure Outlet Flows for years 2013 through 2016

Drawdown Plots for Copco No. 2 Reservoir

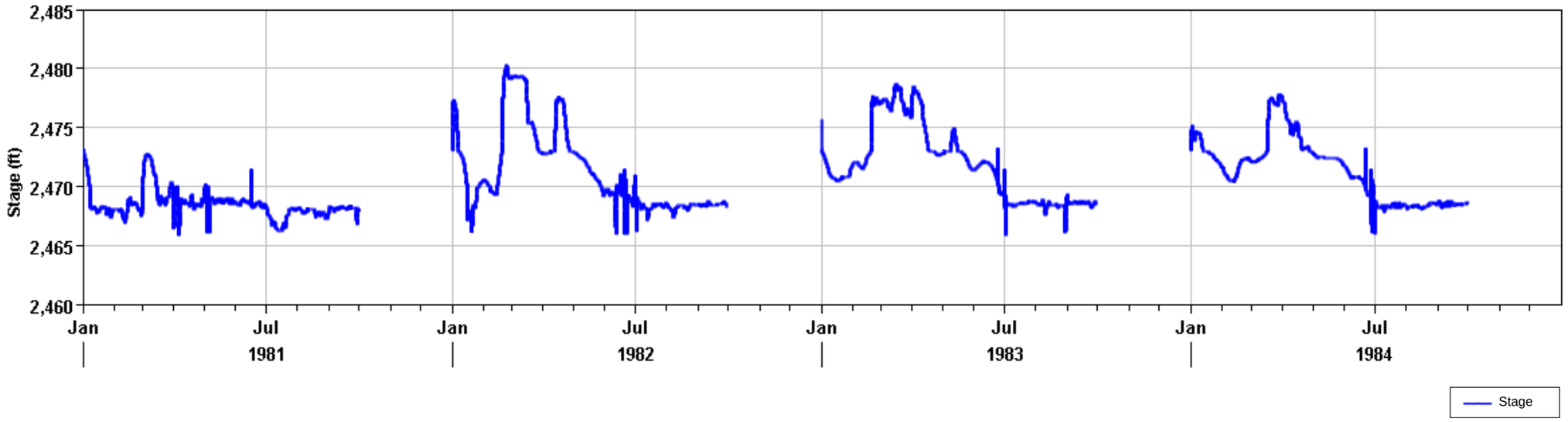


Figure 37: Copco No. 2 Drawdown Stage for years 1981 through 1984

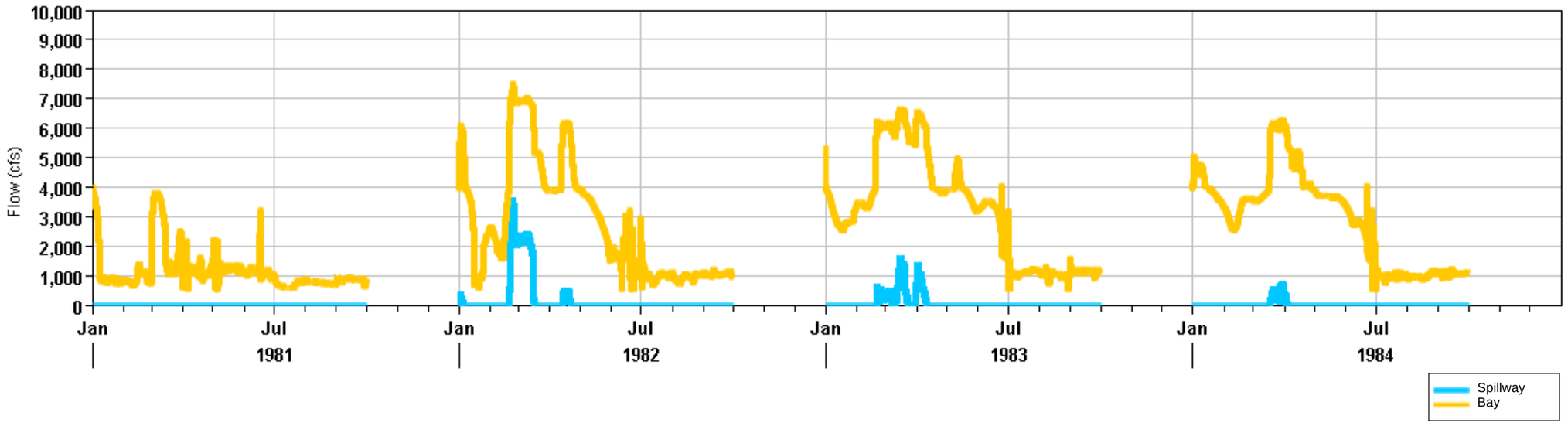


Figure 38: Copco No. 2 Gate Structure Outlet Flows for years 1981 through 1984

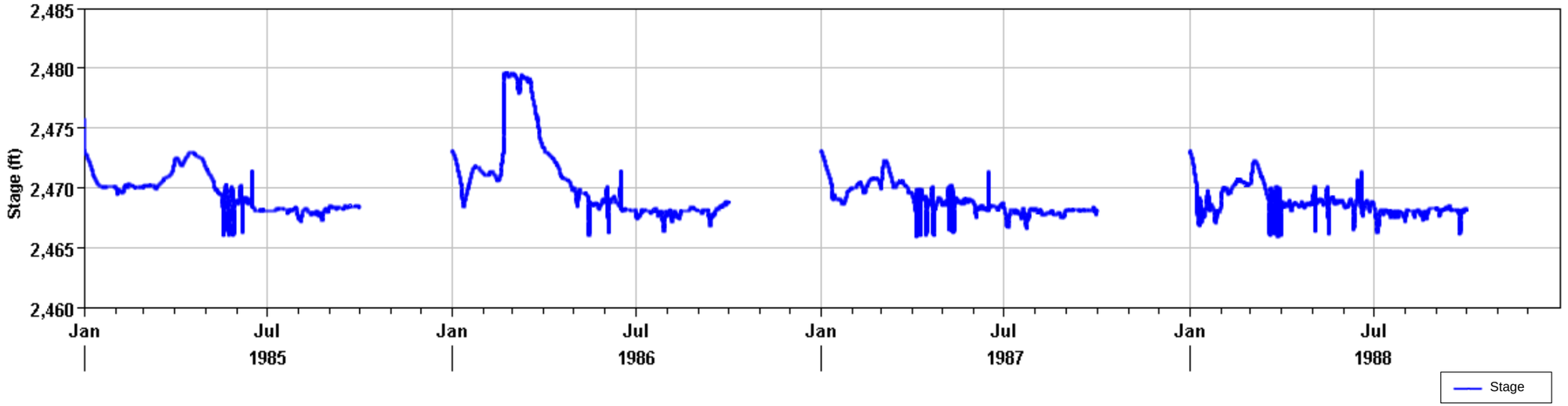


Figure 39: Copco No. 2 Drawdown Stage for years 1985 through 1988

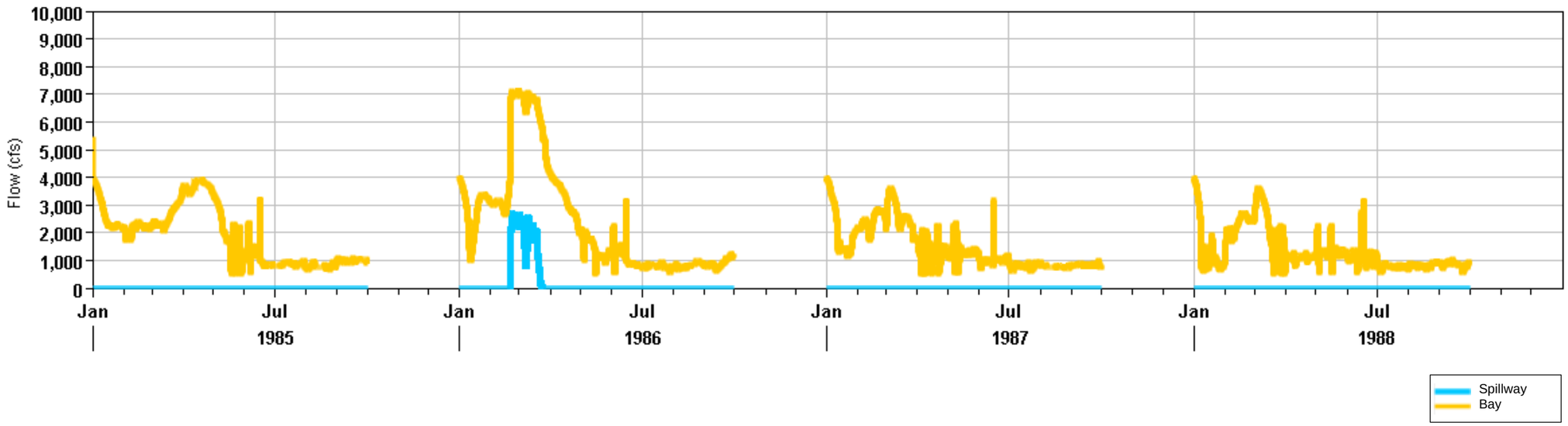


Figure 40: Copco No. 2 Gate Structure Outlet Flows for years 1985 through 1988

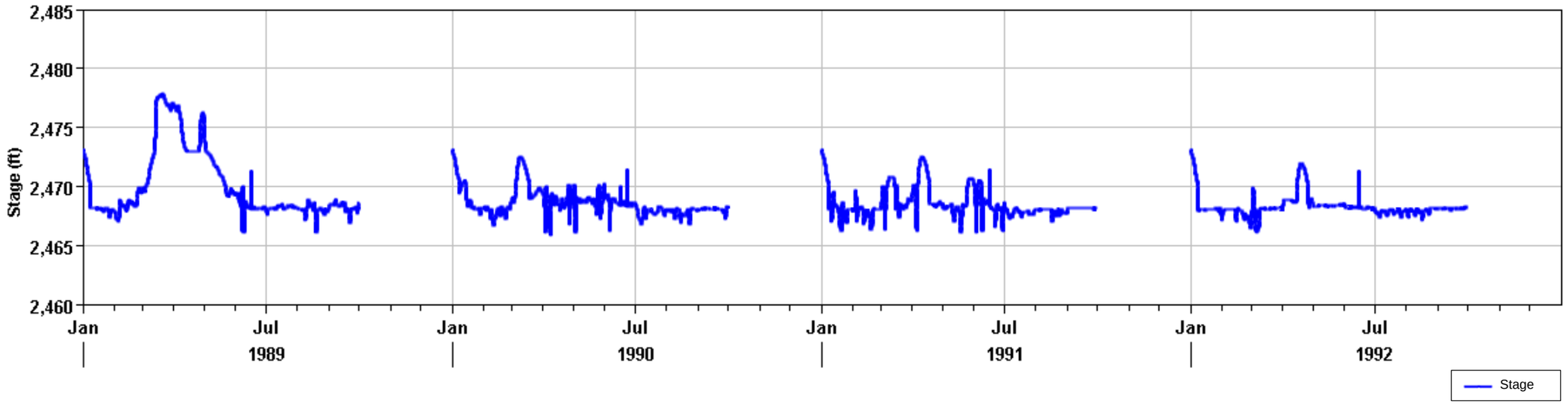


Figure 41: Copco No. 2 Drawdown Stage for years 1989 through 1992

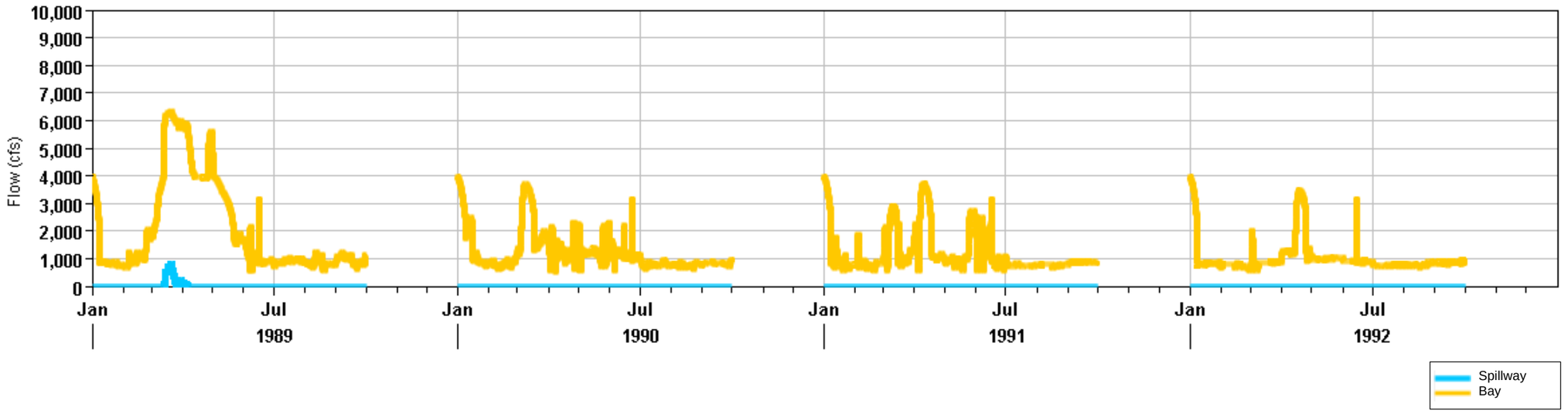


Figure 42: Copco No. 2 Gate Structure Outlet Flows for years 1989 through 1992

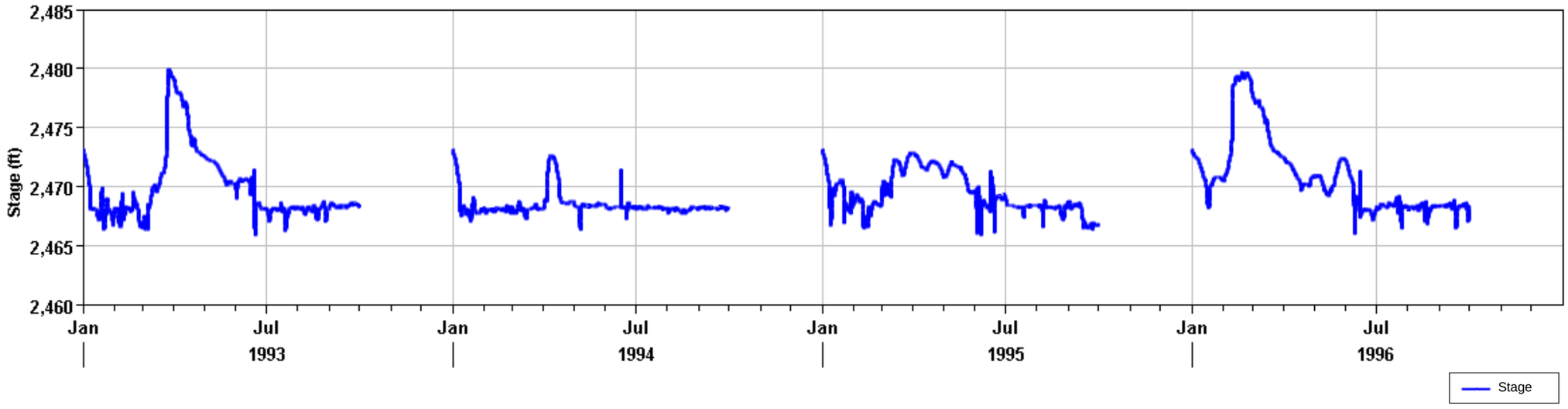


Figure 43: Copco No. 2 Drawdown Stage for years 1993 through 1996

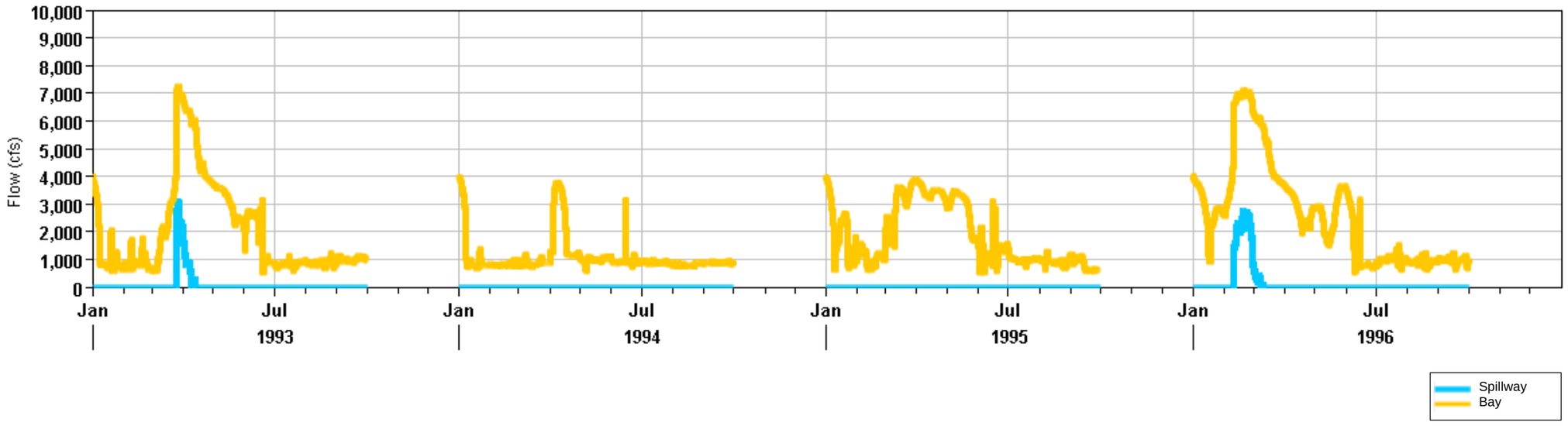


Figure 44: Copco No. 2 Gate Structure Outlet Flows for years 1993 through 1996

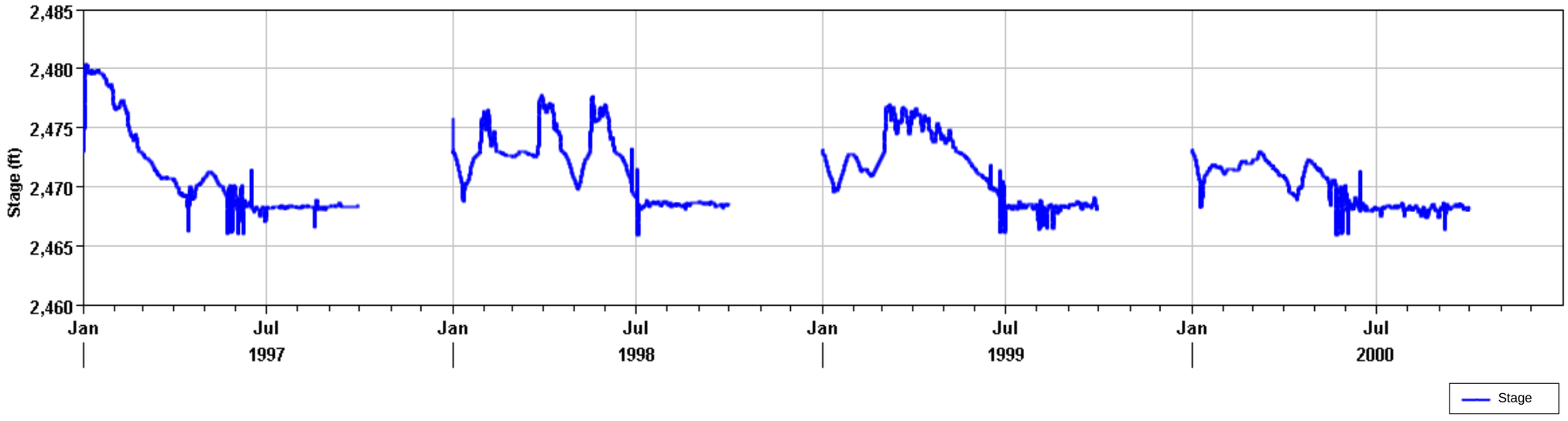


Figure 45: Copco No. 2 Drawdown Stage for years 1997 through 2000

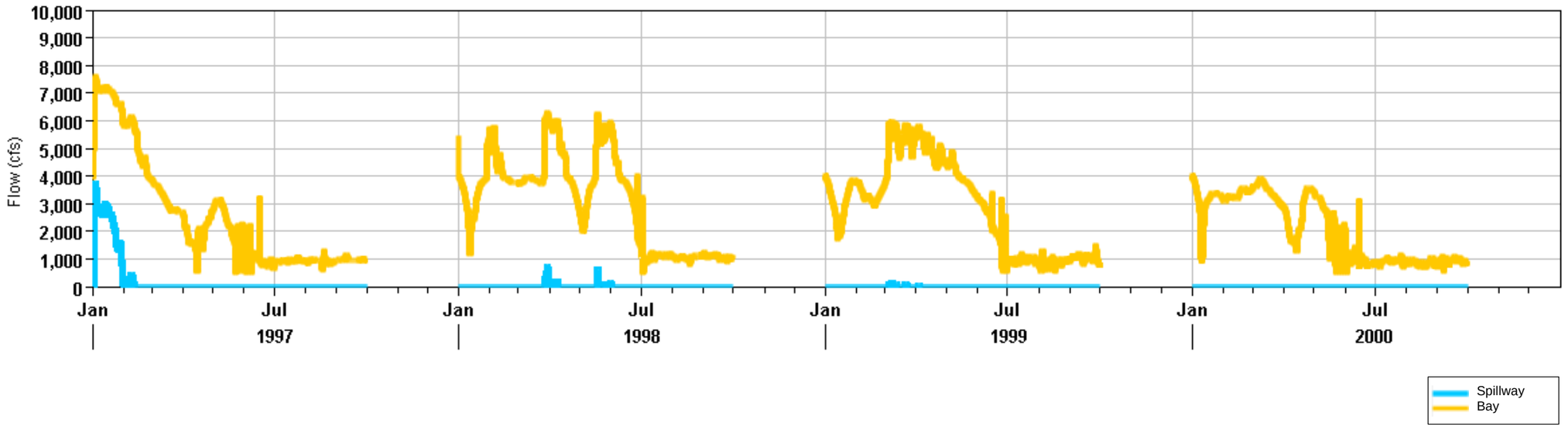


Figure 46: Copco No. 2 Gate Structure Outlet Flows for years 1997 through 2000

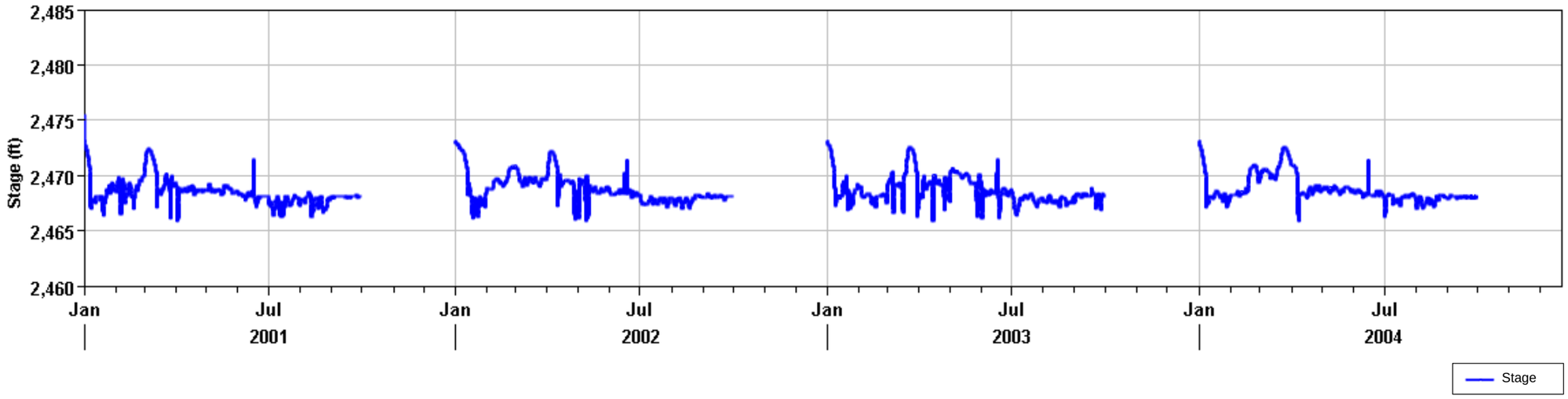


Figure 47: Copco No. 2 Drawdown Stage for years 2001 through 2004

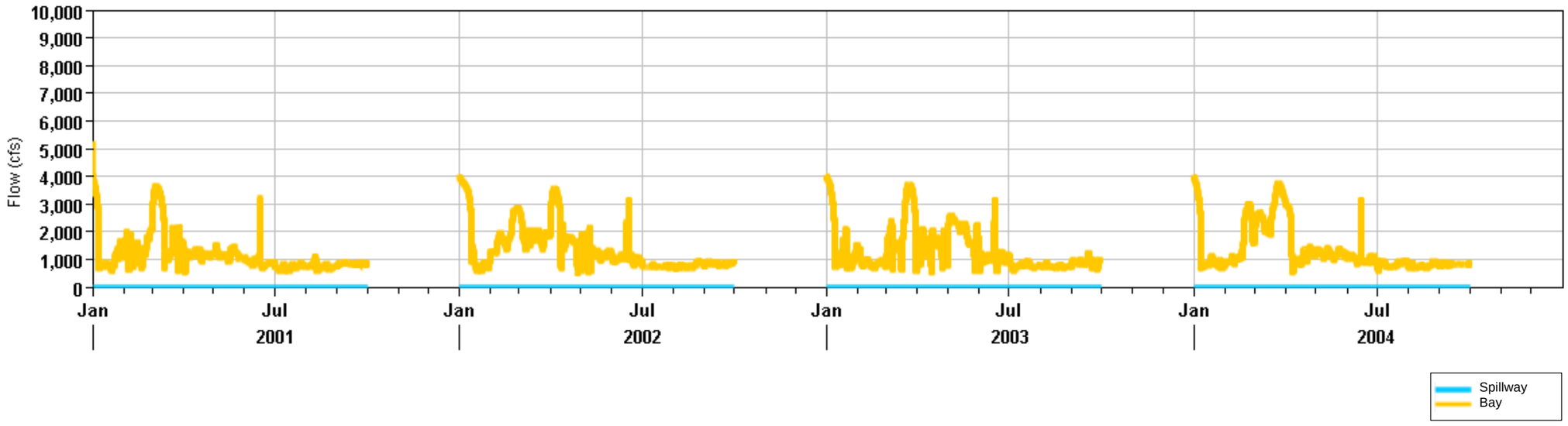


Figure 48: Copco No. 2 Gate Structure Outlet Flows for years 2001 through 2004

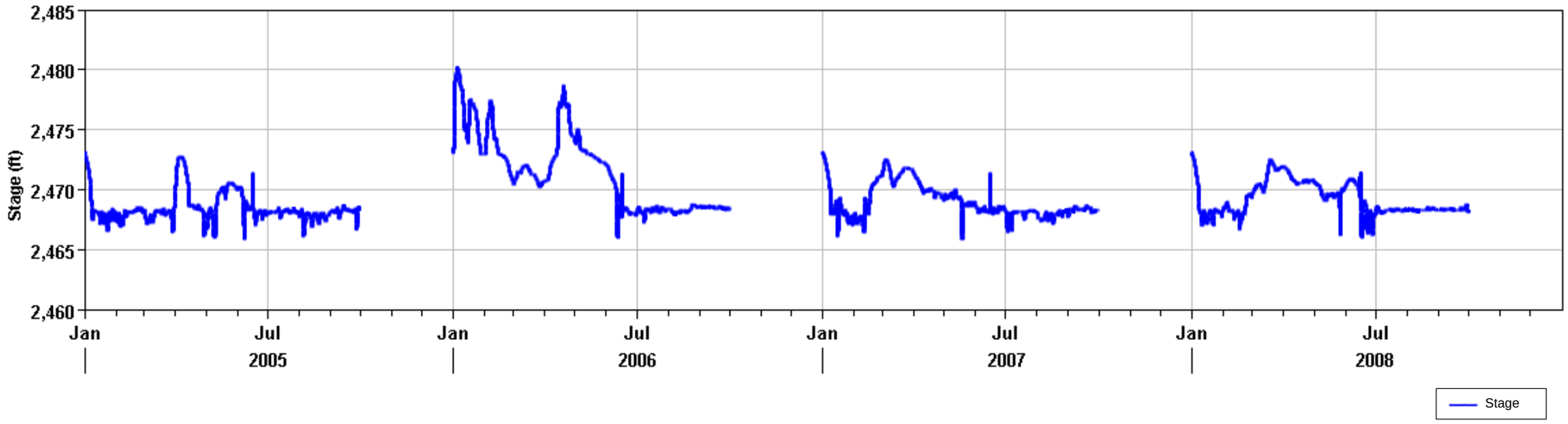


Figure 49: Copco No. 2 Drawdown Stage for years 2005 through 2008

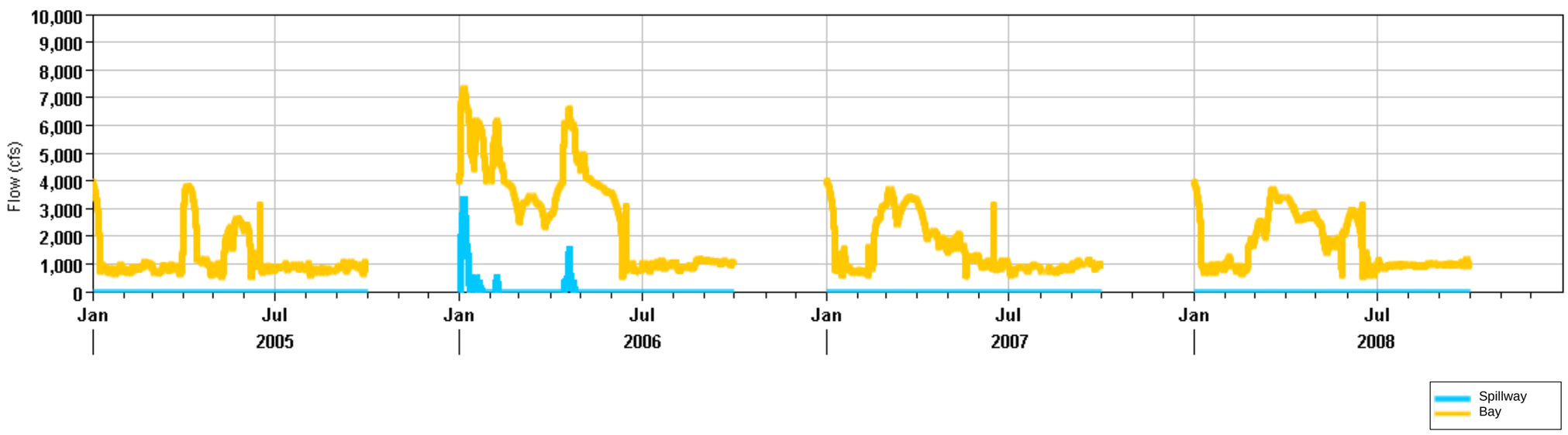


Figure 50: Copco No. 2 Gate Structure Outlet Flows for years 2005 through 2008

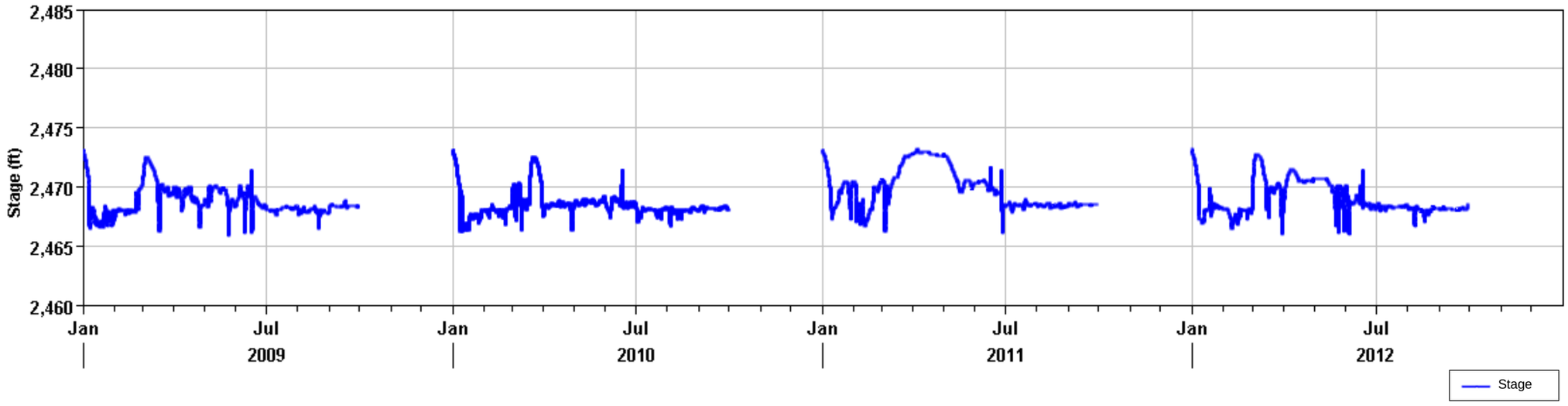


Figure 51: Copco No. 2 Drawdown Stage for years 2009 through 2012

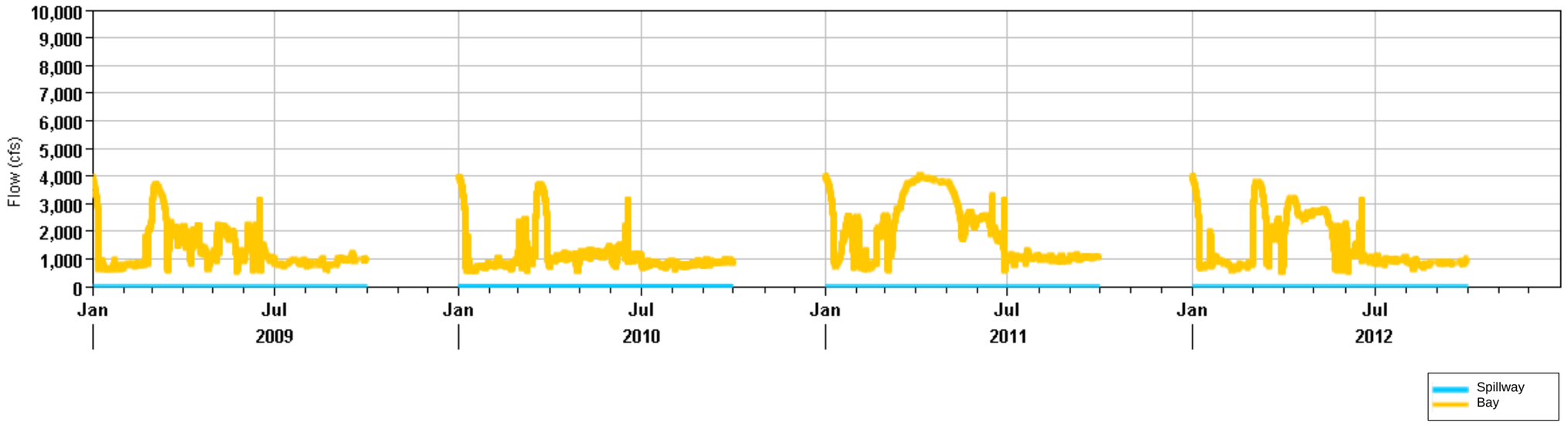


Figure 52: Copco No. 2 Gate Structure Outlet Flows for years 2009 through 2012

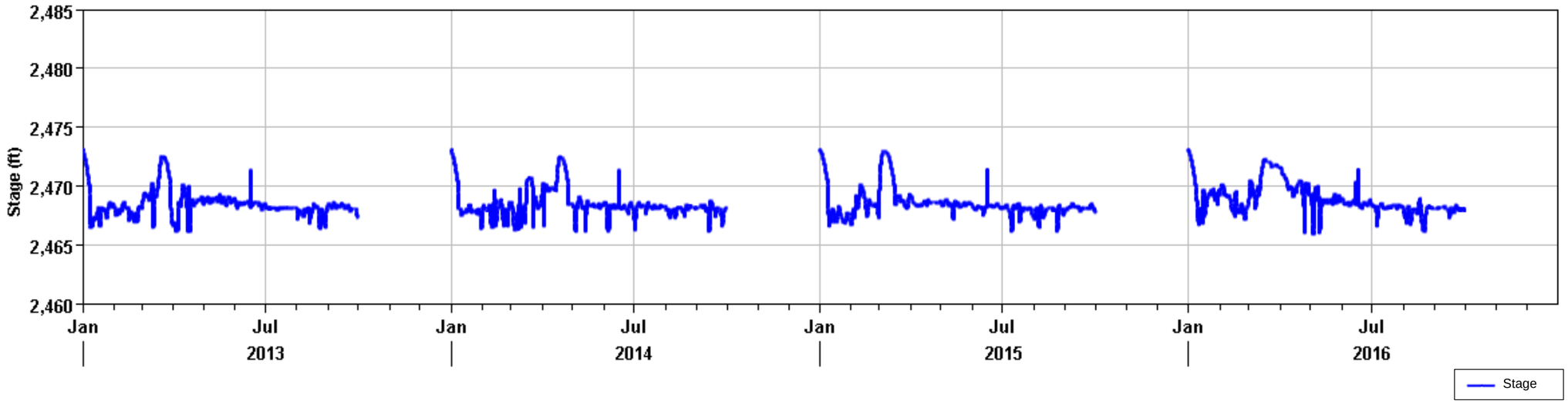


Figure 53: Copco No. 2 Drawdown Stage for years 2013 through 2016

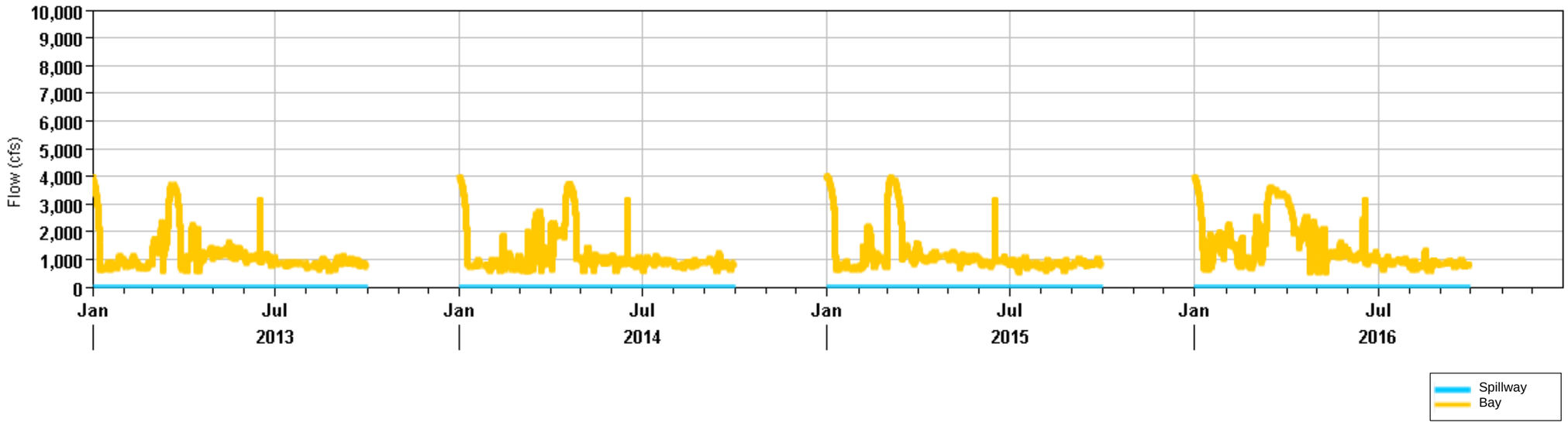


Figure 54: Copco No. 2 Gate Structure Outlet Flows for years 2013 through 2016

Drawdown Plots for Iron Gate Reservoir

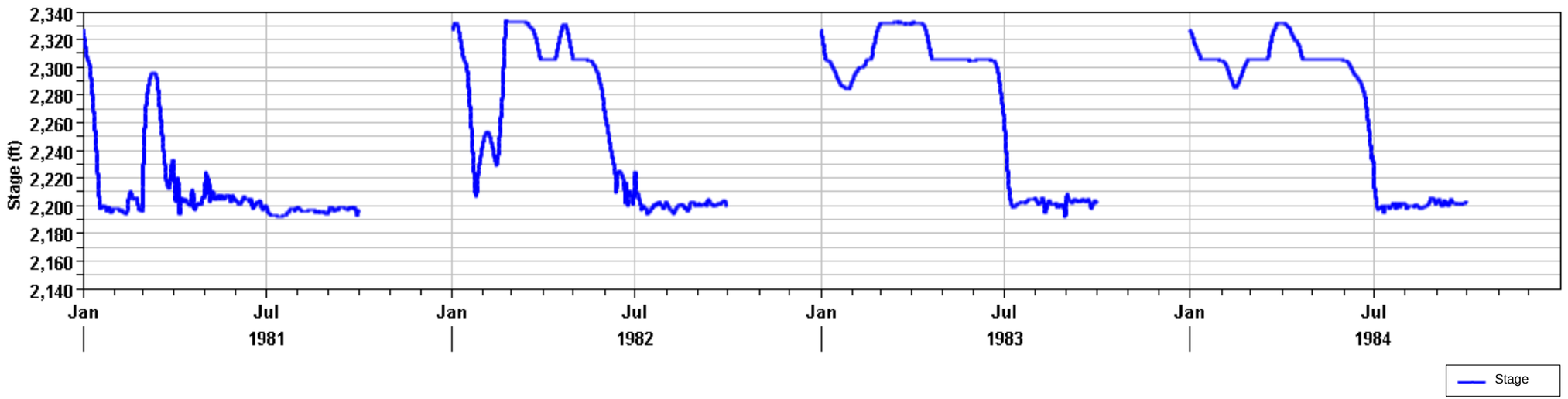


Figure 55: Iron Gate Drawdown Stage for years 1981 through 1984

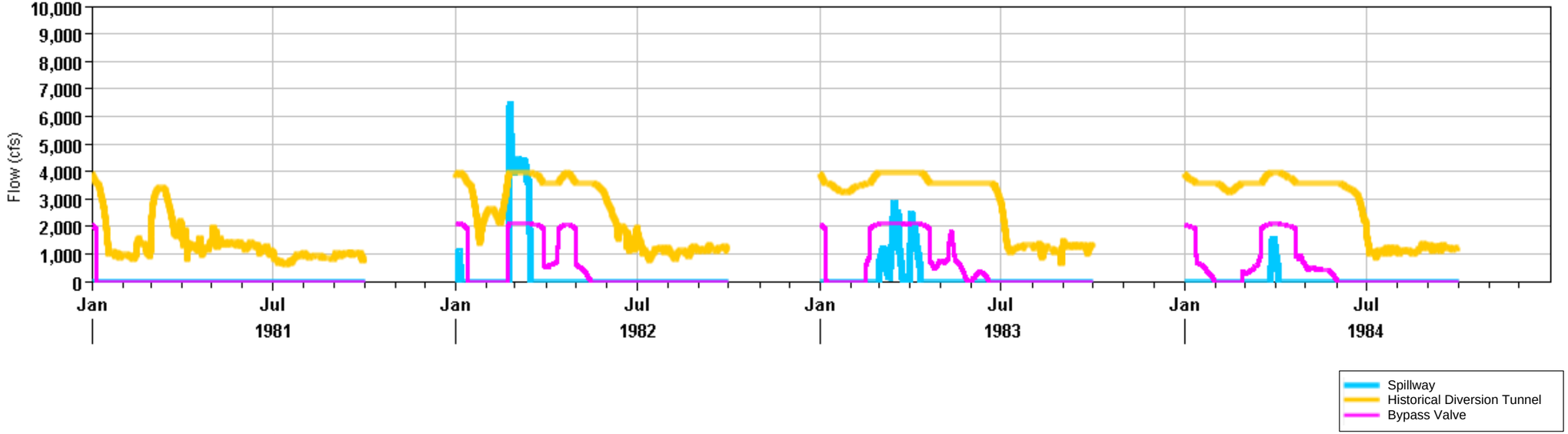


Figure 56: Iron Gate Structure Outlet Flows for years 1981 through 1984

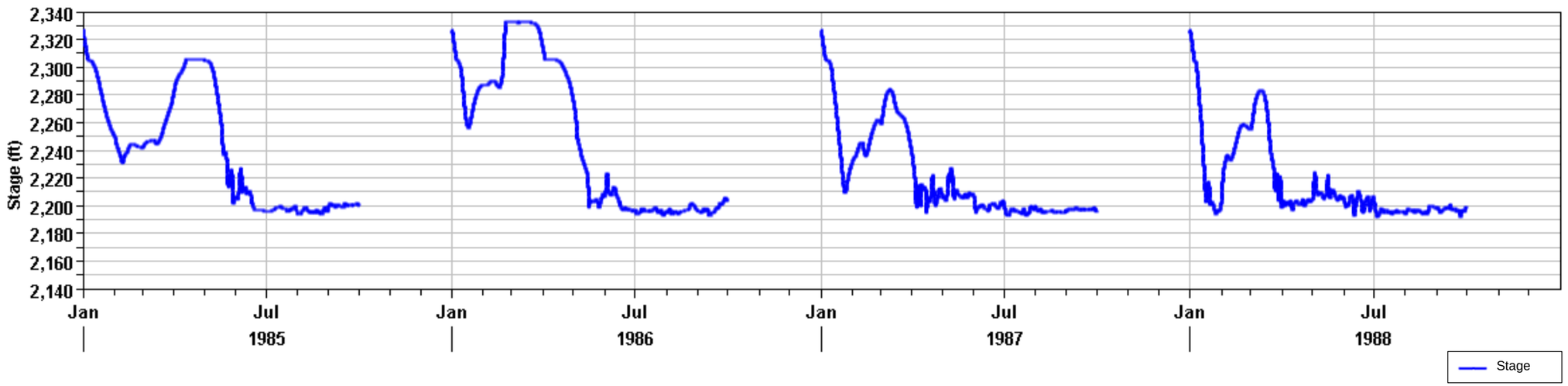


Figure 57: Iron Gate Drawdown Stage for years 1985 through 1988

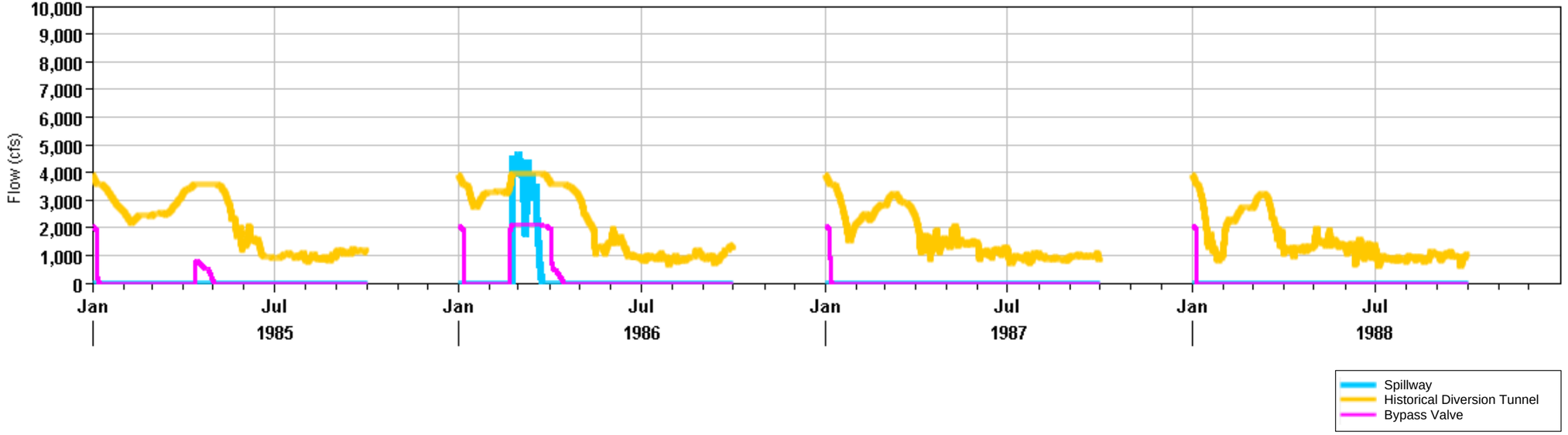


Figure 58: Iron Gate Structure Outlet Flows for years 1985 through 1988

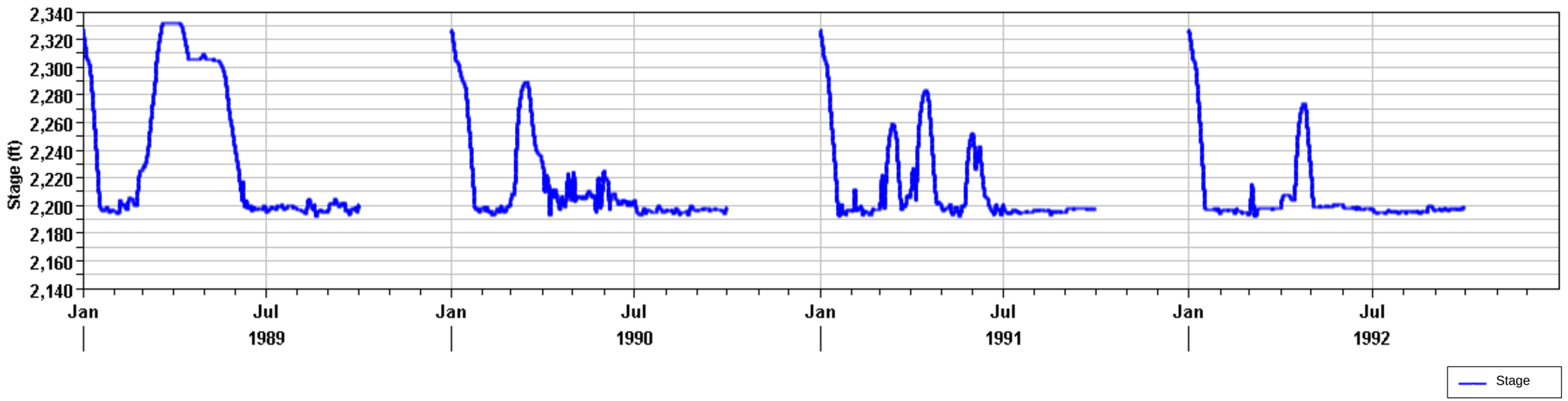


Figure 59: Iron Gate Drawdown Stage for years 1989 through 1992

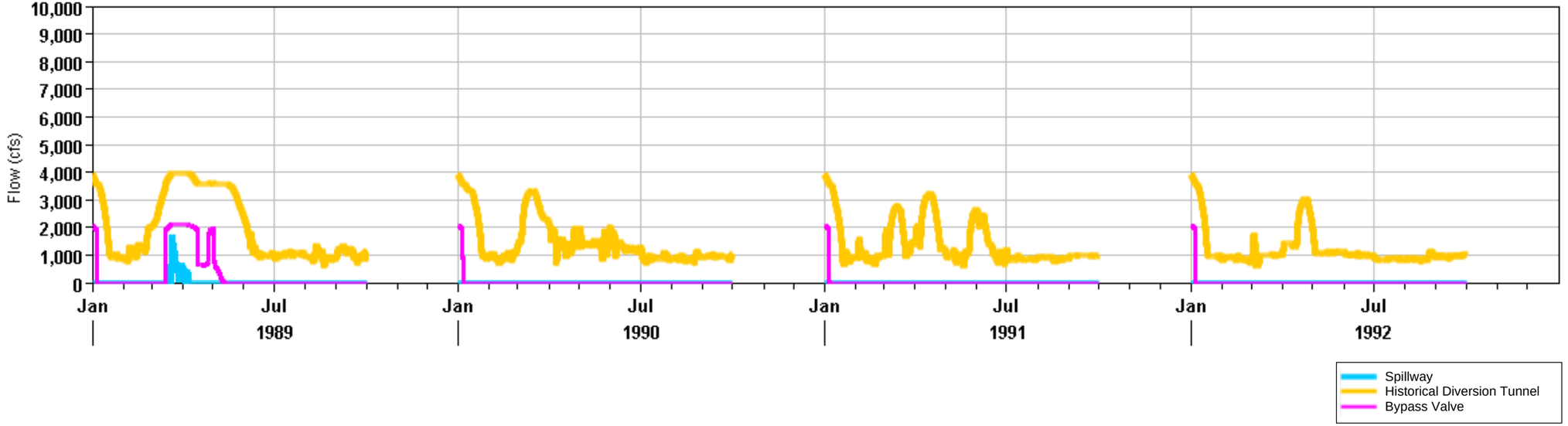


Figure 60 Iron Gate Structure Outlet Flows for years 1989 through 1992

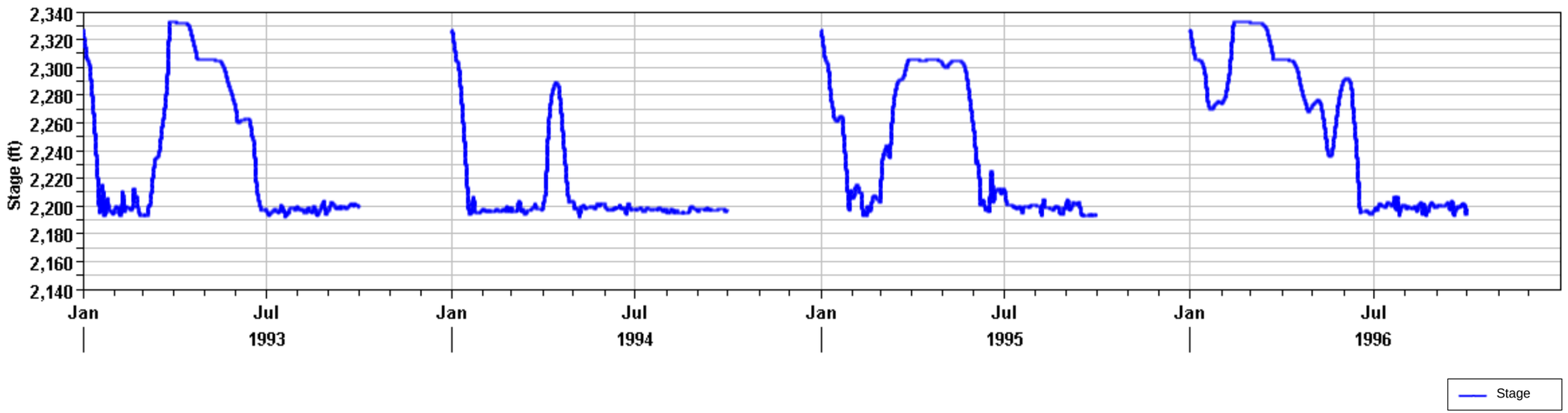


Figure 61: Iron Gate Drawdown Stage for years 1993 through 1996

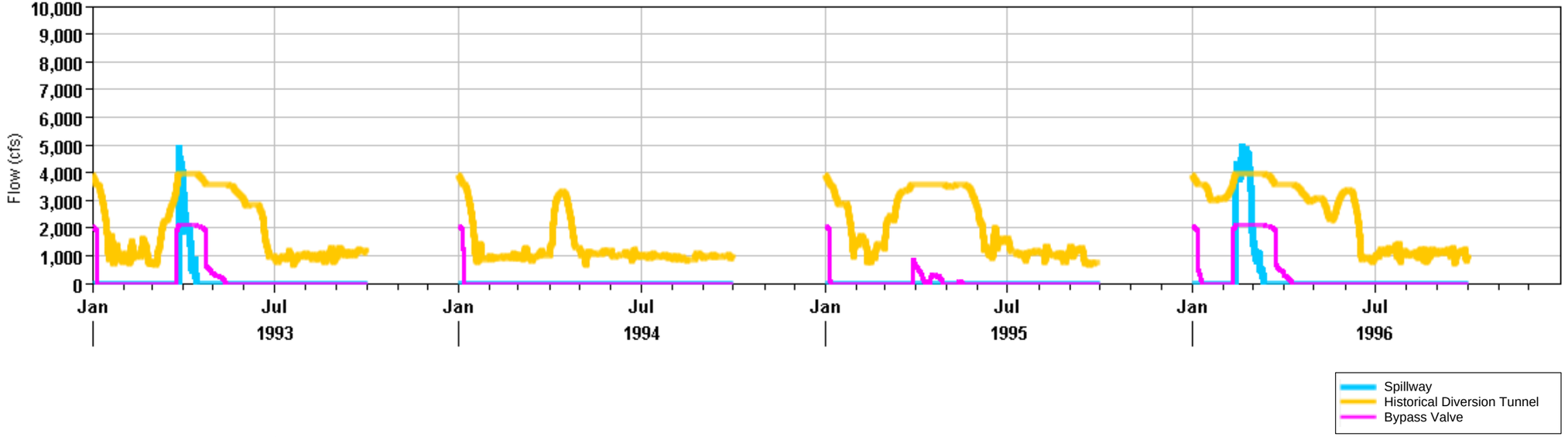


Figure 62: Iron Gate Structure Outlet Flows for years1993 through 1996

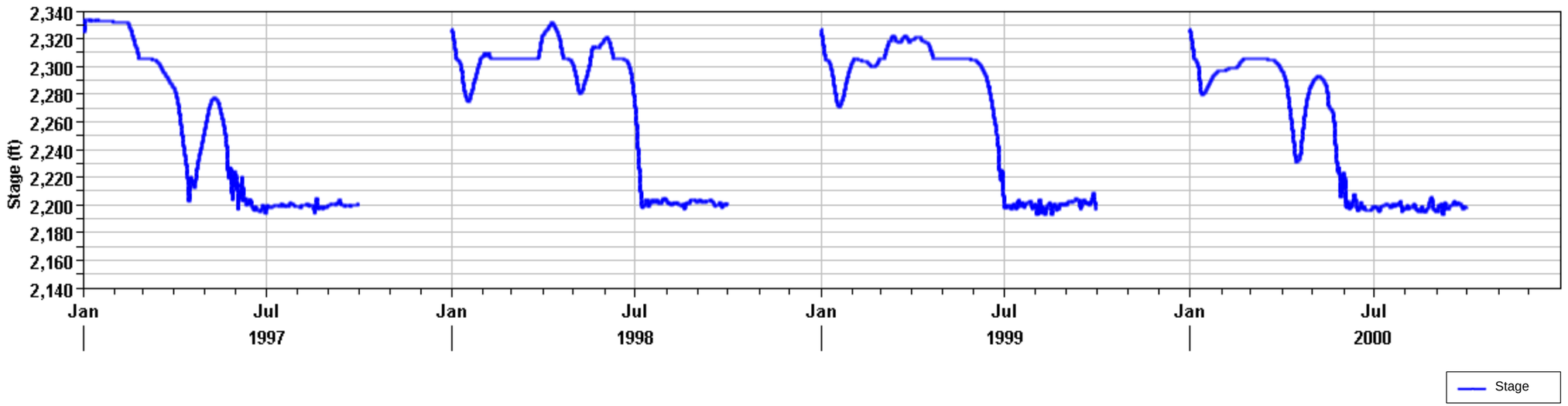


Figure 63: Iron Gate Drawdown Stage for years 1997 through 2000

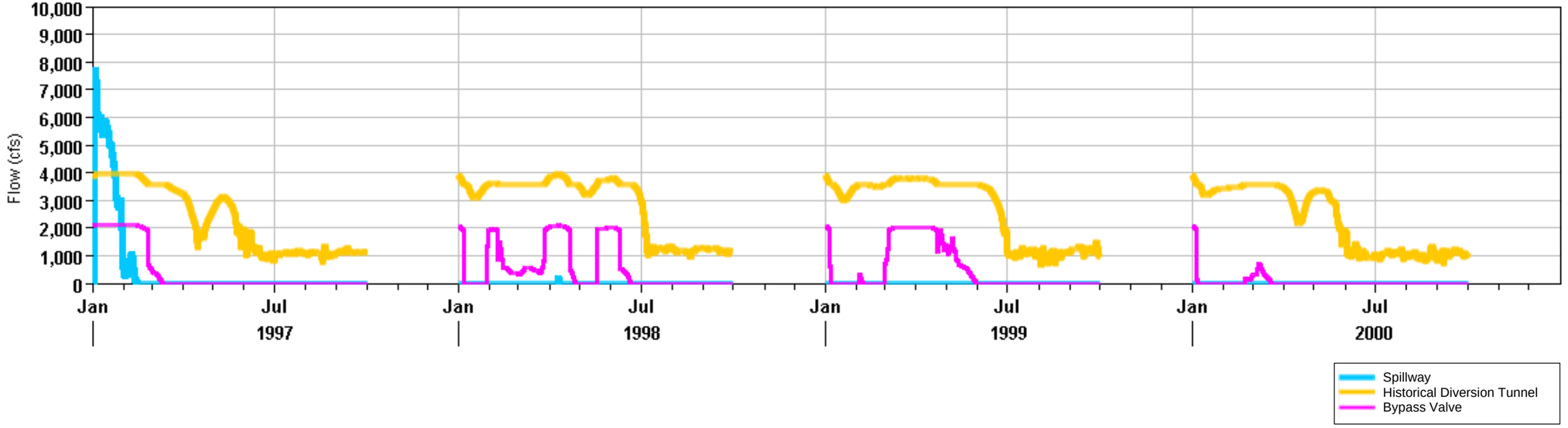


Figure 64: Iron Gate Structure Outlet Flows for years 1997 through 2000

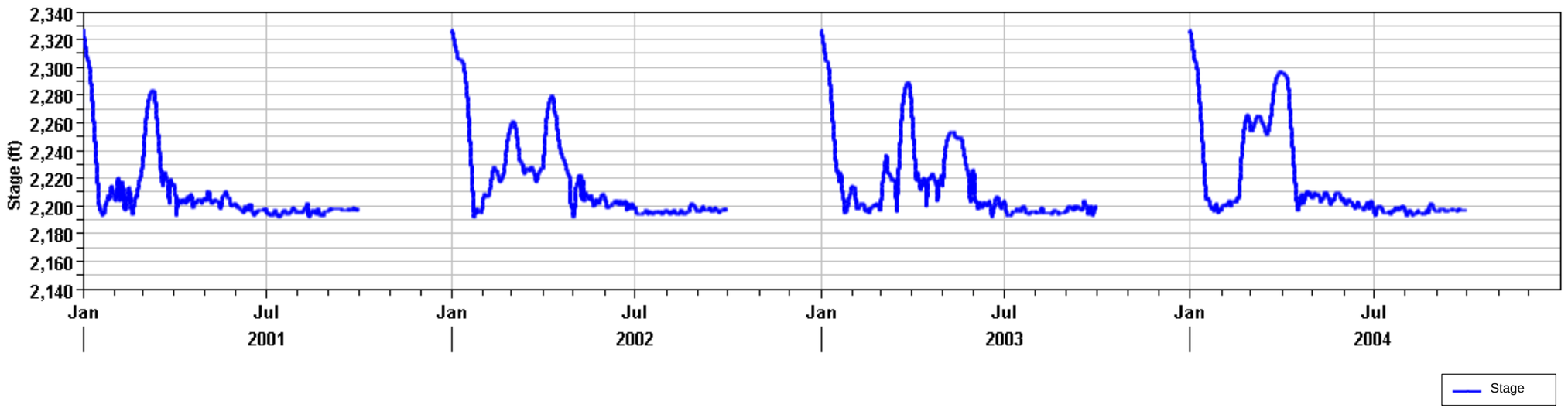


Figure 65: Iron Gate Drawdown Stage for years 2001 through 2004

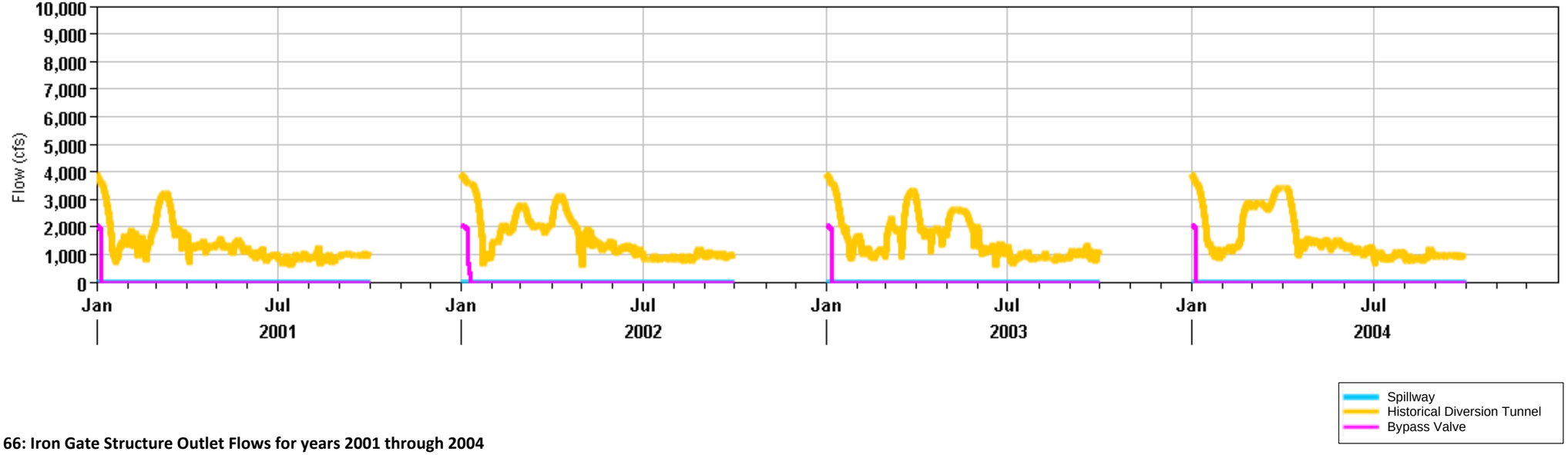


Figure 66: Iron Gate Structure Outlet Flows for years 2001 through 2004

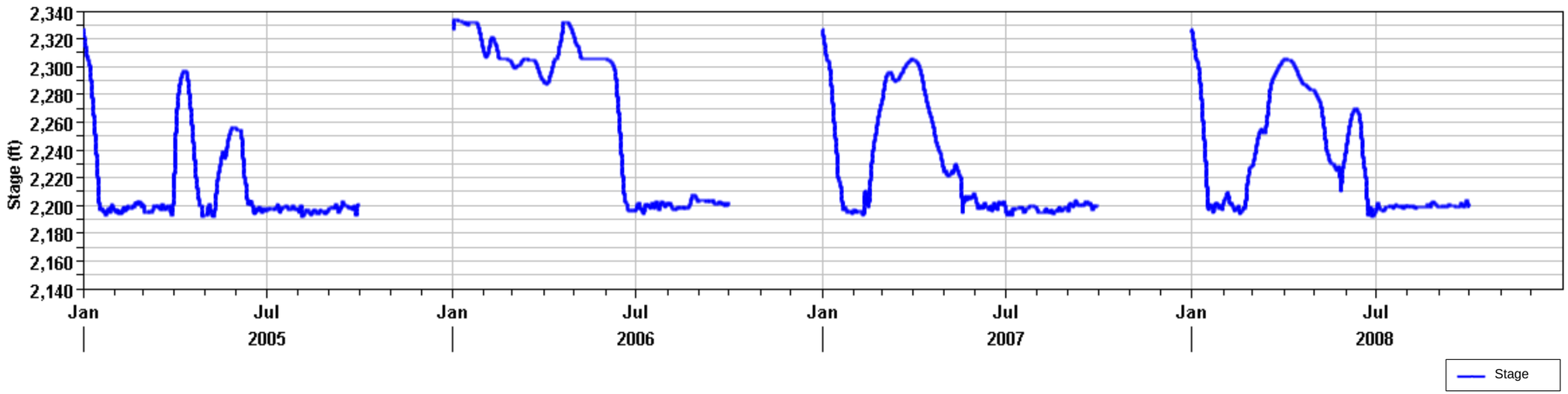


Figure 67: Iron Gate Drawdown Stage for years 2005 through 2008

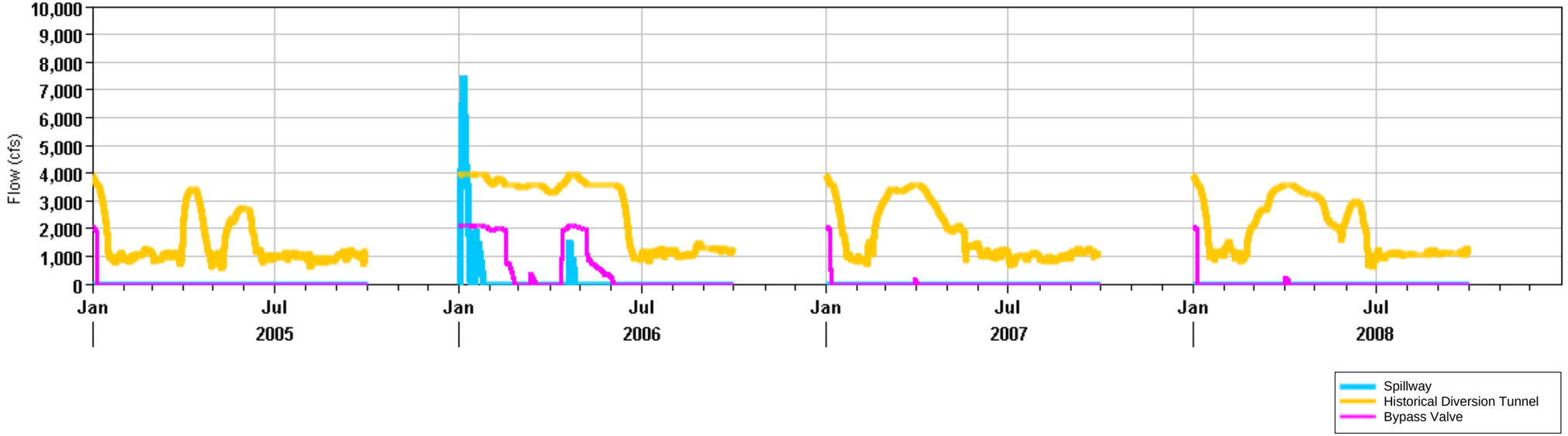


Figure 68: Iron Gate Structure Outlet Flows for years 2005 through 2008

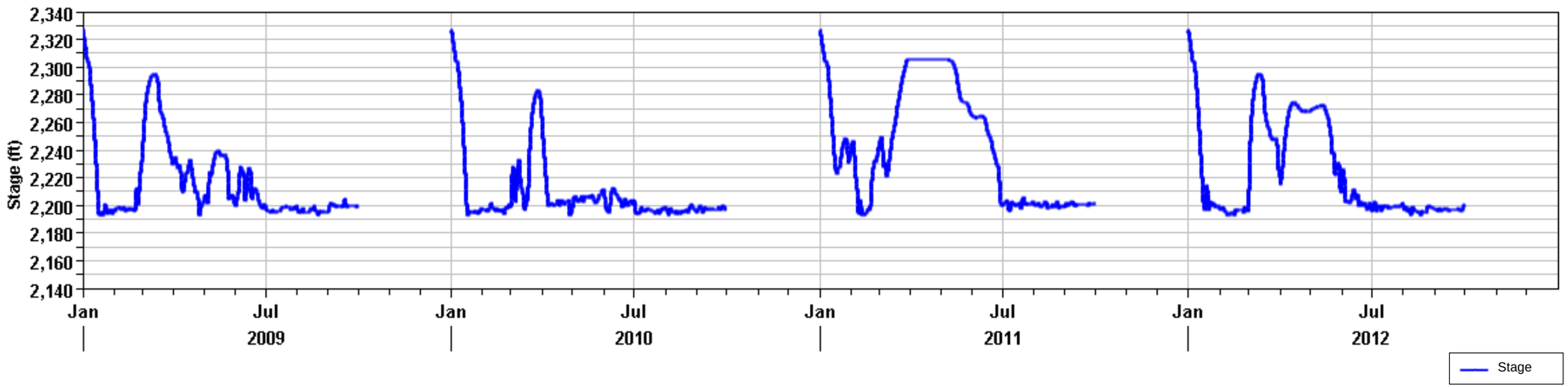


Figure 69: Iron Gate Drawdown Stage for years 2009 through 2012

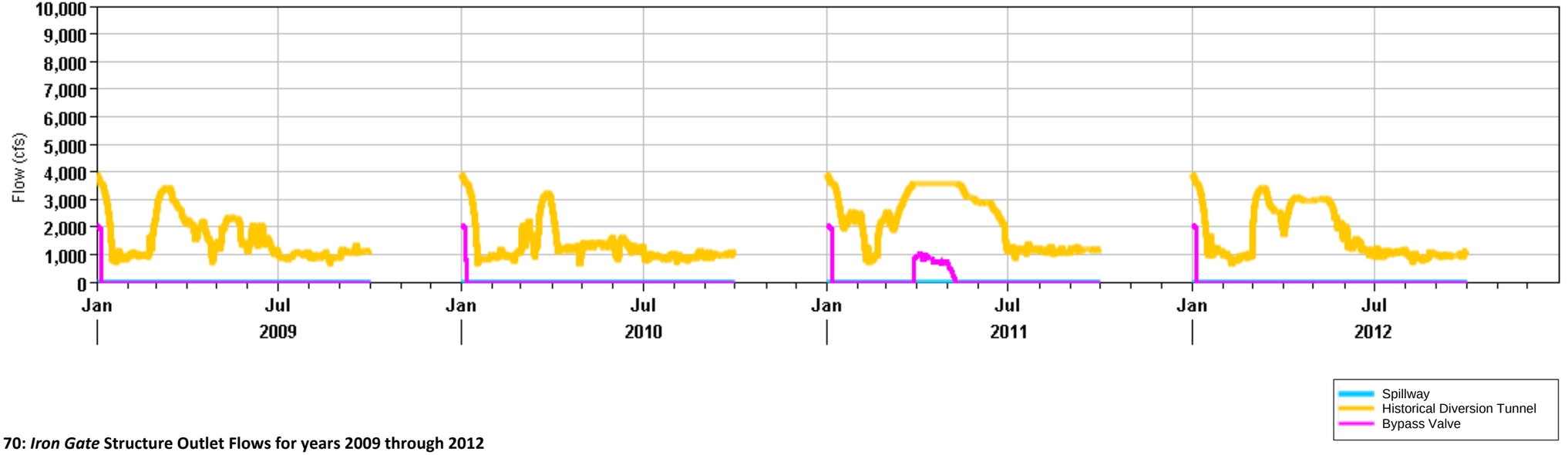


Figure 70: *Iron Gate* Structure Outlet Flows for years 2009 through 2012

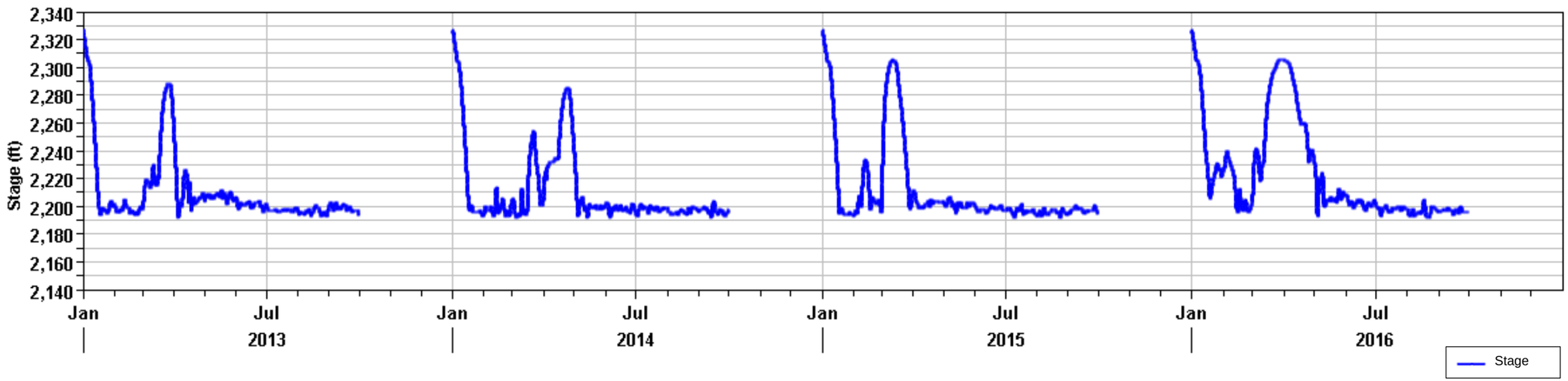


Figure 71: Iron Gate Drawdown Stage for years 2013 through 2016

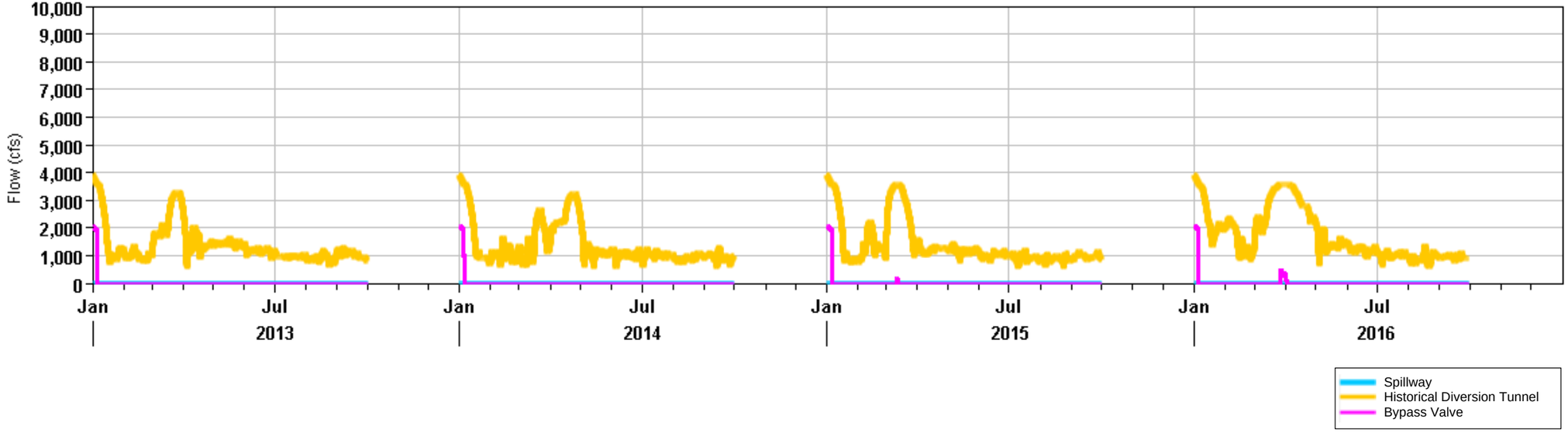
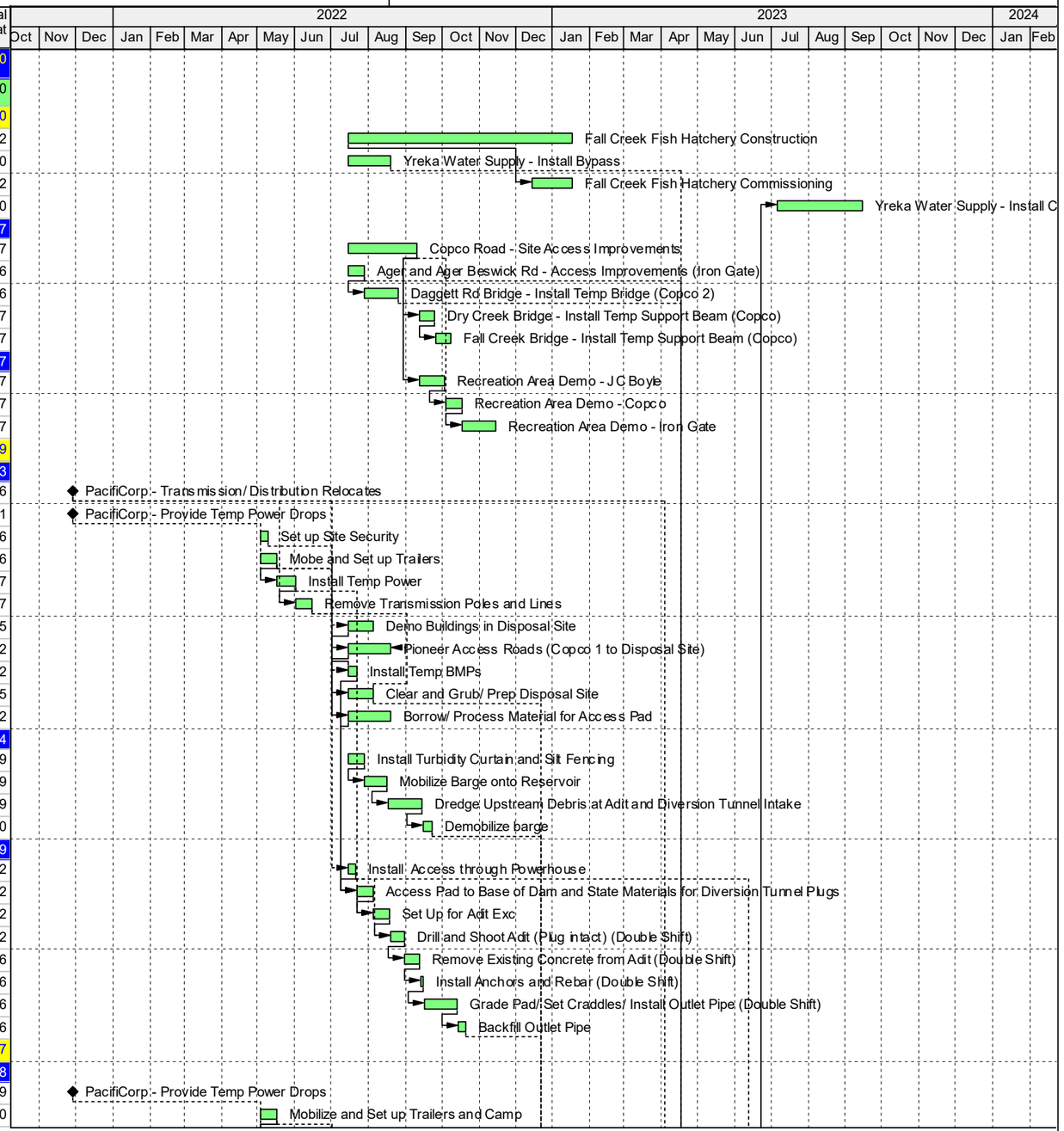


Figure 72: Iron Gate Structure Outlet Flows for years 2013 through 2016

Appendix B

Implementation Schedule

Activity ID	Activity Name	Original Duration	Start	Finish	Total Float
Klamath River Reconstruction Project - Implementation Work Sc		356	29-Nov-21	16-Nov-23	0
PRE-DRAWDOWN YEAR		316	29-Nov-21	14-Sep-23	40
Project Wide		230	15-Jul-22	14-Sep-23	40
PW1104	Fall Creek Fish Hatchery Construction	153	15-Jul-22	16-Jan-23	152
PW1010	Yreka Water Supply - Install Bypass	30	15-Jul-22	19-Aug-22	250
PW1114	Fall Creek Fish Hatchery Commissioning	25	15-Dec-22	16-Jan-23	152
PW1184	Yreka Water Supply - Install Cut and Cover	60	06-Jul-23	14-Sep-23	40
Roads and Bridges		73	15-Jul-22	08-Oct-22	197
PW0044	Copco Road - Site Access Improvements	49	15-Jul-22	10-Sep-22	37
PW1003	Ager and Ager Beswick Rd - Access Improvements (Iron Gate)	12	15-Jul-22	28-Jul-22	56
PW1004	Daggett Rd Bridge - Install Temp Bridge (Copco 2)	24	29-Jul-22	25-Aug-22	56
PW1001	Dry Creek Bridge - Install Temp Support Beam (Copco)	12	12-Sep-22	24-Sep-22	197
PW1002	Fall Creek Bridge - Install Temp Support Beam (Copco)	12	26-Sep-22	08-Oct-22	197
Demo Recreation Sites		55	12-Sep-22	14-Nov-22	37
PW1008	Recreation Area Demo - J C Boyle	19	12-Sep-22	03-Oct-22	37
PW1020	Recreation Area Demo - Copco	12	04-Oct-22	17-Oct-22	37
PW1030	Recreation Area Demo - Iron Gate	24	18-Oct-22	14-Nov-22	37
Copco 1		169	29-Nov-21	20-Oct-22	9
Site Prep		116	29-Nov-21	19-Aug-22	53
CO12222	PacifiCorp - Transmission/ Distribution Relocates	0		29-Nov-21*	86
CO12240	PacifiCorp - Provide Temp Power Drops	0		29-Nov-21	181
CO10290	Set up Site Security	6	03-May-22	10-May-22	106
CO10062	Mobe and Set up Trailers	12	03-May-22	17-May-22	76
CO10600	Install Temp Power	12	17-May-22	01-Jun-22	77
CO10620	Remove Transmission Poles and Lines	12	01-Jun-22	15-Jun-22	77
CO10800	Demo Buildings in Disposal Site	18	15-Jul-22	05-Aug-22	65
CO10021	Pioneer Access Roads (Copco 1 to Disposal Site)	30	15-Jul-22	19-Aug-22	52
CO10040	Install Temp BMPs	6	15-Jul-22	22-Jul-22	52
CO10031	Clear and Grub/ Prep Disposal Site	18	15-Jul-22	05-Aug-22	65
CO10700	Borrow/ Process Material for Access Pad	30	15-Jul-22	19-Aug-22	52
Upstream Work		58	15-Jul-22	22-Sep-22	34
CO10030	Install Turbidity Curtain and Silt Fencing	12	15-Jul-22	28-Jul-22	39
CO10010	Mobilize Barge onto Reservoir	16	29-Jul-22	16-Aug-22	39
CO10210	Dredge Upstream Debris at Adit and Diversion Tunnel Intake	24	17-Aug-22	14-Sep-22	39
CO10052	Demobilize barge	6	15-Sep-22	22-Sep-22	120
Downstream Work		83	15-Jul-22	20-Oct-22	9
CO10034	Install Access through Powerhouse	6	15-Jul-22	21-Jul-22	52
CO16010	Access Pad to Base of Dam and State Materials for Diversion Tunnel Plugs	12	22-Jul-22	04-Aug-22	52
CO10380	Set Up for Adit Exc	12	05-Aug-22	18-Aug-22	52
CO10071	Drill and Shoot Adit (Plug intact) (Double Shift)	10	19-Aug-22	30-Aug-22	52
CO10340	Remove Existing Concrete from Adit (Double Shift)	10	31-Aug-22	12-Sep-22	96
CO10360	Install Anchors and Rebar (Double Shift)	3	13-Sep-22	15-Sep-22	96
CO10451	Grade Pad/ Set Craddles/ Install Outlet Pipe (Double Shift)	23	16-Sep-22	13-Oct-22	96
CO11010	Backfill Outlet Pipe	6	14-Oct-22	20-Oct-22	96
Copco 2		159	29-Nov-21	08-Oct-22	197
Access/Site Work		106	29-Nov-21	08-Aug-22	168
CO20521	PacifiCorp - Provide Temp Power Drops	0		29-Nov-21	409
CO20491	Mobilize and Set up Trailers and Camp	12	03-May-22	17-May-22	110

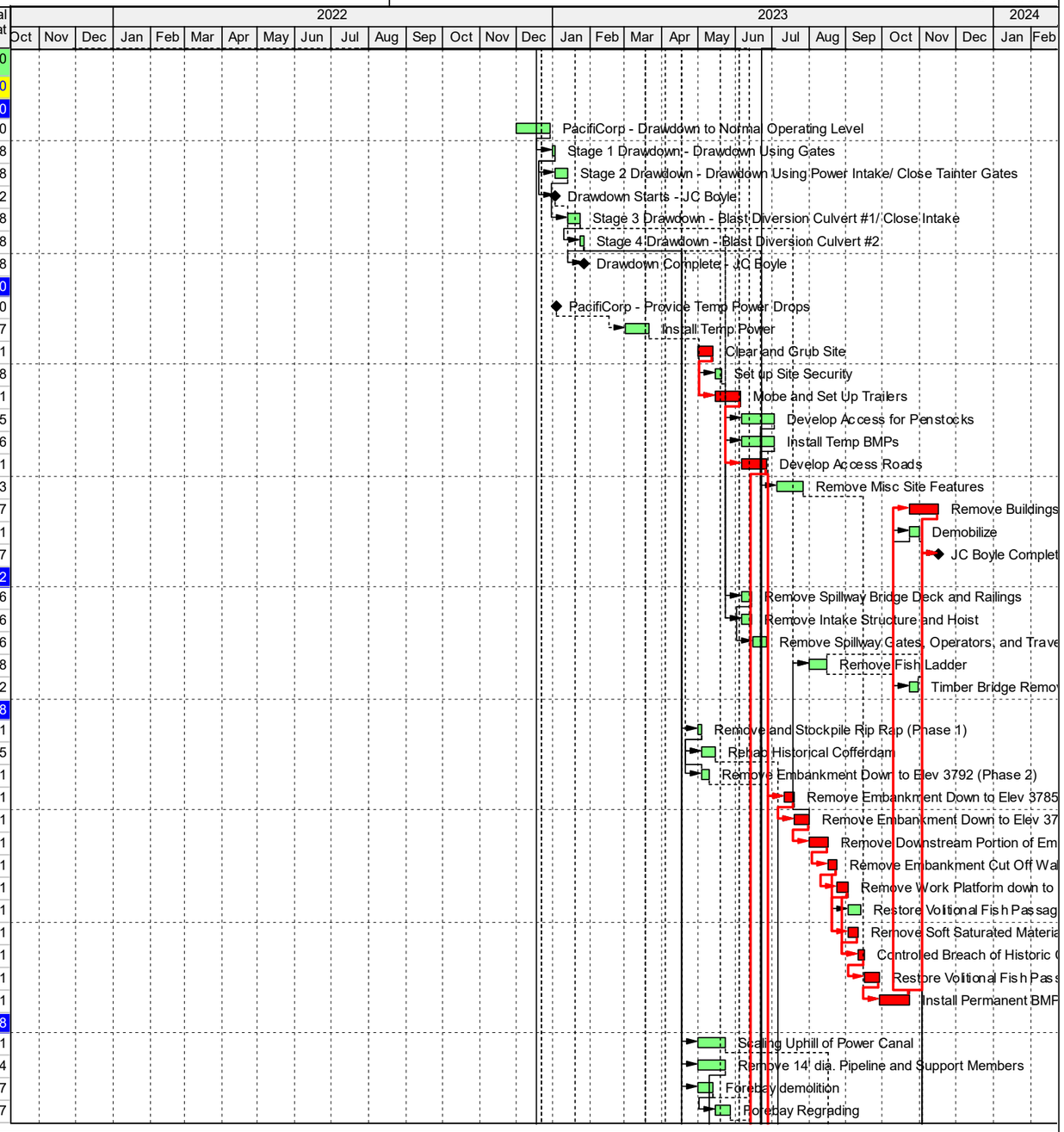


Activity ID	Activity Name	Original Duration	Start	Finish	Total Float
CO20011	Install Temp BMPs	10	17-May-22	28-May-22	110
CO20501	Install Temp Power	10	17-May-22	28-May-22	226
CO20013	Prep Site and Clear and Grub	10	15-Jul-22	27-Jul-22	72
CO20012	Set Up Staging Areas	18	15-Jul-22	05-Aug-22	145
CO20014	Pioneer Access Roads	10	27-Jul-22	08-Aug-22	72
Dam Removal		53	08-Aug-22	08-Oct-22	197
Dry Period #1		25	08-Aug-22	06-Sep-22	203
CO2001	Dry Up Reservoir	1	08-Aug-22	08-Aug-22	79
CO2008	Remove Right Retaining Wall (Double Shift)	2	08-Aug-22	10-Aug-22	147
CO2026	Remove Existing Cofferdam (Double Shift)	5	08-Aug-22	13-Aug-22	223
CO2007	Remove Tainter Gates, Bridge Deck, Hoists (Double Shift)	6	09-Aug-22	15-Aug-22	142
CO2011	Demo Concrete Spillway (Double Shift)	6	09-Aug-22	15-Aug-22	142
CO20541	Refill Reservoir	18	16-Aug-22	06-Sep-22	142
Dry Period #2		28	07-Sep-22	08-Oct-22	197
CO20481	Dry Up Reservoir	1	07-Sep-22	07-Sep-22	79
CO20401	Close Caterpillar Gate	1	08-Sep-22	08-Sep-22	142
CO2004	CIP Plug for Caterpillar Gate (Double Shift)	1	09-Sep-22	09-Sep-22	197
CO20411	Demo and Remove Intake Structure (Double Shift)	3	10-Sep-22	13-Sep-22	197
CO2013	Regrade Right Bank, Remove Access Road, and Grade Area (Double Shift)	6	10-Sep-22	16-Sep-22	216
CO2002	Backfill Intake Structure with Rip Rap (Double Shift)	2	14-Sep-22	15-Sep-22	217
CO20391	Restore Volitional Fish Channel (Downstream of Dam) (Double Shift)	4	14-Sep-22	17-Sep-22	197
CO20551	Refill Reservoir	18	19-Sep-22	08-Oct-22	197
Iron Gate		178	29-Nov-21	25-Nov-22	151
Access/ Site Work		111	29-Nov-21	12-Aug-22	218
IG4000	PacifiCorp - Provide Temp Power Drops	0		29-Nov-21	182
IG2130	Set Up Site Security	6	03-May-22	10-May-22	287
IG0067	Mobe and Setup Trailers	19	03-May-22	24-May-22	68
IG0064	Install Temp BMPs	16	25-May-22	13-Jun-22	268
IG3280	Install Temp Power	16	25-May-22	13-Jun-22	70
IG2140	Install Piping at Fish Facilities	25	15-Jul-22	12-Aug-22	155
IG0051	Build Access Road to Diversion Tunnel and Holding Tanks	18	15-Jul-22	04-Aug-22	27
IG0065	Prep Site and Set Up Staging Areas	16	15-Jul-22	03-Aug-22	227
IG3290	Decommission Holding Ponds	12	15-Jul-22	28-Jul-22	33
Pre-Drawdown Modifications		74	05-Aug-22	25-Nov-22	0
Tunnel Linning		74	05-Aug-22	25-Nov-22	0
IG3050	Mobe Equipment and Set-up	10	05-Aug-22	16-Aug-22	27
IG0001	Close and Secure Hinged Blind Flange	5	17-Aug-22	22-Aug-22	27
IG3060	Demo Weir and Stop Logs/ Water Pump Down (Double Shift)	2	23-Aug-22	24-Aug-22	27
IG3070	Tunnel Inspection Scaling/ Vent/ Utilities/ Temp Support (Double Shift)	10	25-Aug-22	06-Sep-22	27
IG3080	Demo Existing Invert Concrete (double shift)	4	07-Sep-22	10-Sep-22	27
IG3090	Install Anchors for Walls/ invert (double shift)	4	12-Sep-22	15-Sep-22	27
IG3100	Mud Mat (Double Shift)	2	16-Sep-22	17-Sep-22	27
IG3110	Invert Rebar (Double Shift)	2	19-Sep-22	20-Sep-22	27
IG3120	Invert Concrete (Double Shift)	5	21-Sep-22	26-Sep-22	27
IG3130	Wall Rebar (Double Shift)	4	30-Sep-22	04-Oct-22	30
IG0013	Wall Concrete (Double Shift)	14	05-Oct-22	21-Oct-22	30
IG0028	Install Vent Lines (Double Shift)	22	22-Oct-22	17-Nov-22	30
IG3260	Remove Blind Flange (Double Shift)	6	18-Nov-22	25-Nov-22	30

Actual Work
Remaining Work
Critical Remaining Work
◆ Milestone

TASK filters: EXCLUDES MILESTONES, Excludes Permitting.

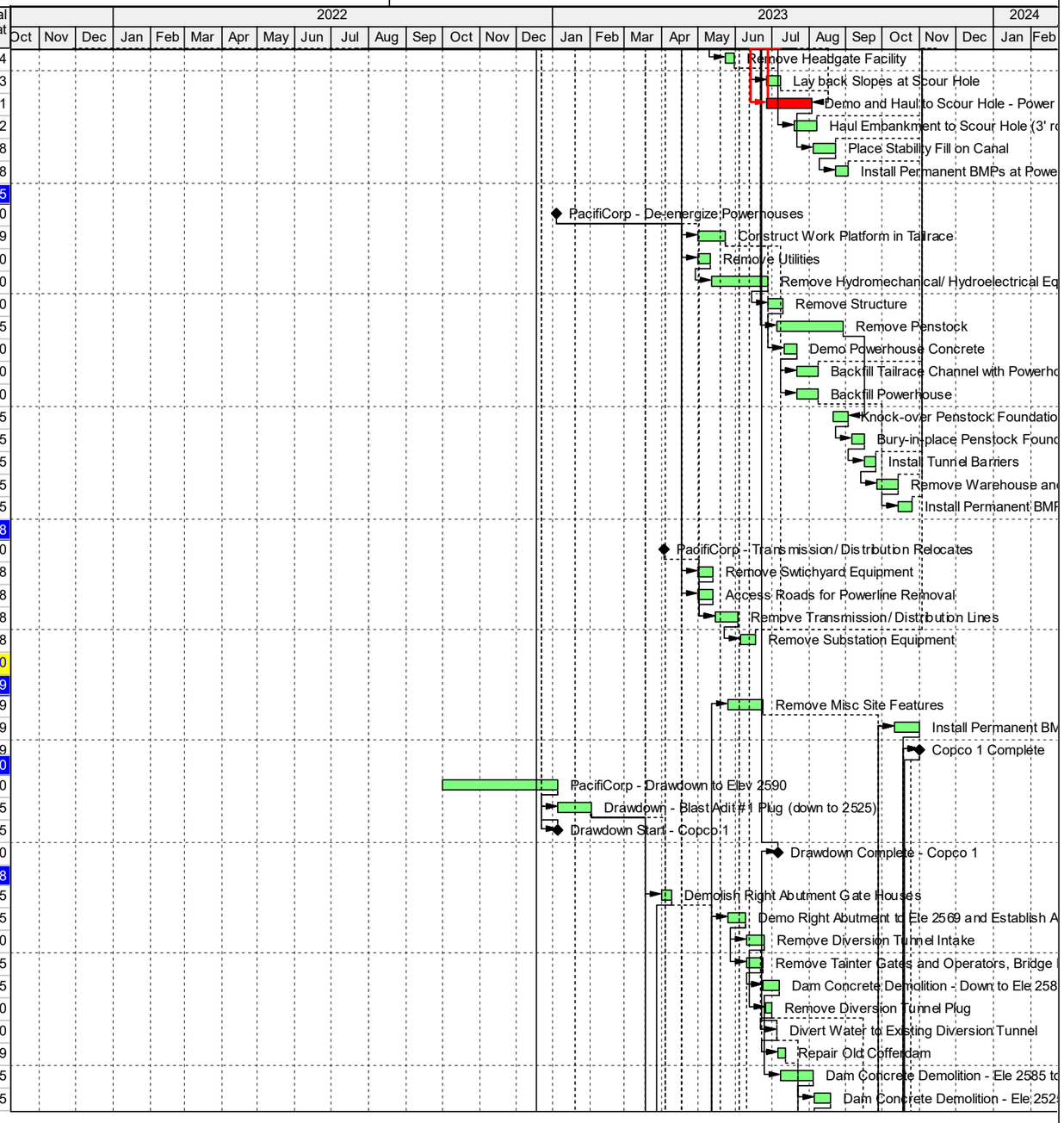
Activity ID	Activity Name	Original Duration	Start	Finish	Total Float
DRAWDOWN YEAR		204	01-Oct-22	16-Nov-23	0
JC Boyle		178	01-Dec-22	16-Nov-23	0
Drawdown		0	01-Dec-22	27-Jan-23	0
JCB1180	PacifiCorp - Drawdown to Normal Operating Level	20	01-Dec-22*	29-Dec-22	0
JCB0017	Stage 1 Drawdown - Drawdown Using Gates	2	01-Jan-23	03-Jan-23	48
JCB1220	Stage 2 Drawdown - Drawdown Using Power Intake/ Close Tainter Gates	10	03-Jan-23	13-Jan-23	48
JCB0082	Drawdown Starts - JC Boyle	0	03-Jan-23		72
JCB1230	Stage 3 Drawdown - Blast Diversion Culvert #1/ Close Intake	10	13-Jan-23	23-Jan-23	48
JCB0019	Stage 4 Drawdown - Blast Diversion Culvert #2	4	23-Jan-23	27-Jan-23	48
JCB1050	Drawdown Complete - JC Boyle	0		27-Jan-23	48
Access/ Site Work		178	03-Jan-23	16-Nov-23	0
JCB1270	PacifiCorp - Provide Temp Power Drops	0		03-Jan-23*	0
JCB1260	Install Temp Power	18	01-Mar-23*	21-Mar-23	47
JCB0057	Clear and Grub Site	12	01-May-23*	13-May-23	1
JCB1060	Set up Site Security	6	15-May-23	20-May-23	18
JCB0056	Mobe and Set Up Trailers	18	15-May-23	05-Jun-23	1
JCB1070	Develop Access for Penstocks	24	06-Jun-23	03-Jul-23	5
JCB0051	Install Temp BMPs	24	06-Jun-23	03-Jul-23	6
JCB0052	Develop Access Roads	18	06-Jun-23	26-Jun-23	1
JCB1190	Remove Misc Site Features	20	05-Jul-23	27-Jul-23	53
JCB1200	Remove Buildings and Storage Sheds at Dam	20	23-Oct-23	16-Nov-23	37
JCB0059	Demobilize	7	23-Oct-23	31-Oct-23	1
JCB0081	JC Boyle Complete	0		16-Nov-23	37
Dam/Intake/Spillway Removal		122	06-Jun-23	30-Oct-23	2
JCB0014	Remove Spillway Bridge Deck and Railings	8	06-Jun-23	14-Jun-23	106
JCB0012	Remove Intake Structure and Hoist	8	06-Jun-23	14-Jun-23	116
JCB0015	Remove Spillway Gates, Operators, and Traveling Hoist	10	15-Jun-23	26-Jun-23	106
JCB0005	Remove Fish Ladder	13	01-Aug-23	16-Aug-23	58
JCB0013	Timber Bridge Removal	6	23-Oct-23	30-Oct-23	2
Embankment Removal		146	01-May-23	23-Oct-23	8
JCB0006	Remove and Stockpile Rip Rap (Phase 1)	3	01-May-23*	03-May-23	51
JCB0003	Rehab Historical Cofferdam	10	04-May-23*	15-May-23	55
JCB1240	Remove Embankment Down to Elev 3792 (Phase 2)	6	04-May-23*	10-May-23	51
JCB0020	Remove Embankment Down to Elev 3785 (Phase 3)	8	11-Jul-23	20-Jul-23	1
JCB1120	Remove Embankment Down to Elev 3775.7 (Phase 4)	10	20-Jul-23*	01-Aug-23	1
JCB1130	Remove Downstream Portion of Embankment down to Bedrock Elev 3738 (Phase	14	01-Aug-23	17-Aug-23	1
JCB0007	Remove Embankment Cut Off Wall	6	17-Aug-23	24-Aug-23	1
JCB1170	Remove Work Platform down to Bedrock (Phase 7)	8	24-Aug-23	02-Sep-23	1
JCB1000	Restore Volitional Fish Passage (Downstream of Historic Cofferdam)	8	02-Sep-23	13-Sep-23	41
JCB1140	Remove Soft Saturated Material	6	02-Sep-23	11-Sep-23	1
JCB0009	Controlled Breach of Historic Cofferdam (down to 3740.7)	5	11-Sep-23	16-Sep-23	1
JCB1150	Restore Volitional Fish Passage (Upstream of Embamkment)	10	16-Sep-23	28-Sep-23	1
JCB1210	Install Permanent BMPs	20	28-Sep-23	23-Oct-23	1
Power Canal Removal		106	01-May-23	02-Sep-23	48
JCB1090	Scaling Uphill of Power Canal	20	01-May-23	23-May-23	61
JCB0024	Remove 14' dia. Pipeline and Support Members	20	01-May-23	23-May-23	114
JCB0029	Forebay demolition	12	01-May-23	13-May-23	37
JCB1010	Forebay Regrading	12	15-May-23	27-May-23	47



Actual Work
Remaining Work
Critical Remaining Work
Milestone

TASK filters: EXCLUDES MILESTONES, Excludes Permitting.

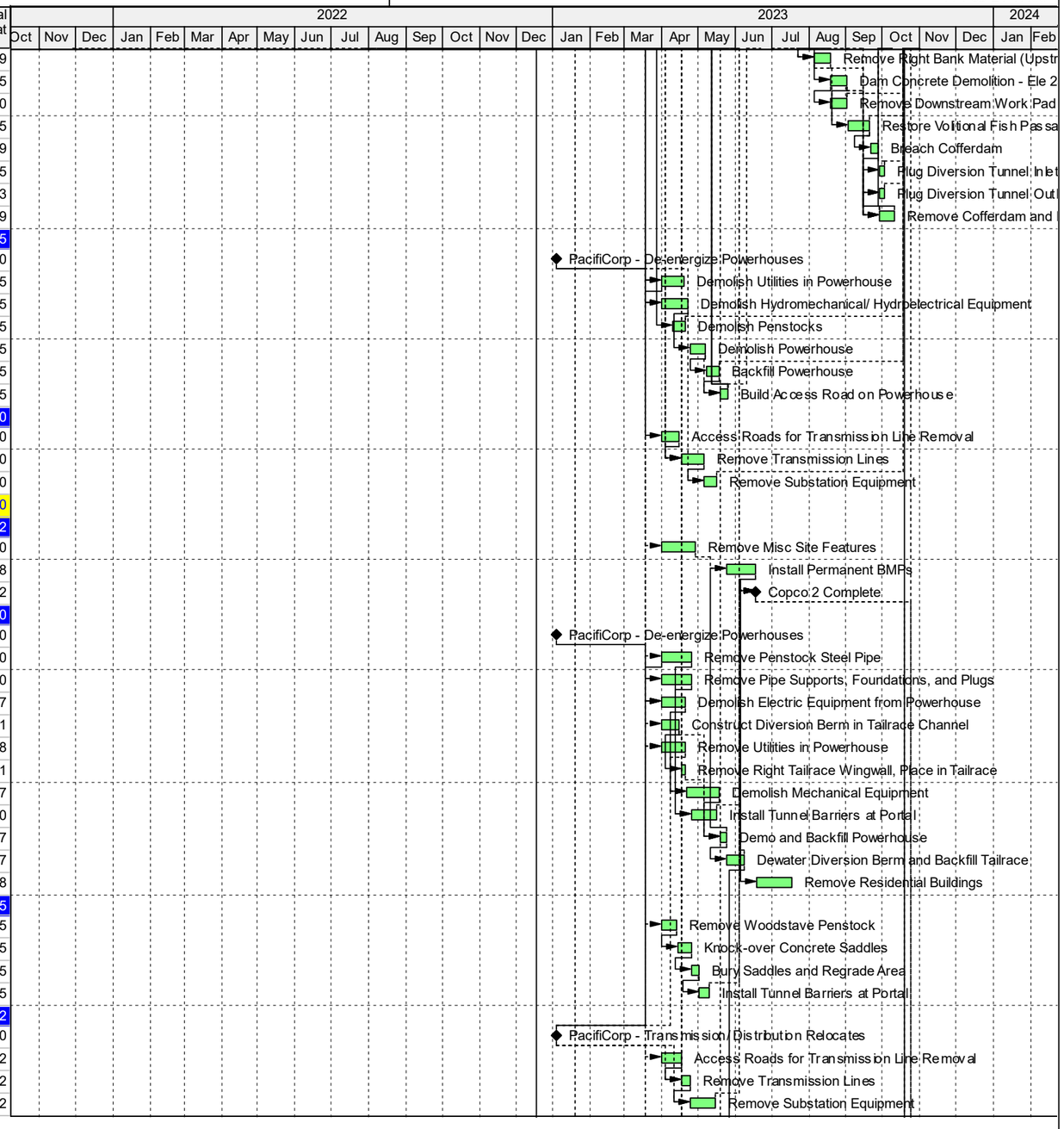
Activity ID	Activity Name	Original Duration	Start	Finish	Total Float
JCB0026	Remove Headgate Facility	5	24-May-23	30-May-23	114
JCB0040	Lay back Slopes at Scour Hole	10	27-Jun-23	08-Jul-23	23
JCB0027	Demo and Haul to Scour Hole - Power Canal Downhill Wall	32	27-Jun-23	03-Aug-23	1
JCB0031	Haul Embankment to Scour Hole (3' rock cover)	15	20-Jul-23	07-Aug-23	72
JCB0028	Place Stability Fill on Canal	16	04-Aug-23	22-Aug-23	48
JCB1100	Install Permanent BMPs at Power Canal and Scour Hole	10	23-Aug-23	02-Sep-23	48
Powerhouse and Penstock Removal		173	03-Jan-23	25-Oct-23	5
JCB1040	PacifiCorp - De-energize Powerhouses	0		03-Jan-23*	0
JCB0034	Construct Work Platform in Tailrace	20	01-May-23	23-May-23	99
JCB0043	Remove Utilities	10	01-May-23*	11-May-23	60
JCB0044	Remove Hydromechanical/ Hydroelectrical Equipment	39	12-May-23	27-Jun-23	60
JCB1020	Remove Structure	10	28-Jun-23	10-Jul-23	60
JCB0022	Remove Penstock	48	05-Jul-23	29-Aug-23	5
JCB0041	Demo Powerhouse Concrete	10	11-Jul-23	21-Jul-23	60
JCB0038	Backfill Tailrace Channel with Powerhouse Concrete and Excavated Alluvial Materi	15	22-Jul-23	08-Aug-23	70
JCB0025	Backfill Powerhouse	15	22-Jul-23	08-Aug-23	60
JCB0023	Knock-over Penstock Foundations	12	21-Aug-23	02-Sep-23	5
JCB0032	Bury-in-place Penstock Foundations	10	05-Sep-23	15-Sep-23	5
JCB0033	Install Tunnel Barriers	8	16-Sep-23	25-Sep-23	5
JCB1030	Remove Warehouse and Buildings	15	26-Sep-23	13-Oct-23	5
JCB1250	Install Permanent BMP	10	14-Oct-23	25-Oct-23	5
Transmission/Distribution		64	03-Apr-23	17-Jun-23	98
JCB1110	PacifiCorp - Transmission/ Distribution Relocates	0		03-Apr-23*	0
JCB0036	Remove Swtichyard Equipment	12	01-May-23*	13-May-23	98
JCB0100	Access Roads for Powerline Removal	12	01-May-23*	13-May-23	98
JCB0042	Remove Transmission/ Distribution Lines	17	15-May-23	03-Jun-23	98
JCB0045	Remove Substation Equipment	12	05-Jun-23	17-Jun-23	98
Copco 1		204	01-Oct-22	31-Oct-23	0
Access/Site Work		132	26-May-23	31-Oct-23	39
CO11000	Remove Misc Site Features	24	26-May-23	23-Jun-23	129
CO11020	Install Permanent BMPs	18	11-Oct-23	31-Oct-23	39
CO10064	Copco 1 Complete	0		31-Oct-23	39
Drawdown		104	01-Oct-22	06-Jul-23	40
CO10018	PacifiCorp - Drawdown to Elev 2590	32	01-Oct-22*	04-Jan-23	0
CO10003	Drawdown - Blast Adit #1 Plug (down to 2525)	10	04-Jan-23	01-Feb-23	15
CO10063	Drawdown Start - Copco 1	0	04-Jan-23		15
CO10260	Drawdown Complete - Copco 1	0	06-Jul-23		40
Dam Removal		160	01-Apr-23	10-Oct-23	18
CO10005	Demolish Right Abutment Gate Houses	6	01-Apr-23	08-Apr-23	65
CO10004	Demo Right Abutment to Ele 2569 and Establish Access	12	26-May-23	09-Jun-23	35
CO10072	Remove Diversion Tunnel Intake	13	10-Jun-23	24-Jun-23	40
CO10002	Remove Tainter Gates and Operators, Bridge Deck and Piers	12	10-Jun-23	23-Jun-23	35
CO10250	Dam Concrete Demolition - Down to Ele 2585	10	24-Jun-23	07-Jul-23	35
CO10240	Remove Diversion Tunnel Plug	6	26-Jun-23	01-Jul-23	40
CO10331	Divert Water to Existing Diversion Tunnel	1	05-Jul-23	05-Jul-23	40
CO10400	Repair Old Cofferdam	6	06-Jul-23	12-Jul-23	79
CO11300	Dam Concrete Demolition - Ele 2585 to Elev 2525	24	08-Jul-23	04-Aug-23	35
CO10300	Dam Concrete Demolition - Ele 2525 to Elev 2511	12	05-Aug-23	18-Aug-23	35



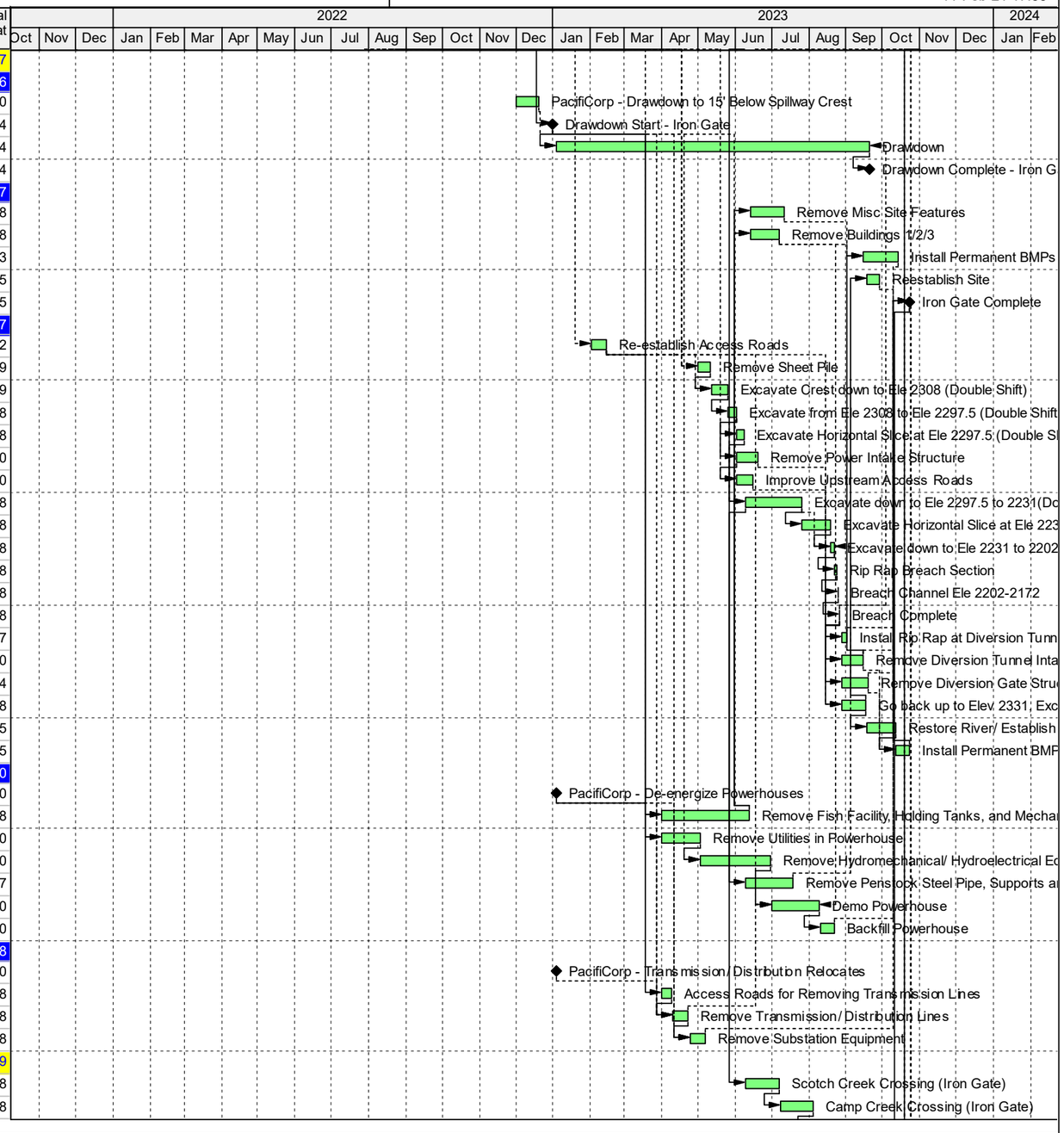
Actual Work
Remaining Work
Critical Remaining Work
◆ Milestone

TASK filters: EXCLUDES MILESTONES, Excludes Permitting.

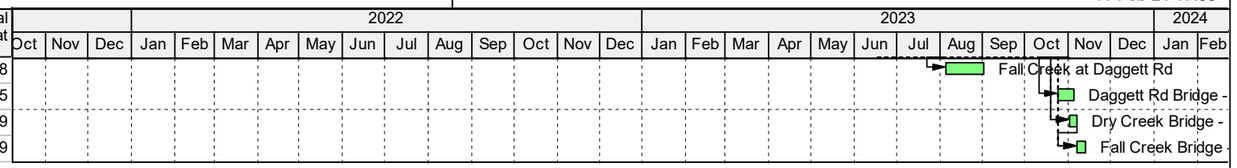
Activity ID	Activity Name	Original Duration	Start	Finish	Total Float
CO10341	Remove Right Bank Material (Upstream of Dam)	12	05-Aug-23	18-Aug-23	59
CO11200	Dam Concrete Demolition - Ele 2511 to Ele 2472	12	19-Aug-23	01-Sep-23	35
CO10017	Remove Downstream Work Pad and Pipe	12	19-Aug-23	01-Sep-23	70
CO10371	Restore Volitional Fish Passage Channel (Downstream of Historical Cofferdam)	15	02-Sep-23	20-Sep-23	35
CO11800	Breach Cofferdam	6	21-Sep-23	27-Sep-23	39
CO11030	Plug Diversion Tunnel Inlet	4	28-Sep-23	02-Oct-23	45
CO10019	Plug Diversion Tunnel Outlet	4	28-Sep-23	02-Oct-23	63
CO10351	Remove Cofferdam and Historical Construction, Volitional Fish Passage Upstream	10	28-Sep-23	10-Oct-23	39
Powerhouse and Penstock Removal		46	03-Jan-23	25-May-23	35
CO12230	PacifiCorp - De-energize Powerhouses	0		03-Jan-23*	0
CO10051	Demolish Utilities in Powerhouse	15	01-Apr-23	19-Apr-23	35
CO10053	Demolish Hydromechanical/ Hydroelectrical Equipment	18	01-Apr-23	22-Apr-23	35
CO10006	Demolish Penstocks	10	10-Apr-23	20-Apr-23	65
CO10007	Demolish Powerhouse	12	24-Apr-23	06-May-23	35
CO10022	Backfill Powerhouse	10	08-May-23	18-May-23	35
CO10390	Build Access Road on Powerhouse	6	19-May-23	25-May-23	35
Transmission/Distribution		38	01-Apr-23	16-May-23	140
CO10220	Access Roads for Transmission Line Removal	12	01-Apr-23	15-Apr-23	140
CO10054	Remove Transmission Lines	17	17-Apr-23	05-May-23	140
CO10055	Remove Substation Equipment	9	06-May-23	16-May-23	140
Copco 2 (Could Happen as Early as Pre-Drawdown Year)		88	03-Jan-23	17-Jul-23	90
Site		66	01-Apr-23	17-Jun-23	152
CO20421	Remove Misc Site Features	24	01-Apr-23*	28-Apr-23	160
CO20441	Install Permanent BMPs	20	25-May-23	17-Jun-23	138
CO2081	Copco 2 Complete	0		17-Jun-23	152
Powerhouse and Penstock Removal		88	03-Jan-23	17-Jul-23	90
CO20531	PacifiCorp - De-energize Powerhouses	0		03-Jan-23*	0
CO20190	Remove Penstock Steel Pipe	20	01-Apr-23*	25-Apr-23	140
CO20110	Remove Pipe Supports, Foundations, and Plugs	20	01-Apr-23	25-Apr-23	140
CO20051	Demolish Electric Equipment from Powerhouse	16	01-Apr-23*	20-Apr-23	97
CO20112	Construct Diversion Berm in Tailrace Channel	12	01-Apr-23*	15-Apr-23	121
CO20471	Remove Utilities in Powerhouse	15	01-Apr-23*	20-Apr-23	98
CO20010	Remove Right Tailrace Wingwall, Place in Tailrace	4	17-Apr-23	20-Apr-23	121
CO20053	Demolish Mechanical Equipment	24	21-Apr-23	18-May-23	97
CO20111	Install Tunnel Barriers at Portal	18	26-Apr-23	16-May-23	140
CO20113	Demo and Backfill Powerhouse	5	19-May-23	24-May-23	97
CO20114	Dewater Diversion Berm and Backfill Tailrace	12	25-May-23	08-Jun-23	97
CO20431	Remove Residential Buildings	24	19-Jun-23	17-Jul-23	138
Wood Stave Penstock Removal		33	01-Apr-23	10-May-23	145
CO2014	Remove Woodstave Penstock	10	01-Apr-23*	13-Apr-23	145
CO2016	Knock-over Concrete Saddles	10	14-Apr-23	25-Apr-23	145
CO2017	Bury Saddles and Regrade Area	5	26-Apr-23	01-May-23	145
CO2018	Install Tunnel Barriers at Portal	8	02-May-23	10-May-23	145
Transmission/Distribution		36	03-Jan-23	15-May-23	142
CO20511	PacifiCorp - Transmission/ Distribution Relocates	0		03-Jan-23*	0
CO20230	Access Roads for Transmission Line Removal	12	01-Apr-23*	17-Apr-23	142
CO20052	Remove Transmission Lines	6	17-Apr-23	24-Apr-23	142
CO20054	Remove Substation Equipment	18	24-Apr-23	15-May-23	142



Activity ID	Activity Name	Original Duration	Start	Finish	Total Float
Iron Gate		171	01-Dec-22	23-Oct-23	7
Drawdown		142	01-Dec-22	19-Sep-23	36
IG2000	PacifiCorp - Drawdown to 15' Below Spillway Crest	16	01-Dec-22*	20-Dec-22	0
IG0040	Drawdown Start - Iron Gate	0	01-Jan-23		14
IG0003	Drawdown	218	03-Jan-23	19-Sep-23	84
IG2110	Drawdown Complete - Iron Gate	0		19-Sep-23	84
Access/Site Work		111	13-Jun-23	23-Oct-23	7
IG1000	Remove Misc Site Features	24	13-Jun-23	11-Jul-23	108
IG0050	Remove Buildings 1/2/3	20	13-Jun-23	07-Jul-23	88
IG1020	Install Permanent BMPs	24	15-Sep-23	13-Oct-23	53
IG3160	Reestablish Site	10	18-Sep-23	28-Sep-23	65
IG0070	Iron Gate Complete	0		23-Oct-23	45
Embankment Removal		171	01-Feb-23	23-Oct-23	7
IG0033	Re-establish Access Roads	12	01-Feb-23*	14-Feb-23	112
IG0021	Remove Sheet Pile	10	01-May-23*	11-May-23	39
IG4030	Excavate Crest down to Ele 2308 (Double Shift)	12	12-May-23*	25-May-23	39
IG0022	Excavate from Ele 2308 to Ele 2297.5 (Double Shift)	5	26-May-23*	01-Jun-23	38
IG4040	Excavate Horizontal Slice at Ele 2297.5 (Double Shift)	6	02-Jun-23	08-Jun-23	38
IG3230	Remove Power Intake Structure	15	02-Jun-23	19-Jun-23	100
IG2150	Improve Upstream Access Roads	12	02-Jun-23	15-Jun-23	100
IG0024	Excavate down to Ele 2297.5 to 2231(Double Shift)	38	09-Jun-23*	25-Jul-23	38
IG4050	Excavate Horizontal Slice at Ele 2231(Double Shift)	21	26-Jul-23*	18-Aug-23	38
IG0025	Excavate down to Ele 2231 to 2202 (Double Shift)	2	19-Aug-23*	21-Aug-23	38
IG3190	Rip Rap Breach Section	3	22-Aug-23	24-Aug-23	38
IG4010	Breach Channel Ele 2202-2172	1	25-Aug-23	25-Aug-23	38
IG4020	Breach Complete	1	26-Aug-23	26-Aug-23	38
IG0080	Install Rip Rap at Diversion Tunnel Intake Structure	5	28-Aug-23	01-Sep-23	87
IG0004	Remove Diversion Tunnel Intake Structure	15	28-Aug-23	14-Sep-23	40
IG0020	Remove Diversion Gate Structure	18	28-Aug-23	18-Sep-23	64
IG3270	Go back up to Elev 2331, Exc Elev 2331 to 2164 (Remaining Embankment)	17	28-Aug-23	16-Sep-23	38
IG3210	Restore River/ Establish Volitional Fish Passage	20	18-Sep-23	11-Oct-23	45
IG3200	Install Permanent BMPs	10	12-Oct-23	23-Oct-23	45
Powerhouse/ Fish Facility Removal (Could Happen as Early as January Drawdown Year)		118	03-Jan-23	21-Aug-23	60
IG3020	PacifiCorp - De-energize Powerhouses	0		03-Jan-23*	0
IG0007	Remove Fish Facility, Holding Tanks, and Mechanical	60	01-Apr-23	12-Jun-23	88
IG0061	Remove Utilities in Powerhouse	26	01-Apr-23	02-May-23	60
IG0062	Remove Hydromechanical/ Hydroelectrical Equipment	50	03-May-23	30-Jun-23	60
IG0031	Remove Penstock Steel Pipe, Supports and Foundations	32	09-Jun-23	18-Jul-23	67
IG0032	Demo Powerhouse	32	01-Jul-23	09-Aug-23	60
IG0036	Backfill Powerhouse	10	10-Aug-23	21-Aug-23	60
Transmission/Distribution		30	03-Jan-23	06-May-23	148
IG3010	PacifiCorp - Transmission/ Distribution Relocates	0		03-Jan-23*	0
IG0210	Access Roads for Removing Transmission Lines	6	01-Apr-23	08-Apr-23	118
IG0054	Remove Transmission/ Distribution Lines	12	10-Apr-23	22-Apr-23	118
IG0063	Remove Substation Equipment	12	24-Apr-23	06-May-23	148
Project Wide		131	09-Jun-23	13-Nov-23	39
PW0042	Scotch Creek Crossing (Iron Gate)	24	09-Jun-23	07-Jul-23	98
PW1074	Camp Creek Crossing (Iron Gate)	24	08-Jul-23	04-Aug-23	98



Activity ID	Activity Name	Original Duration	Start	Finish	Total Float
PW1174	Fall Creek at Daggett Rd	24	05-Aug-23	01-Sep-23	98
PW1051	Daggett Rd Bridge - Remove Temp Bridge (Copco 2)	11	24-Oct-23	04-Nov-23	45
PW1054	Dry Creek Bridge - Remove Temp Bridge Support (Copco 1)	5	01-Nov-23	06-Nov-23	39
PW1053	Fall Creek Bridge - Remove Temp Bridge Support (Copco 1)	5	07-Nov-23	13-Nov-23	39



Appendix B

California Slope Stability and Monitoring Plan

KLAMATH RIVER RENEWAL CORPORATION

Lower Klamath Project
FERC Project No. 14803

California Slope Stability Monitoring Plan

Klamath River Renewal Corporation
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December 2021

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Table of Contents

Attachments

1.0 Introduction

This California Slope Stability Monitoring Plan is a subplan of the Reservoir Drawdown and Diversion Plan that will be implemented as part of the Proposed Action for the Lower Klamath Project.

1.1 Purpose of California Slope Stability Monitoring Plan

This document describes the Klamath River Renewal Corporation's (Renewal Corporation) plan for monitoring slope stability and evaluates practices related to slope stability. The plan identifies reservoir slopes and other areas within the Limits of Work of the Proposed Action prone to instability and describes the Renewal Corporation's measures for monitoring instability during drawdown and dam removal under the Proposed Action. It also describes the Renewal Corporation's measures to address instability and discharges that would violate water quality standards. The Renewal Corporation's slope stability measures are also intended to protect private property, structures, and cultural sites.

The Renewal Corporation will implement the following measures through this California Slope Stability Monitoring Plan or other management plans referenced in this document:

- describe slope stability monitoring, including locations and schedule.
- coordinate with reservoir drawdown to address potential modification of drawdown implementation to control slope instability, if necessary, to protect infrastructure, property, or resources.
- provide a list of measures to be implemented to address erosion and maintain soil stability.
- visually monitor and inspect for evidence of potential slumping, cracking, and other signs of slope instability during drawdown and dam removal and after storm events, and implement necessary repairs, replacements, and/or additional measures to minimize potential slope instability effects on water quality based on information obtained through inspections.
- provide contingency and notification procedures to respond to confirmed or suspected issues related to slope instability or loss of erosion protection.
- submit monthly and annual reports.

1.2 Relationship to Other Management Plans

This California Slope Stability Monitoring Plan is supported by elements of the following management plans to aid in effective implementation: Construction Management Plan, California Reservoir Drawdown and Diversion Plan, and Water Quality Monitoring and Management Plan. So as to not duplicate information, elements from these other management plans are not repeated herein but are, where appropriate, referenced in this plan.

1.3 California Section 401 Water Quality Certificate Condition 18

Under Section 401 of the federal Clean Water Act, the California State Water Resources Control Board (SWRCB) has issued a Section 401 Water Quality Certificate (SWRCB 2020a) that identifies 11 elements for consideration in the Slope Stability Monitoring Plan. These elements are addressed throughout this plan. Modeling for the design (Knight Piésold 2020b) showed that dam stability increases during reservoir drawdown and the proposed dam removal for each of the facilities. Therefore, the Renewal Corporation proposes the installation of zero piezometer wells and inclinometers to monitor dam stability. As an alternative, the Renewal Corporation will monitor drainage and make visual observations of the dam faces and reservoir rim during drawdown and dam removal.

1.4 Elevation Datum

All elevations reported in this plan use the North American Vertical Datum of 1988 (NAVD88), which is 3.48 feet (ft) higher than the National Geodetic Vertical Datum of 1929 (NGVD29) at Copco No. 1 and No. 2 and 3.33 ft higher at Iron Gate.

2.0 Supporting Information

2.1 Reservoir Rim

This section is informational and includes excerpts from the Reservoir Rim Stability Report (Knight Piésold 2020a); it does not contain specific measures to be implemented by the Renewal Corporation as part of the Proposed Action. *Reservoir rim* is defined as the terrain that lies within the normal operating levels of the reservoir. The terrain downslope and upslope of the rim are defined as *submarine* slopes and *upslope* areas, respectively.

The Reservoir Rim Stability Report summarizes the findings of an evaluation of reservoir rim stability during and following drawdown. The evaluation focused on the potential instabilities that could affect residences and other resources adjacent to the rim, such as transportation infrastructure. The evaluation is consistent with previous evaluations completed by the Renewal Corporation (2019) and PanGeo (2008).

The approach used for the stability analyses (Knight Piésold 2020a) commenced with a review of the Renewal Corporation's previous analyses and conclusions (2019). Stability models were then developed based on the interpretation of data and observations collected by the Renewal Corporation, which were influenced by the challenges of gaining site access. Identification and characterization of terrain hazards were completed for each of the reservoir sites and guided the development of slope models. The locations of the features and hazards identified from the terrain analysis are shown in Figures 2-1 and 2-2 (Attachment A). Limit Equilibrium (LE) analyses also allowed for identification of factors that influence slope stability during drawdown of the reservoirs.

The stability models evaluated existing conditions to identify the possible extent of instability during drawdown of the current ground surface as determined by topographic and bathymetric surveys, the assumed geological model, and an established piezometric low (assuming the minimum operating reservoir level represents drawdown conditions). These results provide a framework for judging the results of the drawdown analyses.

2.1.1 Geological Setting

The limits of work are predominantly contained in the Western and High Cascades volcanic regions of the Cascades Geologic Province. The Klamath River predates the formation of the Cascade Mountain Range and maintained a relatively similar course through the mountain-building events. The bedrock within the limits of work comprises volcanic rocks up to 45 million years old as well as basalt and andesite lava flows, tuffs, tuff-breccias, and volcaniclastic sandstone. The volcanic rocks are intruded by numerous dikes and plugs of andesite, rhyolite, and basalt. Many of the volcanoes associated with the Western Cascades have since eroded, but large shield volcanoes and vents of the High Cascades remain and are still active.

Large deposits of coarse alluvium were deposited along the Klamath River during the period of the last glaciation when the river had a higher discharge. Lacustrine deposits were laid down in former temporary lakes that were created at the present-day site of the Copco No. 1 Reservoir when the Klamath River was temporarily “dammed” by volcanic activity. Diatomite deposits surround much of the shoreline of Copco No. 1 Reservoir (PanGeo 2008, as cited in SWRCB 2020b). Diatomaceous deposits and associated fluvio-lacustrine terrace deposits along the rim and below the reservoir water level present the greatest potential for slope instability within the Proposed Action area during drawdown.

2.1.2 Copco No. 1 Reservoir Rim

Residential properties occur locally around the Copco No. 1 Reservoir rim, primarily in the southwestern and eastern sectors of the shoreline. Copco Road follows the north side and Ager Beswick Road follows the south side of the Copco No. 1 Reservoir.

Steep shoreline slopes of weak, white diatomite are a prominent feature along the western part of the rim of Copco No. 1 Reservoir. Shoreline slopes of diatomite are particularly prominent along the south shore of the western part of the reservoir. The presence of diatomaceous deposits and associated fluvio-lacustrine terrace deposits along the rim and below the reservoir water level present the greatest potential for slope instability during drawdown. The shoreline slopes show indications of active erosion undercut by wind-induced reservoir waves, two possible debris slides, a tension crack, slope retrogression, and slumped toe debris.

A natural terrain landslide was identified upslope of Copco No. 1 Reservoir, with the toe located beneath the reservoir shoreline. Past rock falls occur close to Copco No. 1 Reservoir, and two rockslides were identified on a cliff upslope from Ager Beswick Road. Terrain analysis identified three possible debris slides on the downslope side of Copco Road and a possible debris flood deposit within the reservoir (Knight Piésold 2020a). Landslides were identified within the cut slopes along Copco Road and Ager Beswick Road, and a rock cut slope alongside Ager

Beswick Road shows evidence of recent rock falls and rockslides. Minor sheet and gully erosion were identified on the natural slopes and south side of the reservoir.

The Klamath River historically followed a meandering path in the western section of the reservoir footprint. Debris slides were identified on the steep slope on the outside of these former meander bends. These landslides occurred in terrace slopes that consist of alluvium and diatomaceous lacustrine deposits. These locations may be possible sites of terrain instability in the post-drawdown condition once the course of the Klamath River is reestablished. Possible relict rockslides were identified in submarine rock slopes close to the dam in the southern part of the reservoir. Soft sediment that has accumulated on the floor of the reservoir will likely be susceptible to erosion upon drawdown.

Reservoir drawdown is unlikely to adversely affect relict rockslides mapped on the steep slopes of the narrow canyon upstream of the reservoir. The absence of diatomite and presence of colluvium and weathered bedrock along this slope segment indicates there is a low likelihood that drawdown will adversely affect slope stability. Except for the southwest shoreline, which could be affected, other areas of potential slope instability at Copco No. 1 Reservoir are considered low risk.

2.1.3 Copco No. 2 Reservoir Rim

There are no residential properties adjacent to the Copco No. 2 Reservoir rim. The access roads to the Copco No. 1 powerhouse and Copco No. 2 Reservoir are located adjacent to the rim on the north side of the reservoir.

Two shallow debris slides were identified on a steep slope at the left bank of the rim of Copco No. 2 Reservoir. The columnar jointed basalt cliffs upslope of the reservoir have open sub-vertical discontinuities and are susceptible to toppling, causing rock falls. Talus slopes from past rock falls occur adjacent to the downstream portion of the reservoir. The terrain analysis also identified a debris slide on the cut slope along the access road to the Copco No. 1 powerhouse at a switch-back in the road alignment. The surficial geology at the site of this landslide comprises an unwelded pyroclastic deposit, which developed before 1991, and there appears to have been no significant change between 1991 and 2016.

Copco No. 2 Reservoir is relatively shallow, with valley side slopes intersecting the gently sloping terrain of the former riverbed. The submarine slopes are gently inclined, and no submarine landslides have been identified. Soft sediment that has accumulated on the floor of the reservoir will likely be susceptible to erosion upon drawdown.

2.1.4 Iron Gate Reservoir Rim

Copco Road follows the north side of Iron Gate Reservoir. No residential properties were identified adjacent to the rim of the Iron Gate Reservoir in the Reservoir Rim Stability Report (Knight Piésold 2020a). One structure was subsequently identified adjacent to the eastern side of the reservoir rim. The terrain hazard analysis completed by Knight Piésold (2020a) identified

no slope hazards in the area of the structure. Additionally, the slopes below the structure are relatively gentle; therefore, this structure was not included in the stability analysis.

The Klamath River historically followed a meandering path in the footprint area of the reservoir. Over-steepened slope segments are present on the outside of meander bends and are potential sites of terrain instability in the post-drawdown condition once the course of the Klamath River is re-established. Submarine talus slopes have accumulated from rock falls locally around the reservoir rim, particularly in the east part of the south shore of the reservoir. Soft sediment that has accumulated on the floor of the reservoir will likely be susceptible to erosion upon drawdown.

At Iron Gate, there is a potential for local instability to affect Copco Road, particularly where possible historic landslides were identified between the road and the reservoir rim and where cracks were identified on the road pavement (Knight Piésold 2020a). Previous slope instability was identified at the reservoir rim downslope from Copco Road; however, it was relatively small-scale and did not affect the road. It is likely that any slope instability in these areas caused by drawdown will be similarly small-scale and will not affect Copco Road. The terrain analysis identified previous slope instability in an area between the road and reservoir rim; however, it is unlikely that drawdown will reactivate slope instability in this location (Knight Piésold 2020a).

3.0 Proposed Action Areas Potentially Prone to Instability

This section describes slopes and other Proposed Action areas of concern for slope stability.

3.1 Dam Embankments

Stability analyses were conducted for each of the facilities to evaluate the safety of the existing dams and whether dam modifications would result in an unacceptable structural response and risk (Knight Piésold 2020b). The analyses focused on the Potential Failure Modes (PFMs) related to the main dam sections where dam modifications could cause adverse effects to the overall stability or structural response of the dams. Stability analyses indicated that during excavation of the low-level outlet and when there is no impoundment, Copco No. 1 Dam would not be unstable, and no monitoring will be undertaken. The Renewal Corporation will monitor the dam earthfill embankments for the following facilities using visual monitoring and other techniques including the use of unmanned aerial vehicles, as described in more detail in section 4.0:

- Copco No. 2 Dam Embankment: upstream and downstream face and crest of the dam; and
- Iron Gate Dam Embankment: upstream and downstream face and crest of the dam.

3.2 Reservoir Rims

3.2.1 Copco No. 1 Reservoir Rim

For the Copco No. 1 reservoir rim, the LE stability analysis indicates the potential of slope instability impacts from the proposed reservoir drawdown near the southwest shoreline of the reservoir (Knight Piésold 2020a). This finding is consistent with the Renewal Corporation study (2019). Specific areas of slope instability are identified below and are shown in Figure 2-1, Sheets 1-8 (Attachment A).

- segments S5, S11a, S12b, and S23 where private properties and residential dwellings are located.
- segments N2, N5, N7, N10, and N11 where potential slope instability impacts to roads were identified.
- segment S1 and the canyon portion of the reservoir rim immediately upstream of the dam where the valley floor is narrow, and instability could result in constricted flow.

3.2.2 Copco No. 2 Reservoir Rim

For the Copco No. 2 reservoir rim, terrain analysis indicates that although there are areas of potentially unstable terrain around the rim of the reservoir, any slope instability is expected to be relatively small due to the interpreted shallow depth of the bedrock and the fact that the colluvium generally comprises coarse talus (Knight Piésold 2020a). There is also a potential for local instability of the colluvial slopes in the upstream area at the left bank where the colluvium is finer grained and the two recent debris slides were identified. Based on the low risk associated with the identified potential instability areas, drawdown of the reservoir is not expected to result in large-scale slope instability that could affect adjacent infrastructure or properties.

3.2.3 Iron Gate Reservoir Rim

The terrain analysis confirmed the presence of slope instability at the rim of the Iron Gate Reservoir, as previously identified in both the PanGeo (2008) and the Renewal Corporation (2019) reports. A debris slide was identified at a former meander bend of the Klamath River and a possible relict debris slide upstream of the meander bend. The terrain analysis also identified two recent debris slides in colluvium and/or weathered bedrock at the reservoir rim and two additional debris slides that occurred at the site of a former meander bend of the Klamath River. It is possible that undercutting at the former meander bend was contributed to slope instability. The presence of over-steepened bare soil slopes, slumped debris, and inclined trees along the reservoir rim provide evidence of active erosion by wind-generated reservoir waves. Specific areas of potential instability are identified below and are shown in Figure 2-2, Sheets 1-8:

- locations I11, I12a, I12b, and I23 where possible landslides were identified between the road and the reservoir rim and cracks were identified on the road pavement.
- locations I1, I5, and I7 where previous slope instability was identified at the reservoir rim downslope of Copco Road.

- locations I17 and I19 where slope angles show the possibility of slope instability related to the drawdown and where instability could constrict flow due to the narrow valley floor.

3.3 Roads

Improvements to existing roads and development of new temporary access routes are required to support construction activities under the Proposed Action, both to improve access safety and to facilitate movement of construction equipment and traffic. Additional details regarding road improvements and maintenance are included in the Traffic Management Plans, located as appendices to the Construction Management Plan. The Renewal Corporation proposes additional monitoring of areas of potential slope instability, as discussed in Section 4.0.

3.4 Borrow and Disposal Areas

Borrow and disposal areas are required for construction of the Proposed Action. Borrow and disposal sites are designed with stable permanent slopes and suitable drainage requirements using best management practices (BMPs). The Renewal Corporation will place material in the disposal site in layers, track-walk the material, and grade it with a bulldozer to promote surface drainage. The Renewal Corporation will visually monitor slopes during construction and excavation and modify them as needed based on visual observations, as described in the Erosion and Sediment Control Plan and the California Waste Disposal Plan.

4.0 Slope Stability Monitoring

This section discusses monitoring and inspection procedures that the Renewal Corporation will implement to address slope stability concerns. Additional details related to drawdown procedures are included in the California Reservoir Drawdown and Diversion Plan.

4.1 Pre-Drawdown Phase

In 2017, the Renewal Corporation and PacifiCorp entered into an Operations and Maintenance Agreement. Upon the Renewal Corporation's acceptance of License Transfer, PacifiCorp will continue to operate the Lower Klamath Project under the terms of the Operations and Maintenance Agreement. During the pre-drawdown phase of the Proposed Action, PacifiCorp will continue to monitor the dams and embankments consistent with the requirements of the Supporting Technical Information Document (STID; PacifiCorp 2007, 2015, 2016) for each applicable structure.

Daily and weekly inspections are performed by PacifiCorp Operations personnel as part of their normal duties and per license requirements, and annual inspections are performed by PacifiCorp Dam Safety Engineering staff with the assistance of PacifiCorp Operations personnel.

4.2 Active Drawdown and Dam Removal Phase

Drawdown of the primary reservoirs (i.e., Copco No. 1 and Iron Gate) will take place from January 1 through June 15, depending on the water year type, and drawdown of Copco No. 2 will take place by May 1 of the drawdown year (i.e., within approximately six months of drawdown initiation) or in the pre-drawdown year. The specific schedule for the drawdown and removal of each dam is further described in the California Reservoir Drawdown and Diversion Plan.

The Renewal Corporation will monitor slope stability of dam embankments and reservoir rims during the active drawdown and dam removal phase, and following storm events, for changes in ground conditions, changes in displacement of the ground surface, and changes in the reservoir level. The Renewal Corporation will conduct daily, weekly, and monthly monitoring during active drawdown and dam removal as described below.

4.2.1 Remote Sensing Technology

The Renewal Corporation will visually monitor daily displacements of the ground surface, including reservoir rims and embankments, during the drawdown period using unmanned aerial vehicle flights. This method will provide the greatest spatial coverage for daily evaluation of the response to reservoir drawdown. LiDAR data acquisition will be both airborne and ground-based at Copco No. 1 Reservoir. The Renewal Corporation will assess conditions after data acquisition and report to the Engineer of Record (EOR) any variations indicating potential displacement.

4.2.2 Visual Inspections

The Renewal Corporation will visually inspect dam embankments (upstream and downstream face and crest) daily for signs of slope instability. Visual inspection locations may be restricted due to safety concerns and challenges to gaining site access, and the Renewal Corporation will adjust these locations to achieve the best vantage point for inspection. The Renewal Corporation will initially use established site access for inspections when possible. If not possible, the Renewal Corporation will use remote monitoring (see section 4.2.1). Because of safety concerns, some areas on private property may not be accessible for inspection.

4.2.3 Surveillance Monuments

The Renewal Corporation will use existing survey monuments at the dam embankments when accessible during the active drawdown phase until dam removal is complete. Additionally, the Renewal Corporation will establish overall site control through the installation of temporary control points in locations that will not be affected by dam removal activities. The Renewal Corporation will establish temporary monuments on the rock abutments on either side of the dam, as needed.

4.2.4 Other Monitoring

The Renewal Corporation will monitor the reservoirs by level sensors and stream gauges during drawdown. Once the reservoirs drop below their normal operating range, water level gauges will no longer be operational.

At Iron Gate Dam, the Renewal Corporation will continue to collect water level and turbidity readings at Manhole #3 at the toe of the dam during drawdown to monitor changes in seepage through the embankment. Turbidity in the water could indicate seepage erosion occurring through the core if it occurs when turbidity is otherwise low in the tailrace and low-level outlet. Operators will continue to take Secchi tube readings from the reservoir, powerhouse tailrace, and Manhole #3 during drawdown. The manhole will be removed as Iron Gate Dam is demolished.

The Renewal Corporation will perform daily checks of the dams, monitor water levels, and coordinate with the Bureau of Reclamation with respect to potential storm events. Downstream flows will be estimated to provide adequate response time to implement emergency procedures as detailed in the Emergency Response Plan for the Proposed Action (Kiewit 2020). Monitoring requirements for the United States Geological Survey Klamath River stream gauge are included in the California Water Quality Monitoring Plan.

4.3 Post-Drawdown Phase

In the post-drawdown phase, the dam embankments will have been removed so dam embankment monitoring will cease. Reservoir rim instability is limited to the drawdown phase, so daily monitoring of the reservoir rims will cease after drawdown is complete. Post-drawdown monitoring of residual reservoir sediment stability during restoration is addressed in section 6.2.8 of the Reservoir Area Management Plan.

5.0 Slope Stability Measures

5.1.1 Erosion Protection

The Renewal Corporation will conduct the construction and removal work required for the Proposed Action in a manner that provides environmental protection and follows BMPs for erosion and sediment control, as outlined in the California Stormwater Pollution Prevention Plan. In general, the Renewal Corporation will restore areas disturbed by construction of the Proposed Action components to final lines and grades as soon as practical. The Renewal Corporation will install erosion protection at various locations throughout the limits of work (e.g., river channels, scour hole, volitional fish passage channels, Copco No. 1 diversion tunnel erosion protection plug). The hydraulics of the final channels were modeled to determine the design parameters for the required slope erosion protection and to determine the size and thickness of the erosion protection, as specified in the Design Report (Knight Piésold 2020b).

5.1.2 Proposed Measures to Address Instability

If instability issues are confirmed in the areas listed in section 3.0, the Renewal Corporation will implement the following measures:

- slope monitoring,
- structural slope stability measures, and/or
- local rerouting of Copco Road if the existing road is impacted by slope instability.

5.1.3 Local Impact Mitigation Fund

To address potential impacts of slope instabilities related to reservoir drawdown, the Renewal Corporation will implement the measures stated in this plan, as required in the License Surrender Order. In order to address potential damage claims involving private properties, the Renewal Corporation will establish a Local Impact Mitigation Fund (LIMF), to be administered outside of the License Surrender Order. For property owners electing to opt into the fund, the LIMF will provide financial resources to such property owners to mitigate displacement costs and impacts to residential properties that are determined to be caused by the Proposed Action. The fund will be backstopped by insurance.

The LIMF will establish procedures and standards for determining the nature and scope of any impacts, as well as stipulated payments to affected property owners. Developing the standards and procedures will involve proactive participation and input from key stakeholders. The draft methodology for the LIMF program will be made available for public comment through townhalls and other meetings.

Under the LIMF, the Renewal Corporation will not accept responsibility for pre-existing conditions not caused by the Proposed Action. The fund administrator will be supported by a technical team but will ultimately have the discretion to determine the legitimacy of covered claims. Any affected property owners who elect not to participate in the LIMF may, instead, pursue any other remedies available to such property owners under applicable state law.

6.0 Emergency Response

PFMs identified in the STIDs (PacifiCorp 2007, 2015, 2016) have been used to guide previous stability evaluations and are briefly discussed in the California Reservoir Drawdown and Diversion Plan. The dams covered under STIDs will continue their current operations until water levels drop below normal operating elevations during drawdown. PFMs were reevaluated as part of a Construction Potential Failure Mode Analysis (cPFMA) workshop that specifically addressed reservoir drawdown and dam removal (Kleinschmidt 2021). Details concerning the cPFMA workshop are provided in the California Reservoir Drawdown and Diversion Plan.

6.1 Threshold and Action Levels

Threshold and action levels are important to assist in determining if readings taken during monitoring are approaching levels that could cause concern regarding the stability of reservoir

rim or embankment areas. The threshold level is the first level requiring evaluation. When specific action levels have not been determined for an instrument reading or monitored condition, threshold levels and a range of expected (acceptable) values can be developed based on historical data.

Critical threshold and action levels for different situations or types of inspections and associated guidance for determining the proper emergency action level are covered by the existing PacifiCorp Emergency Action Plan (EAP) as well as the Emergency Response Plan for the Proposed Action (Kiewit 2020). The PacifiCorp EAP will not be applicable once normal operations have ceased; the Renewal Corporation will develop emergency procedures for the drawdown and dam removal phases of the Proposed Action. Potential remedial actions for emergency situations related to slope stability are listed in Attachment B and categorized by the emergency action level.

7.0 Equipment Maintenance Program

This section describes equipment maintenance measures, types of maintenance requirements, and the schedule for and/or frequency of maintenance activities. The Renewal Corporation will monitor equipment to ensure that the desired condition is maintained.

7.1 Survey Monuments

Per the STID for the Iron Gate Hydroelectric Development (PacifiCorp 2015), survey monuments were designed to be permanent. The survey monuments are protected by weatherproof covers and, therefore, require little maintenance. During dam removal activities, the Renewal Corporation will protect survey monuments from movement or damage from vehicles or other equipment traversing the crests. The “permanent” survey monuments will be removed along with the dam embankment, and temporary monuments installed for monitoring dam removal will be also removed once the embankment excavation reaches the monuments.

7.2 Remote Sensing Technology

The Renewal Corporation will establish specific maintenance procedures for remote sensing equipment based on the specific technology.

7.3 Other Instrumentation

Continuous measurements of reservoir levels are made using level sensors. The reservoirs also have a fixed gauge, allowing a comparison of the water levels measured by the level sensors with the levels indicated on the gauges. In the pre-drawdown phase and early in the drawdown phase, these comparisons will be made daily by PacifiCorp operators. Any significant difference in water level readings between these two measurements will initiate work to repair or recalibrate the instruments. Once powerhouse operations cease, the PacifiCorp level sensors will no longer function, and the Renewal Corporation will install and maintain new level sensors to monitor water levels during drawdown and dam removal.

8.0 Reporting

The Renewal Corporation will provide monthly and annual reporting concerning inspections and monitoring conducted during the pre-drawdown phase, active drawdown and dam removal phase, and restoration phase, as described below.

8.1 Monthly Reporting

During the rainy season (October 16 to May 14), beginning before the start of drawdown and ending during reservoir drawdown, the Renewal Corporation will submit monthly reports to the SWRCB identifying any areas that have experienced slope instability, any actions taken to control and improve slope stability, and an assessment of the success of initial and any ongoing slope stability actions implemented. Monthly reports to the SWRCB will also be submitted during the first rainy season following drawdown.

8.2 Annual Reporting

The Renewal Corporation will provide an annual report describing the results of slope stability monitoring of the dam embankments and reservoir rims to the SWRCB and the Commission by April 1 and 15, respectively, for the preceding year. The annual report will also include a summary of any measures taken to address slope instabilities, including, but not limited to, physical stabilization measures, rerouting of Copco Road, or relocation of residents.

9.0 Management Plan Updates

If additional risk areas are encountered, the Renewal Corporation will revise the monitoring procedures. The Renewal Corporation will document the risk areas and associated amendments to the Management Plan and will submit all changes to the Commission and to the SWRCB.

10.0 References

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Attachment A

Figures

CRITICAL ENERGY/ELECTRIC INFRASTRUCTURE INFORMATION

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APPENDIX A: FIGURES

Attachment B

Additional Emergency Action Plan Information

Table B-1. Emergency Level 1 – Potential Remedial Actions

CONDITION	ACTION
Erosion	Locate and quantify the extent of erosion at the reservoir rim or embankment.
	Fill and, if possible, compact the eroded area(s) with course soil material, filter sand, and/or gravel/rock fill as appropriate for conditions.
	Place and crimp straw mulch and tackifier.
	Monitor the erosion area(s) weekly following the precipitation event.
	Observe the dam/embankment from the abutment and/or crest. At a minimum, inspect the entire crest, downstream slope, and downstream toe area. Observe carefully for any signs of additional erosion, seepage, or cracking.
	Record all information, observations, and actions.
Sinkhole	Locate and characterize the lateral limits and depth of the sinkhole(s).
	Fill the sinkhole with reverse filter composed of drain gravel, filter sand, and compacted coarse soil material.
	Monitor the sinkhole daily for the following week and following the next precipitation event.
	Observe the dam/embankment from the abutment and/or crest. At a minimum, inspect the entire crest, downstream slope, and downstream toe area. Observe carefully for any signs of additional erosion, seepage, or cracking.
	Measure and record applicable water level elevation and monitor daily for seepage.
	Record all information, observations, and actions.
Sand Boils	Locate and quantify the sand boil(s).
	Fill and, if possible, compact the eroded area(s) with coarse soil material, filter sand, and/or drain gravel, creating an outwardly filter compatible backfill.
	Control the movement of material from the boil by initially constructing a ring dike. The goal of the ring dike is stopping the flow of water rather than stopping movement of the material.
	When the ring reaches an elevation where the water discharging from the ring is flowing clear, the work should stop and flows monitored for changes.
	Cover sand boil area(s) with non-woven geotextile fabric and a reverse filter composed of 2 to 3 feet of filter sand and drain gravel. A drain pipe or filter may be added.
	Monitor the sand boil daily for the following week.
	Observe the dam/embankment from the abutment and/or crest. At a minimum, inspect the entire crest, downstream slope, and downstream toe area. Observe carefully for any signs of additional erosion, seepage, or cracking.
	Measure and record applicable water level elevation and monitor daily for seepage.
	Record all information, observations, and actions.
Seepage	Install a flow-measuring device.
	Measure the flow periodically. Note changes in quality or clarity.
	Locate and quantify the new seepage area(s) that have cloudy seepage.

CONDITION	ACTION
	Monitor the new seepage area(s) daily for at least one week. More frequent monitoring and reporting may be required.
	Observe the dam/embankment from the abutment and/or crest. At a minimum, inspect the entire crest, downstream slope, and downstream toe area. Observe carefully for any signs of additional erosion, seepage, or cracking.
	Measure and record applicable water level elevations and monitor daily for seepage.
	Record all information, observations, and actions.
Piping	Fill and, if possible, compact the eroded area(s) with coarse soil material, filter sand, and/or drain gravel, creating an outwardly filter compatible backfill.
	Control the movement of material by constructing a ring dike. The goal of the ring is stopping the flow of water rather than stopping movement of material.
	When the ring reaches an elevation where the water discharging from the ring is flowing clear, the work should stop and flows monitored for changes.
	Cover area(s) with non-woven geotextile fabric and reverse filter composed of 2 to 3 feet of filter sand and drain gravel. A drain pipe or filter may be added.
	Monitor daily for the following week. Measure the rate of leakage and clarity of the water (e.g., muddy appearance).
	Record all information, observations, and actions.
Flooding	Monitor flood conditions in the reservoir.
	Observe the dam/embankment from the abutment and/or crest. At a minimum, inspect the entire crest, downstream slope, and downstream toe and measure elevations of water and seepage daily.
	Record all information, observations, and actions.
Embankment Movement	Mark the movement area(s). Consider contracting a surveyor to survey the movement area(s).
	Visually monitor the movement area(s).
	Develop, evaluate, and implement measures to resolve the observed condition(s).
	Observe the dam/embankment from the abutment and/or crest. At a minimum, inspect the entire crest, downstream slope, and downstream toe area. Observe carefully for any signs of additional erosion, seepage, or cracking.
	Measure and record applicable water level elevation and monitor daily for seepage.
	Record all information, observations, and actions.
Earthquake	Monitor conditions at the reservoir rim and embankment daily for at least one week.
	Observe the dam/embankment from the abutment and/or crest. At a minimum, inspect the entire crest, downstream slope, and downstream toe area. Observe carefully for any signs of additional erosion, seepage, or cracking.
	Measure and record applicable water level elevation and monitor daily for seepage.
	Record all information, observations, and actions.

CONDITION	ACTION
Instruments	Re-measure the reading and verify the reading was made correctly. Once human error is ruled out, verify the instrument is operating properly.
	After human error and instrument error is ruled out, contact engineering support for additional technical assistance if needed.
	Record all information, observations, and actions.
Bulge	Install a flow-measuring device.
	Measure the flow periodically. Observe and note changes in quality or clarity.
	Locate and quantify the new seepage area(s) that have cloudy seepage.
	Monitor the new seepage area(s) daily for at least one week. More frequent monitoring and reporting may be required.
	Observe the dam/embankment from the abutment and/or crest. At a minimum, inspect the entire crest, downstream slope, and downstream toe area. Observe carefully for any signs of additional erosion, seepage, or cracking.
	Measure and record applicable water level elevation and monitor daily for seepage.
	Record all information, observations, and actions.
Sabotage	Develop, evaluate, and implement measures to resolve the situation.
	Monitor the situation at the reservoir rim or embankment daily for the following week, or until the situation has ended.
	Record all information, observations, and actions.

Table B-2. Emergency Level 2 – Potential Remedial Actions

CONDITION	ACTION
All Conditions	Mobilize personnel and equipment necessary to address ongoing conditions.
Erosion	Locate and quantify the extent of erosion at the reservoir rim or embankment.
	Fill and, if possible, compact the eroded area(s) with course soil material, filter sand, and/or gravel/rock fill as appropriate for conditions.
	Place and crimp straw mulch and tackifier.
	Monitor the erosion area(s) weekly following the precipitation event.
	Observe the dam/embankment from the abutment and/or crest. At a minimum, inspect the entire crest, downstream slope, and downstream toe area. Observe carefully for any signs of additional erosion, seepage, or cracking.
	Record all information, observations, and actions.
Sinkhole	Locate and characterize the lateral limits and depth of the sinkhole(s).
	Fill the sinkhole with reverse filter composed of drain gravel, filter sand, and compacted coarse soil material.
	Monitor the sinkhole daily for the following week and following the next precipitation event.
	Observe the dam/embankment from the abutment and/or crest. At a minimum, inspect the entire crest, downstream slope, and downstream toe area. Observe carefully for any signs of additional erosion, seepage, or cracking.
	Measure and record applicable water level elevation and monitor daily for seepage.
	Record all information, observations, and actions.
Sand Boils	Locate and quantify the sand boil(s).
	Fill and, if possible, compact the eroded area(s) with coarse soil material, filter sand, and/or drain gravel, creating an outwardly filter compatible backfill.
	Control the movement of material from the boil by initially constructing a ring dike. The goal of the ring dike is stopping the flow of water rather than stopping movement of the material.
	When the ring reaches an elevation where the water discharging from the ring is flowing clear, the work should stop and flows monitored for changes.
	Cover sand boil area(s) with non-woven geotextile fabric and a reverse filter composed of 2 to 3 feet of filter sand and drain gravel. A drain pipe or filter may be added.
	Monitor the sand boil daily for the following week.
	Observe the dam/embankment from the abutment and/or crest. At a minimum, inspect the entire crest, downstream slope, and downstream toe area. Observe carefully for any signs of additional erosion, seepage, or cracking.
	Measure and record applicable water level elevation and monitor daily for seepage.
	Record all information, observations, and actions.
Seepage	Install a flow-measuring device.
	Measure the flow periodically. Note changes in quality or clarity.

CONDITION	ACTION
	Fill and, if possible, compact the eroded area(s) with coarse soil material, filter sand, and/or drain gravel, creating an outwardly filter compatible backfill
	Control the movement of material by constructing a ring dike. The goal of the ring dike is stopping the flow of water rather than stopping movement of material.
	When the ring reaches an elevation where the water discharging from the ring is flowing clear, the work should stop and the flows monitored for changes.
	Cover area(s) with non-woven geotextile fabric and a reverse filter composed of 2 to 3 ft of filter sand and drain gravel. A drain pipe or filter may be added.
	Locate and quantify the new seepage area(s) that have cloudy seepage.
	Monitor the new seepage area(s) daily for at least one week. More frequent monitoring and reporting may be required.
	Observe the dam/embankment from the abutment and/or crest. At a minimum, inspect the entire crest, downstream slope, and downstream toe area. Observe carefully for any signs of additional erosion, seepage, or cracking.
	Measure and record applicable water level elevations and monitor daily for seepage.
	Record all information, observations, and actions.
Piping	Fill and, if possible, compact the eroded area(s) with coarse soil material, filter sand, and/or drain gravel, creating an outwardly filter compatible backfill.
	Control the movement of material by constructing a ring dike. The goal of the ring is stopping the flow of water rather than stopping movement of material.
	When the ring reaches an elevation where the water discharging from the ring is flowing clear, the work should stop and flows monitored for changes.
	Cover area(s) with non-woven geotextile fabric and reverse filter composed of 2 to 3 feet of filter sand and drain gravel. A drain pipe or filter may be added.
	Monitor daily for the following week. Measure the rate of leakage and clarity of the water (e.g. muddy appearance).
	Record all information, observations, and actions.
Flooding	If possible, lower the water level in the reservoir by activating pumps or diverting through spillways.
	Monitor flood conditions in the reservoir.
	Observe the dam/embankment from the abutment and/or crest. At a minimum, inspect the entire crest, downstream slope, and downstream toe and measure elevations of water and seepage daily.
	Observe carefully for any signs of additional erosion, seepage, or cracking.
	Record all information, observations, and actions.
Embankment Movement	Mark the movement area(s). Consider contracting a surveyor to survey the movement area(s).
	Visually monitor the movement area(s).

CONDITION	ACTION
	Fill and, if possible, compact the area(s) with coarse soil material, filter sand, and/or drain gravel, creating an outwardly filter compatible backfill.
	Observe the dam/embankment from the abutment and/or crest. At a minimum, inspect the entire crest, downstream slope, and downstream toe area. Observe carefully for any signs of additional erosion, seepage, or cracking.
	Measure and record applicable water level elevation and monitor daily for seepage.
	Record all information, observations, and actions.
Earthquake	Immediately conduct a general overall visual inspection of the reservoir rim and embankment.
	Perform field survey to determine if there has been any settlement and movement of the rim, dam crest, embankment, downstream slope, and downstream toe area. Observe for any signs of additional erosion, seepage, or cracking.
	Activate pump(s) to dewater the reservoir.
	Measure and record applicable water level elevation and monitor daily for seepage.
	Record all information, observations, and actions.
Instruments	Re-measure the reading and verify the reading was made correctly. Once human error is ruled out, verify the instrument is operating properly.
	After human error and instrument error is ruled out, contact engineering support for additional technical assistance if needed.
	Record all information, observations, and actions.
Bulge	Install a flow-measuring device.
	Measure the flow periodically. Observe and note changes in quality or clarity.
	Place a stability berm to buttress the bulge.
	Monitor the new seepage area(s) daily for at least one week. More frequent monitoring and reporting may be required.
	Observe the dam/embankment from the abutment and/or crest. At a minimum, inspect the entire crest, downstream slope, and downstream toe area. Observe carefully for any signs of additional erosion, seepage, or cracking.
	Measure and record applicable water level elevation and monitor daily for seepage.
	Record all information, observations, and actions.
Whirlpool	Control the movement of material by constructing a ring dike. The goal of the ring dike is stopping the flow of water rather than slowing the movement of material.
	Observe the dam from the abutment and/or crest. At a minimum, inspect the entire crest, downstream slope, and downstream toe area. Observe carefully for any signs of additional erosion, seepage, or cracking.
	Record all information, observations, and actions.
Slides	Contact the EOR for assistance in evaluating the surface feature (e.g. tension crack). If the feature does not extend across the dam, and the reservoir elevation is more than 10 ft below the base of the feature, fill with soil and/or rock and compact to help stabilize the slope/toe.

CONDITION	ACTION
	If the surface feature extends across the dam and the reservoir level is less than 10 ft, install a filter overlain by a berm.
	Stabilize damaged areas on the downstream slope by weighting the toe area below the slide with additional soil, rock, or gravel.
	Record all information, observations, and actions.
Embankment Overtopping	If possible, lower the water level in the reservoir by activating pumps or diverting through spillways.
	Increase freeboard by placing sandbags or other erosion-resistant material on the dam crest.
	Cover the dam crest and downstream slope with riprap, sandbags, plastic sheeting, or other materials to provide erosion-resistant protection.
	Monitor the depth, duration, and location of the overtopping. Watch for erosion, backcutting, and slides.
	Record all information, observations, and actions.
Embankment Cracking	Fill and, if possible, compact the eroded area(s) with coarse soil material, filter sand, and/or drain gravel, creating an outwardly filter compatible backfill.
	Observe the dam/embankment from the abutment and/or crest. At a minimum, inspect the entire crest, downstream slope, and downstream toe area. Observe carefully for any signs of additional erosion, seepage, or cracking.
	Measure elevations of applicable water levels and seepage daily.
	Continuously monitor the cracking. Mark the extent of the cracking with stakes, to monitor any increase or change in pattern.
	Record all information, observations, and actions.
Sabotage	Develop, evaluate, and implement measures to resolve the situation.
	Monitor the situation at the reservoir rim or embankment daily for the following week, or until the situation has ended.
	Record all information, observations, and actions.

Table B-3. Emergency Level 3 – Potential Remedial Actions

CONDITION	ACTION
All Conditions	Mobilize personnel and equipment necessary to stabilize or at least minimize impacts downstream.
Erosion	Observe and continually monitor conditions at the reservoir rim or embankment, where safe. The situation should be well documented with photographs and videotape if possible.
	Record all information, observations, and actions.
Sinkhole	Contact the Renewal Corporation Owners Representative and the Local Emergency Responders.
	Observe and continually monitor conditions at the dam/embankment, where safe. The situation should be well documented with photographs and videotape if possible.
	Record all information, observations, and actions.
Sand Boils	Contact the Renewal Corporation Owners Representative and the Local Emergency Responders.
	Take actions noted under piping (below).
	Observe and continually monitor conditions at the dam, where safe. The situation should be well documented with photographs and videotape if possible.
	Record all information, observations, and actions.
Piping	If the entrance to the leak can be found in the reservoir, then on the embankment or abutments (sinkhole), try to plug the leak with whatever materials are available, such as plastic sheeting, straw bales, gravel and cobbles, etc.
	Document and photograph the location for future comparison.
	Record all information, observations, and actions.
Seepage	If the entrance to the leak can be found in the reservoir, then on the embankment or abutments (sinkhole), try to plug the leak with whatever materials are available, such as plastic sheeting, straw bales, gravel and cobbles, etc.
	Document and photograph the location for future comparison.
	Record all information, observations, and actions.
Flooding	If possible, lower the water level in the reservoir by activating pumps or diverting through spillways.
	Monitor flood conditions in the reservoir.
	Observe and continuously monitor the conditions at the dam/embankment from high ground. The situation should be documented with photographs and videotape if possible.
	Record all information, observations, and actions.
Embankment Movement	Observe the dam/embankment from the abutment and/or crest. At a minimum, inspect the entire crest, downstream slope, and downstream toe area. Observe carefully for any signs of additional erosion, seepage, or cracking.
	Observe and continuously monitor conditions at the dam/embankment from high ground. The situation should be documented with photographs and videotape if possible. Times of key events should be noted.

CONDITION	ACTION
	Record all information, observations, and actions.
Earthquake	Observe the dam/embankment from the abutment and/or crest. At a minimum, inspect the entire crest, downstream slope, and downstream toe area. Observe carefully for any signs of additional erosion, seepage, or cracking.
	Observe and continuously monitor conditions at the dam/embankment from high ground. The situation should be documented with photographs and videotape if possible. Times of key events should be noted.
	Record all information, observations, and actions.
Bulge	Contact personnel to immediately evacuate downstream of the dam.
	If possible, lower the water level in the reservoir by activating pumps or diverting through spillways.
	Install a flow-measuring device.
	Observe condition constantly for any further changes in flow rates or clarity, unless notified otherwise by the EOR.
	Observe and continuously monitor conditions at the dam from high ground. The situation should be documented with photographs and videotape if possible. Times of key events should also be noted.
	Record all information, observations, and actions.
Whirlpool	Contact the Renewal Corporation Owners Representative and the Local Emergency Responders.
	Take actions noted under piping (above).
	If possible, lower the water level in the reservoir by activating pumps or diverting through spillways.
	Observe and continually monitor conditions at the dam, where safe. The situation should be well documented with photographs and videotape if possible.
	Record all information, observations, and actions.
Slides	Observe the dam/embankment from the abutment and/or crest. At a minimum, inspect the crest, downstream slope, and downstream toe area. Observe carefully for any signs of additional erosion, seepage, or cracking.
	If the slide is on the downstream slope, stabilize the toe of the slide by constructing a berm with additional soil and rock. If there is significant leakage (indicated by muddy ground), install a filter overlain by a berm (see Piping above).
	Monitor settlement, rate of settlement, and extent of slide.
	Observe and continually monitor conditions at the dam from high ground. The situation should be documented with photographs and videotape if possible. Times of key events should also be noted.
	Record all information, observations, and actions.
	Contact personnel to immediately evacuate downstream of the dam.

CONDITION	ACTION
Embankment Overtopping	If possible, lower the water level in the reservoir by activating pumps or diverting through spillways.
	Observe and continuously monitor conditions from high ground.
	Increase freeboard by placing sandbags or other erosion resistant materials on the dam crest. Use riprap or other materials to provide erosion protection for the crest and downstream slope.
	Monitor the depth, duration, and location of the overtopping. Watch for erosion, backcutting, and slides.
	Record all information, observations, and actions.
Sabotage	Contact personnel to immediately evacuate downstream of the dam.
	If possible, lower the water level in the reservoir by activating pumps or diverting through spillways.
	Record all information, observations, and actions.

Appendix C

Oregon Reservoir Drawdown and Diversion Plan

KLAMATH RIVER RENEWAL CORPORATION

Lower Klamath Project
FERC Project No. 14803

Oregon Reservoir Drawdown and Diversion Plan

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1.0 Introduction

This Oregon Reservoir Drawdown and Diversion Plan is a subplan of the Reservoir Drawdown and Diversion Plan that will be implemented as part of the Proposed Action for the Lower Klamath Project.

1.1 Purpose of the Oregon Reservoir Drawdown and Diversion Plan

The purpose of the Oregon Reservoir Drawdown and Diversion Plan is to describe the proposed drawdown methods, procedures, schedules, and monitoring measures that the Renewal Corporation will implement on Oregon as part of the Proposed Action.

The Renewal Corporation and PacifiCorp have entered into an Operations and Maintenance Agreement (2017) filed with the Commission. Under the agreement, PacifiCorp will continue to operate the hydroelectric facilities until final drawdown is initiated after the spring freshet when the reservoir levels drop below the power intakes. At that point, the Renewal Corporation will use the low-level outlets at each dam to release water to completely lower the reservoirs.

1.2 Relationship to Other Management Plans

The Oregon Reservoir Drawdown and Diversion Plan is supported by elements of the following management plans for effective implementation: Erosion and Sediment Control Plan, Remaining Facilities Plan, Waste Disposal and Hazardous Materials Management Plan, Health and Safety Plan, and the Reservoir Area Management Plan. So as to not duplicate information, elements from these other management plans are not repeated herein but are, where appropriate, referenced in this Oregon Reservoir Drawdown and Diversion Plan.

1.3 Elevation Datum

All elevations reported within this plan use the North American Vertical Datum of 1988 (NAVD88), which, at the J.C. Boyle location, is 3.71 ft higher than the National Geodetic Vertical Datum of 1929 (NGVD29).

2.0 Drawdown and Diversion Plan

2.1 Drawdown Criteria

Pertinent drawdown criteria for the Proposed Action are summarized in Table 2.1, below, which includes information from the Design Report (Knight Piésold 2020b).

Table 2.1. Reservoir Drawdown Design Criteria

FEATURE/CONSIDERATION	CRITERIA	REMARKS	REFERENCE
OPERATING REQUIREMENTS			
Daily Minimum Downstream Flows	Downstream of Iron Gate: • September through November and March - 1,000 cfs • December through February - 950 cfs • April - 1,325 cfs • May - 1,175 cfs • June - 1,025 cfs • July and August - 900 cfs	• Minimum flows will be dictated by USBR requirements which may supersede the biological opinion flows as set out. Minimum flows only applicable up to completion of drawdown. • Operations Flow Parameters meetings are being held to further define the minimum flows in the J.C. Boyle bypass reach and the peaking reach along with the required ramp rates.	• USBR, BiOp 2019
Normal Maximum Operating Surface Elevation (ft NAVD88)	• J.C. Boyle = 3,796.7 ft		FERC License Application - Exhibit A (2004) - NAVD88 Elevations
Normal Minimum Operating Surface Elevation (ft NAVD88)	• J.C. Boyle = 3,791.7 ft		
PRE-DRAWDOWN			
Pre-Drawdown Construction Activities (Downstream of Reservoirs)	• Construction and commissioning to occur prior to January 1 of the drawdown year.		
	• All reservoirs to be operated at or below minimum operating water levels during early works construction; minimum operating water levels are specific to each facility	• Water levels to be defined through consultation with PacifiCorp.	• PacifiCorp STID Section 4 Standard Operations Procedures (PacifiCorp 2015)

FEATURE/CONSIDERATION	CRITERIA	REMARKS	REFERENCE
Pre-Drawdown Flow Regulation	• Regulate project operation flows to keep reservoir levels at or below minimum operating levels to maintain construction safety • The reservoir lowering will begin prior to construction and will be accomplished through project power and water bypass operations on a site-specific basis	• Required for construction staging and work safety.	• PacifiCorp STID Section 4 Standard Operations Procedures (PacifiCorp 2015)
DRAWDOWN			
Initial Drawdown	• To begin on or about January 1 of the drawdown year		
Reservoir Drawdown Rate	• Target drawdown water surface level rate 5 ft/day	• Each facility is unique relative to reservoir area capacity and proposed drawdown. Actual drawdown will be based on the actual water year.	
Drawdown Completion	• Water surface level at or below historic cofferdam level.		• Knight Piésold Memo VA20-01231 - Klamath Drawdown Model
GEOTECHNICAL REQUIREMENTS			
Slope Stability of Reservoir Rim			
Minimum Required FOS	• Drawdown FOS = 1.2	• Reservoir Drawdown criterion applies to existing dam, rim, and embankment slopes.	• USBR Design Standard No. 13 • USACE EM 1110-2-1902, 2003
	• Long-term, Post Drawdown FOS = 1.5		• USBR Design Standard No. 13 • USACE EM 1110-2-1902, 2003

FEATURE/CONSIDERATION	CRITERIA	REMARKS	REFERENCE
Design Earthquake for Temporary Construction	• 10% Probability of Exceeding Operating Basis Earthquake in 50 Years (1/475-Year Event); 0.2% Probability in 1 Year • 2% Probability of Exceeding Maximum Design Earthquake in 50 Years (1/2,475- Year Event); 0.04% Probability in 1 Year		• Appendix A4 of the Design Report
Slope Stability of Temporary Embankment Slopes			
Reservoir Drawdown	• FOS = 1.3	• Reservoir Drawdown criterion applies to temporary embankment slopes during removal.	• USBR Design Standard No. 13 • USACE EM 1110-2-1902, 2003

Notes:

BiOp = Biological Opinion
CFS = Cubic feet per second
EM = Engineer Manual
FERC = Federal Energy Regulatory Commission
FOS = Factor of Safety
NAVD88 = North American Vertical Datum of 1988
STID = Supporting Technical Information Document
USBR = United States Bureau of Reclamation
USACE = United States Army Corps of Engineers

2.1.1 Discharge Volumes and Rates

2.1.1.1 J.C. Boyle Facility

Discharges during the drawdown stages will be made through the existing outlets at the intake structure: three spillway bays, the power intake, and the two diversion culverts. The Renewal Corporation will not alter the existing outlets except for the removal of the concrete stop logs upstream of the two diversion culverts. Development of discharge rating capacities for the outlets are outlined in Appendix B of the Design Report (Knight Piésold 2020b) and are summarized below. The discharge rating curves for J.C. Boyle are also presented in Appendix B (drawing C1056). Discharge capacities of J.C. Boyle Dam components are presented in Table 2.2, below.

Table 2.2. J.C. Boyle Total Discharge Capacity and Drawdown Operations Plan

RESERVOIR WATER SURFACE ELEVATION (FEET, NAVD88)	TOTAL DISCHARGE RATE CAPACITY (CFS)					
	SPILLWAY ONLY (CFS)	POWER INTAKE ONLY (CFS)	ONE CULVERT - NO POWER (CFS)	ONE CULVERT - WITH POWER (CFS)	TWO CULVERTS (CFS)	TWO CULVERTS PLUS SPILLWAY (CFS)
3,801.7	30,402	2,850	3,786	6,636	7,572	37,974
3,800.7	27,680	2,850	3,740	6,590	7,480	35,160
3,799.7	25,045	2,850	3,694	6,544	7,388	32,433
3,798.7	22,500	2,850	3,647	6,497	7,294	29,794
3,797.2	20,046	2,850	3,599	6,449	7,198	27,244
3,796.7	17,690	2,850	3,550	6,400	7,100	24,790
3,795.7	15,433	2,850	3,501	6,351	7,002	22,435
3,794.7	13,282	2,850	3,451	6,301	6,902	20,184
3,793.7	11,241	2,850	2,915	5,765	5,830	17,071
3,791.7	9,265	2,850	2,868	5,718	5,736	15,001
3,791.7	7,433	2,850	2,820	5,670	5,640	13,073
3,790.7	5,752	2,850	2,772	5,622	5,544	11,296
3,789.7	4,233	2,850	2,723	5,573	5,446	9,679
3,788.7	2,887	2,805	2,674	5,479	5,348	8,235
3,787.7	1,733	2,531	2,623	5,154	5,246	6,979
3,786.7	801	2,269	2,572	4,841	5,144	5,945
3,785.7	153	2,020	2,520	4,540	5,040	5,193
3,785.2	–	1,784	2,494	4,278	4,988	4,988
3,784.7	–	1,561	2,467	4,028	4,934	4,934
3,783.7	–	1,351	2,414	3,765	4,828	4,828

RESERVOIR WATER SURFACE ELEVATION (FEET, NAVD88)	TOTAL DISCHARGE RATE CAPACITY (CFS)					
	SPILLWAY ONLY (CFS)	POWER INTAKE ONLY (CFS)	ONE CULVERT - NO POWER (CFS)	ONE CULVERT - WITH POWER (CFS)	TWO CULVERTS (CFS)	TWO CULVERTS PLUS SPILLWAY (CFS)
3,782.7	–	1,155	2,359	3,514	4,718	4,718
3,781.7	–	973	2,303	3,276	4,606	4,606
3,780.7	–	805	2,240	3,045	4,480	4,480
3,779.7	–	651	2,187	2,838	4,374	4,374
3,778.7	–	512	2,128	2,640	4,256	4,256
3,777.7	–	388	2,066	2,454	4,132	4,132
3,776.7	–	279	2,003	2,282	4,006	4,006
3,775.7	–	187	1,939	2,126	3,878	3,878
3,774.7	–	111	1,872	1,983	3,744	3,744
3,773.7	–	54	1,803	1,857	3,606	3,606
3,772.7	–	15	1,731	1,746	3,462	3,462
3,771.7	–	–	1,657	1,657	3,314	3,314
3,770.7	–	–	1,578	1,578	3,156	3,156
3,769.7	–	–	1,496	1,496	2,992	2,992
3,768.7	–	–	1,409	1,409	2,818	2,818
3,767.7	–	–	1,316	1,316	2,632	2,632
3,766.7	–	–	1,135	1,135	2,270	2,270
3,765.7	–	–	1,098	1,098	2,196	2,196
3,764.7	–	–	868	868	1,736	1,736
3,763.7	–	–	735	735	1,470	1,470
3,762.7	–	–	609	609	1,218	1,218
3,761.7	–	–	491	491	982	982
3,760.7	–	–	382	382	764	764
3,760.2	–	–	331	331	662	662
3,760.0	–	–	312	312	624	624
3,759.7	–	–	283	283	566	566
3,758.7	–	–	194	194	388	388
3,757.7	–	–	117	117	234	234
3,756.7	–	–	54	54	108	108
3,755.7	–	–	10	10	20	20

Source: Northwest Hydraulic Consultants computational fluid dynamics modeling in Appendix B2 of the Design Report (Knight Piésold 2020b).

2.2 Drawdown and Diversion Procedures

The Renewal Corporation will initiate the release of sediment to the Klamath River from the three larger reservoirs (J.C. Boyle, Copco No. 1, and Iron Gate) with reservoir drawdown. Initial reservoir releases will be accomplished with the facilities' existing structures to bring the reservoirs at or near their minimum allowable operating levels, which will occur prior to January 1st. Starting January 1st, Stage 1 of 4 stages will commence, allowing for regulated releases to draw down the reservoirs and release associated sediment in a controlled manner. Drawdown will continue until removal of the dams. The following reservoir drawdown and diversion approach described in this section is from the Design Report (Knight Piésold 2020b). Drawdown and diversion procedures for Copco No. 1, Copco No. 2, and Iron Gate Developments is detailed in the California Reservoir Drawdown and Diversion Plan.

2.2.1 Existing Facility Components

The J.C. Boyle Development construction is well documented in historic design drawings and construction photographs. Historic drawings are provided in Appendix K of the Design Report (Knight Piésold 2020b). The Supporting Technical Information Document (STID) is provided in Appendix J of the Design Report.

2.2.2 Pre-Drawdown Works

The Renewal Corporation will utilize existing facility features to assist with pre-drawdown and drawdown at the J.C. Boyle Development. The Renewal Corporation will use two existing diversion culverts under the current spillway to facilitate reservoir drawdown and flow passage during dam removal. The historic cofferdam and earthfill dam embankment divert water into the diversion culverts. No new cofferdams will be installed.

The dam site is accessible without additional access improvements. The Renewal Corporation can commence site preparation, equipment mobilization, and construction access improvements to other parts of the facility after drawdown is complete.

The J.C. Boyle Reservoir operation during the pre-drawdown period will follow the PacifiCorp STID operating levels (PacifiCorp 2015). The reservoir operation elevations are defined as follows:

- Normal maximum reservoir operation level: 3,796.7 ft
- Normal minimum reservoir operation level: 3,791.7 ft

2.2.3 Reservoir Operation

The Renewal Corporation will lower the reservoir and maintain it at a targeted level just below the spillway crest by using normal power operations or controlled spillway releases prior to the commencement of drawdown (January 1 of the drawdown year).

2.2.4 Drawdown Works

The Renewal Corporation will commence drawdown operation at J.C. Boyle on or about January 1 of the drawdown year. No special provisions for pre-drawdown are needed for J.C. Boyle; however, PacifiCorp will lower the reservoir to the normal minimum operating level prior to January 1 using normal power operations or controlled spillway releases, as inflows allow. The proposed drawdown occurs in four stages; the first utilizes the spillway gates, the second utilizes the power facilities, and the third and fourth utilize a sequenced removal of the diversion culvert stoplogs (shown on drawing C1050 in Appendix B).

The Renewal Corporation will maintain a reservoir water surface level of 3,783.2 ft (NAVD88; 2 ft below the spillway crest) to initiate both Stage 3 and Stage 4. This level allows workers to safety access the downstream side of the diversion culverts. River forecasting and coordination with the United States Bureau of Reclamation (USBR), operator of Link River Dam and Upper Klamath Lake, is required so the reservoir water level will remain below the spillway crest while crews are actively working on the downstream side of the diversion culverts. The maximum rate of drawdown varies from stage to stage due to inflow, the geometry of the reservoir, and the nature of the outflow (free-flowing) through the diversion culverts.

The design analysis completed to support the Design Report (Knight Piésold 2020b) compared steady-state inflows to culvert rating curves to determine the maximum flow allowable for crews to safely access the downstream side of the diversion culverts. These are presented in the Stage 2 and Stage 3 drawdown sections below. The United States Bureau of Reclamation (USBR) controls Link River Dam releases, which therefore has the capacity to regulate flows into JC Boyle. For safety of working crews, during Stage 2 and Stage 3, flow coordination with the USBR will be finalized when climatic information is available and flow forecasts are prepared by the USBR to keep J.C. Boyle Reservoir below the spillway crest.

Steady state water surface elevations are provided on drawing C1055 in Appendix B.

2.2.4.1 Stage 1 Drawdown

The Renewal Corporation will direct PacifiCorp to commence Stage 1 drawdown no earlier than January 1 of the drawdown year, with the reservoir at or above the minimum operating elevation of 3,791.7 ft. This stage of drawdown will be achieved by using the gated spillway bays and/or power intake to lower reservoir levels at a target rate of 5 ft per day, controlling the rate by varying spillway openings according to actual reservoir inflow rates.

The Renewal Corporation will direct PacifiCorp to undertake to complete Stage 1 drawdown within 48 to 72 hours of commencement, when the water level in the reservoir has stabilized above the spillway crest (spillway crest El. 3,785.2 ft). The stabilized elevation marking completion of Stage 1 may depend on the reservoir inflows at the time of drawdown.

2.2.4.2 Stage 2 Drawdown

The Renewal Corporation may direct PacifiCorp to initiate Stage 2 drawdown by continued power operations once Stage 1 is completed, and with the use of the spillways during wet year inflows. With power operations, outflow rates will initially increase and then quickly subside as water levels recede (ranging up to 2,850 cfs). The diversion culverts may remain closed during Stage 2.

Stage 2 drawdown will be complete when the water level in the reservoir has stabilized at least 2 ft below the spillway crest (spillway crest El. 3,785.2 ft). The stabilized elevation marking completion of Stage 2 may depend on the reservoir inflows at the time of drawdown. A reservoir water level which is 2 ft below the spillway crest is associated with a reservoir inflow of 1,260 cfs and may require river forecasting and coordination with the USBR, operator of Link River Dam and Upper Klamath Lake to achieve this flow release.

2.2.4.3 Stage 3 Drawdown

The Renewal Corporation will initiate Stage 3 drawdown once Stage 2 is completed by removing one of the diversion culvert concrete stoplogs. The Renewal Corporation will remove the diversion culvert #1 stoplog by controlled blasting. The explosives required to remove the culvert stoplog and initiate Stage 3 can only be set when there is no flow coming over the spillway. Diversion culvert #1 is located below the gated spillways and provides a 9.5 ft by 10 ft opening with an invert elevation of 3,755.2 ft. With diversion culvert #1 opened, outflow rates will initially increase and then subside as reservoir water levels recede (ranging up to 3,786 cfs). The Renewal Corporation will close the power intake wheel gate simultaneously with (or immediately prior to) the removal of the diversion culvert #1 stoplog. Once the power intake is closed, it will remain closed for the duration of the drawdown period.

The J.C. Boyle reservoir is narrow and does not have a large storage capacity below the spillway crest elevation. As a result, the culvert outflow rate will quickly equalize with the reservoir inflow rates over a 48- to 72-hour period. The maximum anticipated drawdown rate for Stage 3 is 10 ft per day. The stabilized elevation marking completion of Stage 3 will depend on the reservoir inflows at the time of drawdown. Similarly to Stage 2, a reservoir water level that is 2 ft below the spillway crest is required for access to the downstream side of diversion culvert #2 to prepare for Stage 4. While water is flowing from diversion culvert #1, the Renewal Corporation will cut an access hole in the roof of diversion culvert #2 to gain access to the diversion culvert #2 stoplog. This process will allow the Renewal Corporation to conduct diversion culvert #2 concrete stoplog demolition work in the dry (i.e., isolated from diversion culvert #1 outflows to the greatest extent possible). This reservoir elevation is associated with a reservoir inflow of about 2,120 cfs and may require river forecasting and coordination with the USBR, operator of Link River Dam and Upper Klamath Lake to achieve this flow release.

2.2.4.4 Stage 4 Drawdown

The Renewal Corporation will initiate Stage 4 drawdown on or about June 10 of the drawdown year by removing the diversion culvert #2 concrete stoplog. The exact timing of the removal of

the stoplog for Stage 4 may be adjusted to best accommodate the inflow rates and water levels at the time.

The Renewal Corporation will remove the diversion culvert #2 stoplog by controlled blasting, if required. Diversion culvert #2 is located below the gated spillways and provides a 9.5 ft by 10 ft opening with an invert elevation of 3,755.2 ft. The outflow rate will initially increase and then equalize with the reservoir inflow rates over approximately 12 to 24 hours, as the reservoir water level drops (ranging up to 7,572 cfs). The maximum anticipated drawdown rate for Stage 4 is 10 ft per day. Completion of the Stage 4 drawdown may provide the lowest possible drawdown of the reservoir based on reservoir inflow.

The drawdown will be complete when both diversion culverts are operating, the J.C. Boyle reservoir has been substantially dewatered, and reservoir inflows and outflows equalize (water levels are relatively stable). The diversion culverts will remain open and will pass all river flows until the historic cofferdam breach is conducted.

2.3 Flood Frequency and Hydrological Evaluation

This Section 2.3 of the Oregon Reservoir Drawdown and Diversion Plan is informational and discusses the results of the drawdown model and implications to the Proposed Action. This section does not contain specific measures to be implemented by the Renewal Corporation as part of the Proposed Action.

Operation of the J.C. Boyle reservoir during drawdown and post-drawdown will lower the reservoir impoundment and provide the required flood control. The Renewal Corporation will complete the reservoir drawdown sequencing over four stages as described in the previous section and as outlined in detail in the Design Report (Knight Piésold 2020b) and on drawing C1050 in Appendix B. The drawdown model was developed to assess the drawdown sequencing in terms of reservoir water surface levels under a range of hydrologic conditions.

2.3.1 Reservoir Conditions During Drawdown

Hydrologic simulations of the reservoir drawdown inflows into the J.C. Boyle Reservoir and drawdown regulation and outflows through the J.C. Boyle Dam are included in Appendix B. Appendix B also shows the hydrologic simulations of the reservoir drawdown inflows into the Copco No.1, Copco No. 2, and Iron Gate Reservoirs and drawdown regulation and outflows from the upstream dam.

Reservoir water surface levels were simulated in the drawdown model for the full record of inflows available for the 2019 Biological Opinion (2019 BiOp [NMFS 2019]) dataset. The 2019 BiOp flows reflect 36 years of river flows, from October 1980 through September 2016. The results of the drawdown model are summarized in three ways:

- Individual year simulations were produced for the J.C. Boyle Simulated Drawdown. These plots indicate the following:

  - Reservoir water surface levels.
  - Daily average inflows, total outflows, and outflows for each outlet structure (i.e., spillway, power intake, and flows through the diversion culverts).
- Maximum daily reservoir water surface level daily non-exceedance percentiles (percentiles) are shown on Figure 2.1, and on drawing C1056 in Appendix B. This figure represents the results from all 36 model simulations as non-exceedance percentiles to summarize the distribution of the results on any given day of the simulations. These results do not represent a simple simulation and are based on all the model simulations.
- Ensemble figures, Figure 2.2, with each line representing a single model simulation for a different year. This figure overlaps the simulated reservoir water surface levels on a common x-axis that spans January 1 to September 30. Each line represents a single model simulation.

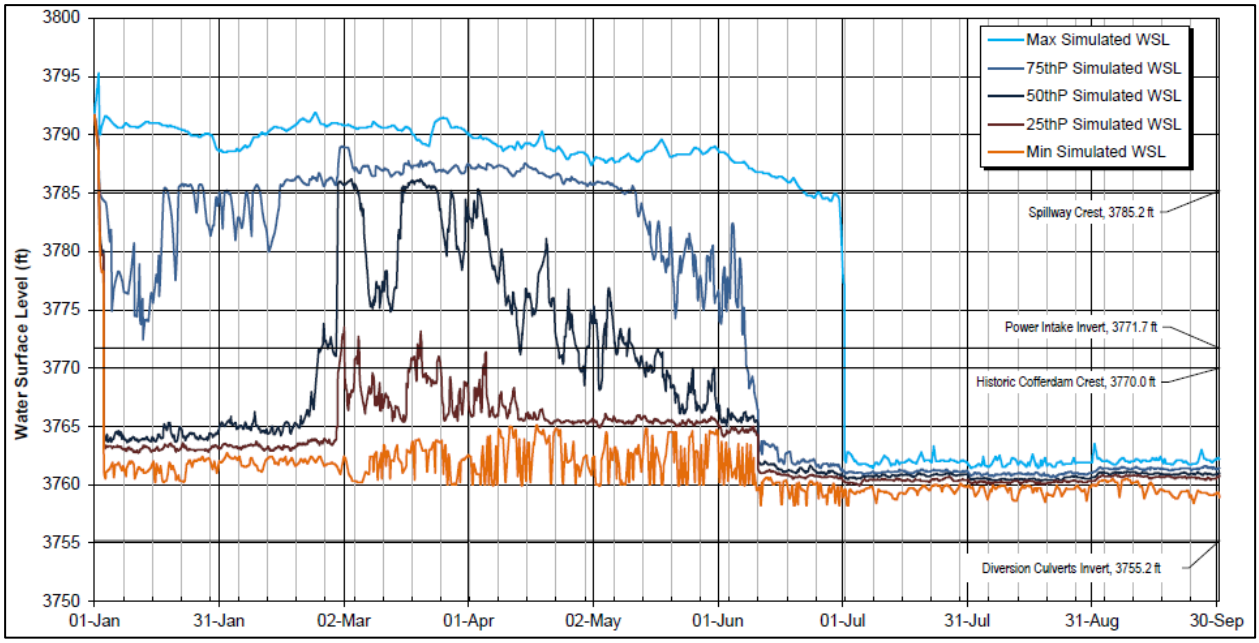

Figure 2.1. J.C. Boyle Reservoir Drawdown Simulated Water Surface Levels Non-Exceedance Percentiles

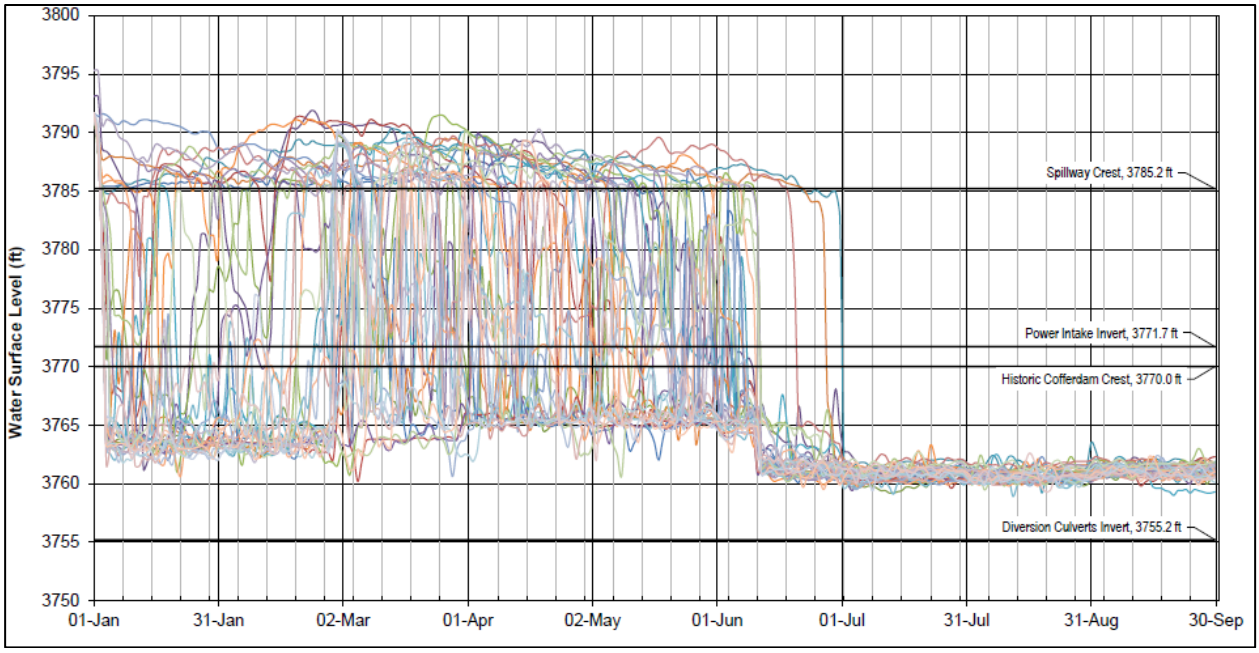

Figure 2.2. J.C. Boyle Reservoir Drawdown Simulated Water Surface Levels Ensemble Plot

The simulated water surface levels on Figure 2.1 and Figure 2.2 show that there is a substantial reduction in the reservoir water levels in mid-June with the majority of the simulated years achieving sustained water levels below the historical cofferdam crest in early June. This is a function of initiating Stage 4 of drawdown on June 10 and the inflow hydrology, which indicates a reduction in streamflow for the second half of June (Appendix A6 of the Design Report [Knight Piésold 2020b]). There are three model years (1983, 1984, and 1998) that show elevated reservoir water surface levels past June 15. However, in these years, the reservoir water surface levels do drop below the crest of the historic cofferdam prior to July 1.

Figure 2.2 shows that there are large fluctuations in the reservoir water surface levels from January through June as a function of the inflow hydrology into the J.C. Boyle reservoir. The J.C. Boyle reservoir has a small storage capacity, and the reservoir can refill quickly during the higher flow months, typically in January through May, resulting in spillway flows. Lower reservoir levels will be sustained below the crest of the historic cofferdam after June 1 depending on the hydrologic conditions and throughout Stage 4.

Figure 2.3 shows the cumulative percent of model simulations and the date when the reservoir water surface level is lower, and sustained, below the crest of the historic cofferdam. The drawdown model indicates that approximately 50% of the simulations have reservoir water levels sustained below the crest of the historic cofferdam by June 1, with 100% of the simulations by July 1. Note that these water levels are for average daily conditions and do not account for the low probability flood flows (i.e., the 1% and 5% probable flood flows).

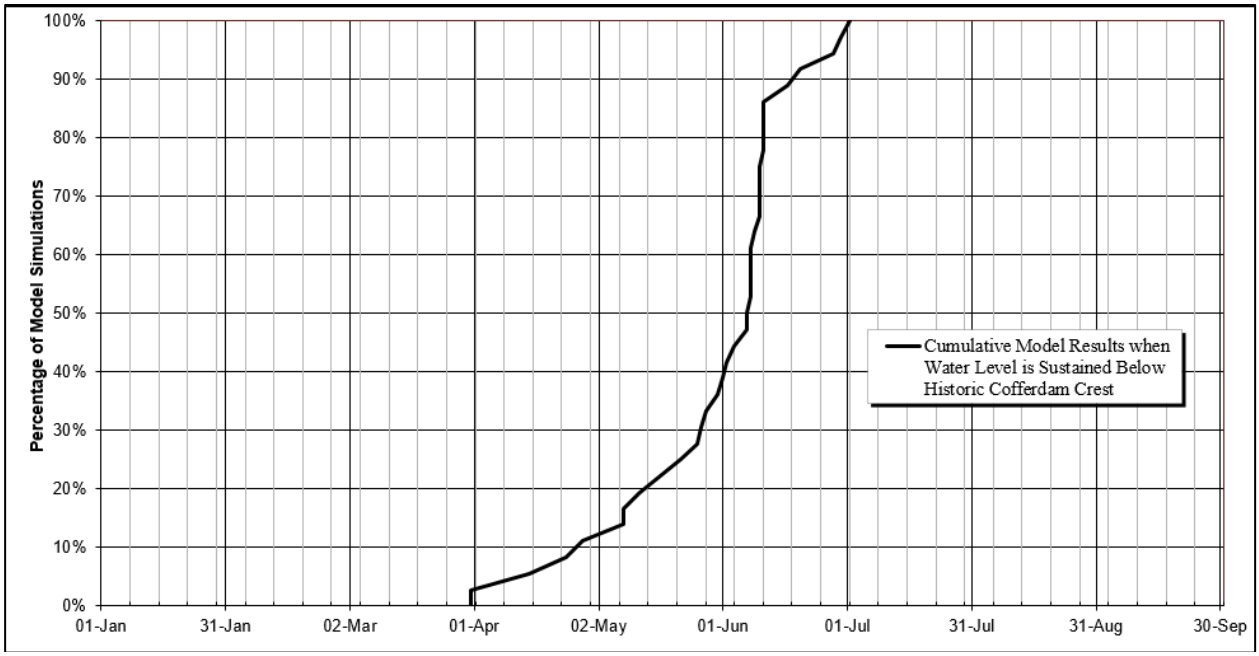

Figure 2.3. J.C. Boyle Reservoir Drawdown Cumulative Model Simulation Dates to Achieve and Sustain Reservoir Water Surface Levels below the Crest of the Historic Cofferdam

The results of the reservoir drawdown model are outlined below for each stage of drawdown.

- Stage 1 - Spillway Gates:
    - The spillway gates and/or power intake are used to target a drawdown of 5 ft/day, and drawdown occurs over one day.
- Stage 2 - Power Intake is Opened:
    - The reservoir water levels are controlled by the discharge capacity of the power intake and are dependent on the reservoir inflows.
    - Outflows through the power intake are limited to 2,850 cfs. The total outflow can be higher if the spillway is still engaged.
    - The reservoir can lower up to 5 ft when the power intake is initially opened in drier climatic conditions, as seen in the simulated results for 1990 and 2015.
    - The drop in reservoir water surface levels is not as large in wetter climatic conditions, and may be maintained above the spillway crest, as seen in simulated results for 1984 and 1997.
    - The duration of Stage 2 is determined by the hydrologic conditions and when the downstream of the diversion culverts can be accessed to successful remove the stoplogs. Approximately 75% of the simulations indicate that the duration of Stage 2 is limited to less than a week under the simulated drawdown methodology. Years with much higher-than-average inflows (wet years) indicate that Stage 2 can be sustained for many weeks and beyond April 1. This is observed in less than 15% of the simulated years (1983, 1984, 1985, 1997, and 2006). In approximately 10% of simulations, Stage 2 was limited to 2 weeks (1982, 1996, 1998, and 2002).

  - River forecasting and coordination with the upstream refilling of Upper Klamath Lake may be used to limit the duration of Stage 2. Reduced inflows to the reservoir will result in lower reservoir water levels, therefore, allowing for safe access to the downstream end of the diversion culverts. The steady-state inflow to the reservoir to maintain a water level 2 ft below the spillway crest with the power intake is 1,250 cfs for Stage 2. Alterations to the flow releases from refilling of Upper Klamath Lake outside of the 2019 BiOp flows were not simulated with the drawdown model.
- Stage 3 – Diversion Culvert #1 is Opened:
  - A temporary drop in reservoir water surface level and an increase in outflow is observed when the diversion culvert is opened. The reservoir water surface levels can drop below 3,765 ft under most hydrologic conditions when the diversion culvert is opened. Wetter hydrologic conditions will result in a lesser drop in the reservoir level (e.g., 1998 drops to approximately 3,770 ft as there is an increase in reservoir inflows shortly after removing the diversion culvert stoplogs).
  - After removal of the diversion culvert #1 concrete stoplog, the power tunnel intake will be permanently closed.
  - Outflows through the diversion culvert are limited to approximately 2,400 cfs prior to the spillway being engaged. Total outflows in Stage 3 can be higher if the spillway is still engaged.
  - The reservoir water surface level is likely to increase periodically after opening Diversion Culvert #1. Nearly 90% of the model simulations indicate that the spillway will be reengaged during Stage 3.
  - The drawdown model report notes that under the drawdown operating criteria evaluated for the drawdown model, in some years both diversion culverts open on the same date (June 11). Under these hydrologic conditions, coordination with the refilling of Upper Klamath Lake will be required to permit the opening of diversion culvert # 1 on an earlier date, therefore initiating Stage 3 of drawdown prior to June 10.
- Stage 4 – Diversion Culvert #2 is Opened:
  - Stage 4 represents the final stage of drawdown.
  - Stage 4 is initiated on or after June 10 and when the reservoir water surface level is 2 ft below the spillway crest, or lower. The steady-state inflow to the reservoir to maintain a water level 2 ft below the spillway crest with diversion culvert #1 open is 2,120 cfs.
  - Over 90% of the drawdown model simulations indicate that diversion culvert #2 is opened on June 10. Under wet hydrologic conditions, such as those in simulation years 1983, 1984, and 1998, the opening on the diversion culvert is delayed – the latest date resulting from the simulations is June 29.
  - The reservoir water surface levels can drop below 3,763 ft under most hydrological conditions when diversion culvert #2 is opened. Wetter hydrologic conditions will result in a lesser drop in the reservoir level (e.g., 1993, 1998, 1999

and 2011 drops to approximately 3,765 ft with the initial opening of the diversion culvert).

After the diversion culvert has been opened, and after July 1, the reservoir water surface levels remain low and are within the range of 3,758.0 to 3,763.5 ft for all the model simulations.

3.0 Monitoring Plan

3.1 Reservoir Level Monitoring

Reservoir levels for J.C. Boyle are currently continuously monitored through the powerhouse control room and Hydro Control Center (PacifiCorp 2015). Flows can increase the amount of debris deposited against facility components during high-flow storm events. Erosion, back cutting, sloughing, or obstruction in the spillway or tailrace channel might occur because of these high-flow conditions. Special attention to these areas is included in the monitoring and surveillance of the facility during or after high-flow events. The Proposed Action will comply with high-flow event monitoring. If obstructions occur, the Renewal Corporation can implement measures to remove obstructions, such as mechanical removal or controlled blasting.

The Renewal Corporation will monitor reservoir levels during drawdown by level sensors and staff gauge. If readings are approaching a level that could cause concern regarding stability of the reservoir rim or embankment areas, the Renewal Corporation will, if necessary, take remedial actions described in the Emergency Response Plan (Kiewit 2020) for the Project and Appendix A (Oregon Slope Stability Monitoring Subplan) to this plan.

3.2 Flow Monitoring

The Renewal Corporation will continue to monitor USGS stream gages (11509500 below Keno Reservoir and 11510700 below J.C. Boyle Reservoir) as described in the Oregon Water Quality Management Plan.

3.3 Embankment and Reservoir Rim Monitoring

Slope stability monitoring for the J.C. Boyle Reservoir rim and embankment structures is addressed in the Oregon Slope Stability Monitoring Plan (Appendix A). The Oregon Slope Stability Monitoring Plan presents the Renewal Corporation's proposed monitoring and evaluates practices to avoid and minimize potential impacts related to slope stability. The appendix proposes measures to address instability and discharges that may impact water quality.

4.0 Implementation Plan

4.1 J.C. Boyle Development

This section describes the post-drawdown decommissioning and removal measures for the J.C. Boyle Development. The demolition and removal work will include removal of the dam, water

conveyance, powerhouse, and electrical infrastructure. It will also involve establishment of the final river channel for volitional fish passage through the former dam and reservoir inundation area. Drawing C1055 (Appendix B) presents water surface elevations based on steady state flood flows and with both low-level outlets (diversion culverts #1 and #2) open. The drawdown modeling provides simulated water surface levels through to October 1 of the drawdown year. Additional information is provided in the design drawings provided in Appendix B and supporting details of the Design Report (Knight Piésold 2020b).

4.1.1 Dam and Intake Concrete Removal

With the diversion culverts operating as described above, the Renewal Corporation will remove the concrete components at the dam and intake. Dam and intake structure removals are shown on drawings C1210 and C1220 (Appendix B) and are described in the subsections below.

4.1.1.1 Concrete Removal

The Renewal Corporation will remove spillway gates and hoisting equipment after drawdown is complete. Partial removal of the concrete spillway may occur in the low-flow summer period coinciding with the decline in flood water surface elevations. The Renewal Corporation will remove the fish ladder, concrete cut-off wall and power intake concrete in conjunction with dam embankment removal. The phased removal elevations are shown on drawings C1234 and C1239 (Appendix B). Removal methods include dam embankment excavation, mechanical demolition, drilling, and controlled blasting. The final removal elevation at the intake is approximately 3,785.2 ft. Following use as an access road to the left bank, the Renewal Corporation will bury in place any concrete below this elevation. The Renewal Corporation will place excavated concrete rubble in the scour hole. The top-down concrete removal process will confirm structural stability criteria are met throughout the entire concrete structure removal process.

4.1.2 Earthfill Embankment Removal

The Renewal Corporation will commence embankment removal and demolition work following reservoir drawdown. The removal plan allows for most of the dam removal to occur in the dry, by leaving the upstream portion of the dam embankment and historic cofferdam in place and removing the dam embankment in phases (as shown in Table 4.1). The Renewal Corporation will remove the embankment in Phases 1 to 7, remove the historic cofferdam in Phase 8, and bury the diversion culvert channel and remaining concrete in Phase 9. Additional detail is provided in the following subsections.

Proposed stability requirements for the embankment through drawdown and embankment removal are provided in Table 3.1, and embankment removal drawings (C1230 to C1232, and C1234 to C1239) are included in Appendix B.

4.1.2.1 Stability, Freeboard, and Removal Phases

Removal of the J.C. Boyle earthfill dam embankment and concrete structures is planned and proposed in a manner that maintains the current stability criteria. This is achieved by removing

the embankment in a sequence that does not result in narrowing of the crest or steepening of the downstream embankment slopes (drawing C1050 in Appendix B). Appendix B of the Design Report provides a description of the geotechnical, civil, and hydrotechnical details proposed for the phased dam embankment removal. The embankment removal work is broken into multiple phases related to flood water surface elevations. The phased embankment removal, historic cofferdam removal, and downstream rockfill grading, including historic cofferdam breach and removal are shown on the design drawings in Appendix B.

In addition to meeting the stability criteria discussed above, the Renewal Corporation will remove the dam in a manner that provides a 3-ft freeboard for a reservoir water level corresponding to a 1% flood event (100-year instantaneous flood flow), as shown on the design drawings in Appendix B.

4.1.2.2 Final Embankment Removal

The Phase 5 embankment crest will be at El. 3,770.7 ft. The Renewal Corporation will complete the majority of embankment dam fill removal in the dry, as the historic cofferdam upstream is anticipated to route flows to the diversion culverts. The Renewal Corporation will excavate the final river channel footprint to approximately 3,739 ft at the dam embankment centerline based on the anticipated bedrock depth. This river bottom elevation is lower than the diversion culvert invert elevation of 3,755.2 ft. The Renewal Corporation will complete visual inspection of the historic cofferdam and remaining sediment prior to removal of the Phase 6 embankment. The Renewal Corporation will complete the removal of the Phase 6 embankment in conjunction with the riverbank slope protection installation, as shown on drawing C1230 in Appendix B.

4.1.3 Historic Cofferdam and Sediment Removal

The Renewal Corporation will use the historic cofferdam that is located approximately 450 ft upstream of the dam embankment centerline. No historic design or construction cofferdam details are available. The Renewal Corporation will assess the condition of the historic cofferdam after the reservoir is lowered and make any repairs needed for the cofferdam to function as originally intended. This may include:

- Adding earthfill to the crest to restore original crest elevation and freeboard.
- Lining the upstream portion of the cofferdam with impervious material.
- Mechanically removing sediment from the diversion culvert approach channel.

Following use of the historic cofferdam to divert flows to the diversion culverts, the Renewal Corporation will remove the cofferdam as well as accumulated sediment between the embankment dam and the cofferdam. This is required to restore the river channel and achieve volitional fish passage.

The Renewal Corporation will cut the cofferdam embankment back towards the river right bank (drawing C1239, Appendix B). Once the cofferdam is breached, flow will naturally erode and remove portions of the historic cofferdam. The Renewal Corporation will remove material

remaining and place this material in the disposal area. This removal will return flows to the historic channel and allow for in-water removal of the remaining fill.

4.1.4 Final River Channel

The Renewal Corporation will remove the embankment, historic cofferdam, and soft sediment to an elevation that provides channel width and grade suitable for volitional fish passage as described in the Reservoir Area Management Plan Section 5.1.2.1. No bedrock or rockfill will be excavated. The Renewal Corporation will install erosion protection prior to historic cofferdam breach. The Renewal Corporation will line areas along the final river channel that are expected to be inundated during the 1% flood with a layer of bedding material to provide the appropriate filter relationship with the subgrade material, and rock material to mitigate scour. Proposed gradations and appropriate thicknesses are detailed in the Design Report (Knight Piésold 2020b), and the final grading plan of the channel through the J.C. Boyle site is shown on drawing C1230 (Appendix B).

4.2 Drawdown Implementation Timeline

Table 4.1 summarizes key dates and associated work activities for the drawdown of the J.C. Boyle Reservoir. A complete implementation schedule for the Oregon Reservoir Drawdown and Diversion Plan is provided in Appendix C.

Table 4.1. Key Intake and Embankment Elevations and Removal Timing

REMOVAL ITEM	ELEVATION (FT NAVD88)	EARLIEST REMOVAL DATE	DESIGN FLOOD EVENT	COMMENTS
Spillway Gates and Trunnions	3,790.0	January 1	-	Once the drawdown is initiated, spillway control is no longer required, so the spillway gates and trunnions can be removed.
Diversion Culvert #1 (Drawdown Stage 3)	3,755.2	Varies	-	See drawdown section (Stage 3).
Embankment Removal **Phase 1**	-	March 15	1% Probable Flood + 3ft freeboard	Remove erosion protection material from downstream face of the dam.
Embankment Removal **Phase 2**	3792.1	June 1	1% Probable Flood + 3ft freeboard	Remove embankment to June 1 1% probable flood with 3 ft freeboard.
Diversion Culvert #2 (Drawdown Stage 4)	3,755.2	Varies	-	See drawdown section (Stage 4).

REMOVAL ITEM	ELEVATION (FT NAVD88)	EARLIEST REMOVAL DATE	DESIGN FLOOD EVENT	COMMENTS
Embankment Removal **Phase 3**	3,784.7	June 15	1% Probable Flood + 3ft freeboard	Remove embankment to June 15 1% probable flood with 3 ft freeboard.
Spillway Structure	3785.2	July 1	1% Probable Flood + 3ft freeboard	Remove spillway and intake structure to max removal elevation – maintain 15 ft width for access to left bank.
Abutment Left Wall Phase 1	3,785.2	July 1	1% Probable Flood + 3ft freeboard	Match left wall elevation to spillway and elevation.
Embankment Removal **Phase 4**	3,776.7	July 1	1% Probable Flood + 3ft freeboard	Remove embankment to July 1 1% probable flood with 3 ft freeboard.
Embankment Removal **Phase 5**	3,770.4	July 15	1% Probable Flood + 1ft freeboard	Criteria changes from 1% probable flood with 3 ft freeboard to 1% probable flood with 1 ft freeboard. Remove embankment to July 15 1% probable flood with 1 ft freeboard.
Embankment Removal **Phase 6** and Erosion Protection Installation	-	Aug 1	1% Probable Flood + 1ft freeboard	Remove remaining embankment and silt. Excavate final channel to lines and grades shown on C1230, followed by installation of erosion protection and bedding material. Stockpile material for eventual placement in diversion culvert channel and to bury intake concrete (Phase 9).
Evaluate/Grade Downstream Rockfill **Phase 7**	3770.0	Aug 1	1% Probable Flood + 1ft freeboard	Evaluate rockfill for use in final channel following removal Phase 6 and grade as required.
Historic Cofferdam Breach **Phase 8**	3,755.2 (min)	September 1	-	To start no earlier than September 1 and be completed no later than September 30. Breaching of the historic cofferdam must take place after the final channel excavation is substantially complete.
Intake Cover **Phase 9**	-	September 1	-	To occur after cofferdam breach and substantial completion of the Final River

REMOVAL ITEM	ELEVATION (FT NAVD88)	EARLIEST REMOVAL DATE	DESIGN FLOOD EVENT	COMMENTS
				Channel. Place material in diversion culvert channel and bury intake concrete.

4.3 Coordination with Agencies and Stakeholders During Drawdown and Removal

Methods used for notification of the Commission; site emergency response personnel; and local, State, and Federal Emergency Response Centers are included in the Emergency Response Plan (Kiewit 2020) for the Project. In addition, the Renewal Corporation will notify ODEQ and the Commission within 72 hours of an event that may substantially delay drawdown or cause the timeline to complete drawdown to exceed the anticipated schedule.

Any emergency or incident will be immediately communicated to a direct supervisor and, once it is safe to do so, all supervisors will report as outlined in the Emergency Response Plan and Health and Safety Plan for the Project. The Renewal Corporation will implement an alarm system that will sound to alert all personnel in nearby areas of a danger. Emergency Contact Information is included is also included in the Emergency Response Plan, which outline measures for directing emergency responses as well as notifications to the public, as necessary.

5.0 Construction Potential Failure Mode Analysis (cPFMA)

Construction Potential Failure Modes (cPFMs) were determined as part of the December 11 and 14 2020 informal cPFMA workshop (Kleinschmidt 2021) that included participation by representatives from the Renewal Corporation, Kleinschmidt, the independent Board of Consultants, California Division of Safety of Dams, the FERC, and PacifiCorp. The purpose of the cPFMA workshop was to identify and analyze cPFMs for each of the 4 dams included in the Proposed Action, focusing on the construction phases. As part of the workshop, a range of cPFMs were identified and evaluated in relation to the proposed dam removal design and construction work activities.

All cPFMs identified were fully developed and assigned an appropriate significance category following FERC guidelines. The path to failure was defined, risk reduction measures were listed, and considerations for surveillance and monitoring were discussed and included in the cPFMA report (Kleinschmidt 2021).

5.1 Outcomes of cPFMA Workshop for J.C. Boyle

A total of 16 cPFMs for J.C. Boyle Dam were identified and analyzed during the cPFMA workshop. Of the 16 cPFMs identified, eight were not developed or were withdrawn due to design revisions that eliminated them from consideration. For the remaining eight cPFMs,

surveillance and monitoring actions as well as opportunities for risk reduction were identified for J.C. Boyle; these are detailed in the cPFMA report (Kleinschmidt 2021). The recommended actions were incorporated into the Project construction document, work sequence, and risk register where appropriate.

6.0 Training and Awareness

Section 6.0 discusses the qualifications required for maintenance personnel including training requirements and documentation. The Renewal Corporation will provide personnel and required training as discussed below.

6.1 Current Responsibilities and Training

PacifiCorp Operations personnel consist of Operators and Foremen, reporting to the Production Manager. The Operators are either journeymen or apprentice, and the Foreman is a General Foreman Hydro. The Foreman is responsible for Operators that perform surveillance duties and read the active instrumentation at the Project (except for the movement surveys). The Foreman and Operators are also responsible for relaying copies of the inspection check lists and sheets to the Dam Safety Engineer. The Foreman is experienced in the safe operation of hydroelectric projects and has participated in all dam safety-related training associated with the execution of dam-specific DSSMPs. The Operators and Foreman are responsible for carrying out surveillance duties and reading active instrumentation at their respective dams. Temporary monument surveys are the responsibility of the Renewal Corporation.

Personnel training in surveillance and monitoring includes review and familiarization of the most current PFMA study and the DSSMP. New personnel at any level of responsibility are trained by experienced personnel at the same or greater level of responsibility. Training includes a review of the surveillance procedures included in the DSSMP and the Daily Log, Weekly Check Sheet, and Annual Engineering Inspection Check Sheets. New PacifiCorp staff review the procedures and accompany an experienced Operators or Foreman to gain an understanding of each aspect of surveillance activities and learn the type of observations and readings needed for valid data input. The Renewal Corporation will implement a training program to train new staff operations after PacifiCorp concedes full control of the Project facilities.

6.2 Training, Awareness, and Competency

Training is required for all personnel prior to commencing work on site. The level of training is commensurate with the level of individual risk their works are likely to entail. Trainings include:

- Environmental and safety policies, site management plans, as well as environmental roles and responsibilities;
- The significance of environmental impacts caused by individual roles and activities;
- Incident management; and
- Potential consequences of non-conformance.

The Renewal Corporation will document training associated with implementation of activities.

6.3 Inductions

All personnel working onsite will undergo mandatory Project training to cover the key requirements of the Workplace Safety Management Plan.

6.3.1 Project Induction

The Project induction will cover an overview and related safety-, environmental-, and community-related risks and responsibilities for the Proposed Action. It is the responsibility of all personnel to adhere to the safety requirements of the Project. The Project induction with respect to reservoir drawdown will include:

- Overview of the Oregon Reservoir Drawdown and Diversion Plan,
- Project contact details;
- Potential Areas of Concern and inaccessible areas;
- Notification procedures; and
- EAP, Emergency Response Plan for the Proposed Action, and other emergency protocols.

6.3.2 Visitor Induction

Visitors must undergo a visitor's induction and their host is responsible for all actions and conduct of the visitor. The Renewal Corporation will restrict visitor access, and personnel who have previously undergone Project induction and safety training will accompany visitors at all times.

7.0 Reporting

The Renewal Corporation will provide an Annual Compliance Report including a summary of drawdown activities and their results to ODEQ and the Commission by April 1 and 15, respectively, for the preceding year. During the drawdown phase, the Renewal Corporation will submit monthly progress reports to ODEQ and the Commission including details regarding drawdown status.

8.0 References

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PacifiCorp. 2015. J.C. Boyle Development, Klamath River Project, Supporting Technical Information Document (STID). April.

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Renewal Corporation. 2019. Geotechnical Data Report. Prepared by the Renewal Corporation Technical Representatives: AECOM Technical Services, Inc. and CDM Smith. June.

Appendix A

Oregon Slope Stability Monitoring Subplan

KLAMATH RIVER RENEWAL CORPORATION

Lower Klamath Project
FERC Project No. 14803

Oregon Slope Stability Monitoring Plan

J.C. Boyle

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December 2021

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1.0 Introduction

This Oregon Slope Stability Monitoring Plan is an appendix to the Oregon Reservoir Drawdown and Diversion Plan, which is a subplan of the Reservoir Drawdown and Diversion Plan that will be implemented as part of the Proposed Action for the Lower Klamath Project.

1.1 Purpose of Oregon Slope Stability Monitoring Plan

This document describes the Klamath River Renewal Corporation's (Renewal Corporation) plan for monitoring slope stability and evaluates practices related to slope stability. The plan identifies reservoir slopes and other areas within the Limits of Work of the Proposed Action prone to instability and describes the Renewal Corporation's measures for monitoring instability during drawdown and dam removal under the Proposed Action. It also describes the Renewal Corporation's measures to address instability and discharges that would violate water quality standards. The Renewal Corporation's slope stability measures are also intended to protect private property, structures, and cultural sites.

The Renewal Corporation will implement the following measures through this Oregon Slope Stability Monitoring Plan or other management plans referenced in this document:

- describe proposed survey monuments to monitor slope stability during and following drawdown.
- visually monitor for evidence of potential slumping, cracking, or slope failure of dam embankment during dam removal.
- monitor J.C. Boyle Reservoir elevation and stream flow at the United States Geological Survey (USGS) gauge 11509500 below Keno Reservoir and 11510700 below J.C. Boyle powerhouse during drawdown.
- provide contingency and notification procedures to respond to confirmed or suspected issues for slope instability or loss of erosion protection.
- submit monthly and annual reports.

1.2 Relationship to Other Management Plans

This Oregon Slope Stability Monitoring Plan is supported by elements of the following management plans to aid in effective implementation: Construction Management Plan, Erosion and Sediment Control Plan, Oregon Reservoir Drawdown and Diversion Plan, and Water Quality Monitoring and Management Plan. So as to not duplicate information, elements from these other management plans are not repeated herein but are, where appropriate, referenced in this plan.

1.3 Oregon Section 401 Water Quality Certificate Condition 5

Under Section 401 of the federal Clean Water Act, the Oregon Department of Environmental Quality has issued a Section 401 Water Quality identifies several elements for consideration in the Reservoir Drawdown and Diversion Plan, including the location, schedule, and installation procedures for piezometer wells proposed for the upstream shell and core of J.C. Boyle Dam

and procedures to monitor water levels and pore pressure at these locations (Condition 5(b)(i), ODEQ 2018). These elements are addressed throughout this plan. Modeling for the design (Knight Piésold 2020b) showed that dam stability increases during reservoir drawdown and the proposed dam removal for each of the facilities. Therefore, the Renewal Corporation proposes the installation of zero piezometer wells and inclinometers to monitor dam stability. As an alternative, the Renewal Corporation will monitor drainage and make visual observations of the dam faces and reservoir rim during drawdown and dam removal.

1.4 Elevation Datum

All elevations reported in this plan use the North American Vertical Datum of 1988 (NAVD88), which is 3.71 ft higher than the National Geodetic Vertical Datum of 1929 (NGVD29) at J.C. Boyle.

2.0 Supporting Information

2.1 Reservoir Rim

This section is informational and includes excerpts from the Reservoir Rim Stability Report (Knight Piésold 2020a); it does not contain specific measures to be implemented by the Renewal Corporation as part of the Proposed Action. *Reservoir rim* is defined as the terrain that lies within the normal operating levels of the reservoir. The terrain downslope and upslope of the rim are defined as *submarine* slopes and *upslope* areas, respectively.

The Reservoir Rim Stability Report summarizes the findings of an evaluation of reservoir rim stability during and following drawdown. The evaluation focused on the potential instabilities that could affect residences and other resources adjacent to the rim, such as transportation infrastructure. The evaluation is consistent with previous evaluations completed by the Renewal Corporation (2019) and PanGeo (2008).

The approach used for the stability analyses (Knight Piésold 2020a) commenced with a review of the Renewal Corporation's previous analyses and conclusions (2019). Stability models were then developed based on the interpretation of data and observations collected by the Renewal Corporation, which were influenced by the challenges of gaining site access. Identification and characterization of terrain hazards were completed for each of the four reservoir sites and guided the development of slope models. The analysis for JC Boyle established that there were no hazards identified. In addition, Limit Equilibrium (LE) analyses also allowed for identification of factors that influence slope stability during drawdown of the reservoir.

The stability models evaluated existing conditions to identify the possible extent of instability during drawdown of the current ground surface as determined by topographic and bathymetric surveys, the assumed geological model, and an established piezometric low (assuming the minimum operating reservoir level represents drawdown conditions). These results provide a framework for judging the results of the drawdown analyses.

2.1.1 Geological Setting

The limits of work are predominantly contained in the Western and High Cascades volcanic regions of the Cascades Geologic Province. The Klamath River predates the formation of the Cascade Mountain Range and maintained a relatively similar course through the mountain-building events. The bedrock within the limits of work comprises volcanic rocks up to 45 million years old as well as basalt and andesite lava flows, tuffs, tuff-breccias, and volcaniclastic sandstone. The volcanic rocks are intruded by numerous dikes and plugs of andesite, rhyolite, and basalt. Many of the volcanoes associated with the Western Cascades have since eroded, but large shield volcanoes and vents of the High Cascades remain and are still active.

Large deposits of coarse alluvium were deposited along the Klamath River during the period of the last glaciation when the river had a higher discharge. Lacustrine deposits were laid down in former temporary lakes that were created at the present-day site of the J.C. Boyle Reservoir when the Klamath River was temporarily “dammed” by volcanic activity. Diatomite deposits surround much of the shoreline of the J.C. Boyle Reservoir (PanGeo 2008, as cited in SWRCB 2020). The presence of diatomaceous deposits and associated fluvio-lacustrine terrace deposits along the rim and below the reservoir water level present the greatest potential for slope instability.

2.1.2 J.C. Boyle Reservoir Rim

There are no residential properties adjacent to the J.C. Boyle Reservoir rim. A bridge crossing on Highway 66 separates the broad north part of the reservoir from the south part, which is mainly confined within a canyon.

Undercutting has been identified at one location around the J.C. Boyle Reservoir rim. There is an approximately 15 ft-high, steep shoreline slope, comprised of diatomite, in the north part of the reservoir approximately 0.4 miles west of Spencer Creek that has been undercut by wave action (Figure 2.1, Figure 2.2; Knight Piésold, 2020a). No submarine landslides were identified in the terrain analysis. The soft sediment that has accumulated on the floor of the reservoir will be highly susceptible to erosion upon drawdown.

The lower slopes of the southwest oriented bedrock canyon, south of the road crossing, are comprised of geological materials that are not expected to be prone to slope instability during the drawdown.

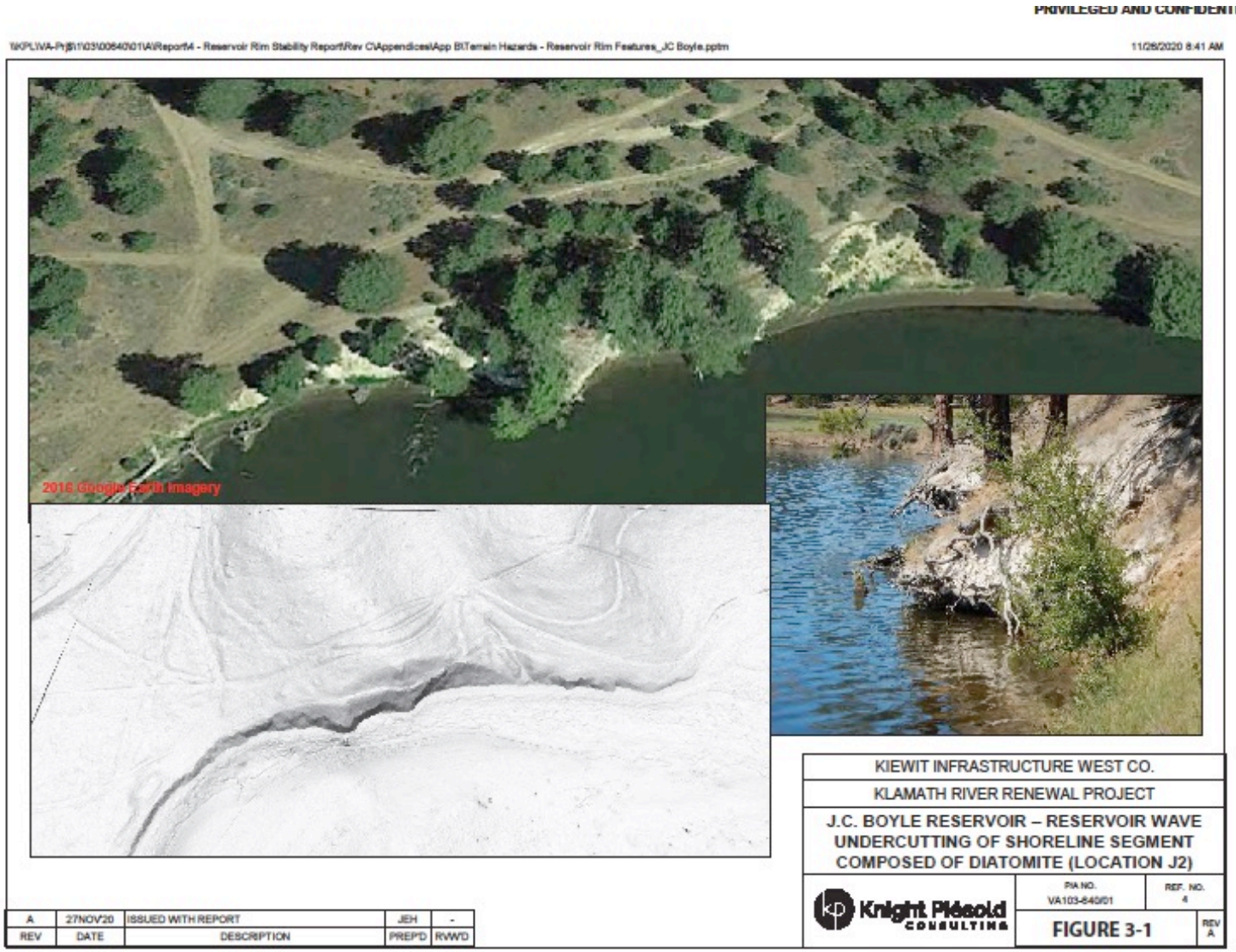

Figure 2.1. J.C. Boyle Reservoir – Reservoir Wave Undercutting of Shoreline Segment Composed of Diatomite (Location J2)

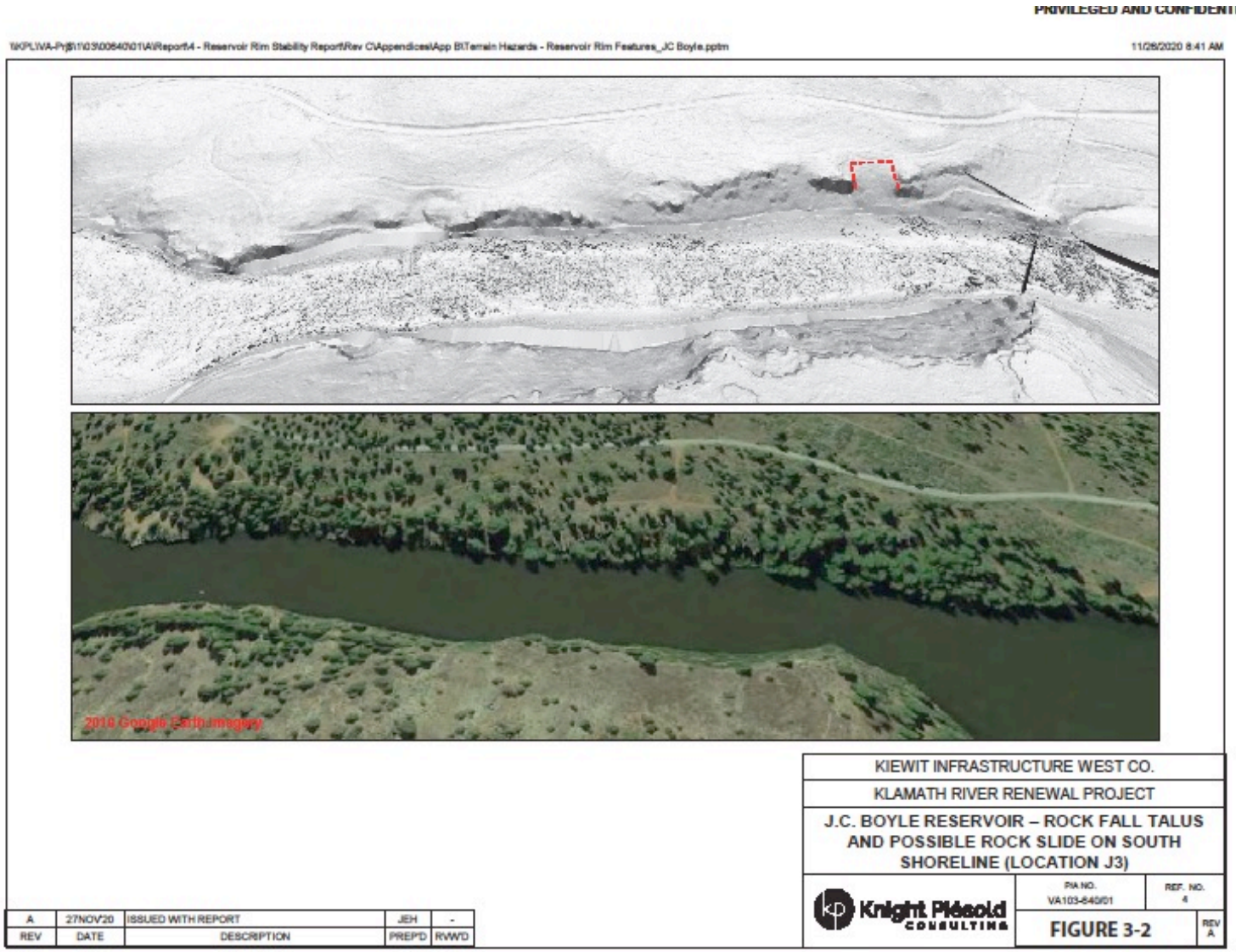

Figure 2.2. J.C. Boyle Reservoir – Rock Fall Talus and Possible Rock Slide On South Shoreline (Location J3)

3.0 Proposed Action Areas Potentially Prone to Instability

This section describes slopes and other Proposed Action areas of concern for slope stability.

3.1 Dam Embankments

Stability analyses were conducted for each of the facilities to evaluate the safety of the existing dams and whether dam modifications would result in an unacceptable structural response and risk (Knight Piésold 2020b). The analyses focused on the Potential Failure Modes (PFMs) related to the main dam sections where dam modifications could cause adverse effects to the overall stability or structural response of the dams. The Renewal Corporation will monitor the upstream and downstream face and crest of the J.C. Boyle Dam earthfill embankment.

3.2 J.C. Boyle Reservoir Rim

Previous studies completed by PanGeo (2008) and the Renewal Corporation (2019) and supported by a recent study by Knight Piésold (2020a), indicate that drawdown of the J.C. Boyle Reservoir will not result in large-scale slope instability effecting adjacent infrastructure or properties. Undercutting has been identified at one location around the J.C. Boyle Reservoir rim. There is an approximately 15 ft-high, steep shoreline slopes, comprised of diatomite, in the north part of the reservoir approximately 0.4 miles west of Spencer Creek that has been undercut by wave action (Figure 2.1, Figure 2.2; Knight Piésold, 2020a). However, the occurrence of gentle slopes beneath the diatomite cliff will render the possibility low. No submarine landslides were identified in the terrain analysis. The soft sediment that has accumulated on the floor of the reservoir will be highly susceptible to erosion upon drawdown.

3.3 Roads

Improvements to existing roads and development of new temporary access routes are required to support construction activities under the Proposed Action, both to improve access safety and to facilitate movement of construction equipment and traffic. Additional details regarding road improvements and maintenance are included in the Traffic Management Plans, located as appendices to the Construction Management Plan. The Renewal Corporation proposes additional monitoring of areas of potential slope instability, as discussed in Section 4.0.

3.4 Borrow and Disposal Areas

Borrow and disposal areas are required for construction of the Proposed Action. Borrow and disposal sites are designed with stable permanent slopes and suitable drainage requirements using best management practices (BMPs). The Renewal Corporation will place material in the disposal site in layers, track-walk the material, and grade it with a bulldozer to promote surface drainage. The Renewal Corporation will visually monitor slopes during construction and excavation and modify them as needed based on visual observations, as described in the Erosion and Sediment Control Plan and the Oregon Waste Disposal and Hazardous Materials Management Plan.

4.0 Slope Stability Monitoring

This section discusses monitoring and inspection procedures that the Renewal Corporation will implement to address slope stability concerns. Additional details related to drawdown procedures are included in the Oregon Reservoir Drawdown and Diversion Plan.

4.1 Pre-Drawdown Phase

In 2017, the Renewal Corporation and PacifiCorp entered into an Operations and Maintenance Agreement. Upon the Renewal Corporation's acceptance of License Transfer, PacifiCorp will continue to operate the Lower Klamath Project under the terms of the Operations and Maintenance Agreement. During the pre-drawdown phase of the Proposed Action, PacifiCorp will continue to monitor the dam and embankment consistent with the requirements of the Supporting Technical Information Document for J.C. Boyle Dam (STID; PacifiCorp 2015). Daily and weekly inspections are performed by PacifiCorp Operations personnel as part of their normal duties and per license requirements, and annual inspections are performed by PacifiCorp Dam Safety Engineering staff with the assistance of PacifiCorp Operations personnel.

4.2 Active Drawdown and Dam Removal Phase

Drawdown of the J.C. Boyle reservoir is proposed to take place from January 1 through June 15, depending on the water year type. The specific schedule for the drawdown and removal of the dam is further described in the Oregon Reservoir Drawdown and Diversion Plan.

The Renewal Corporation will monitor slope stability of the dam embankment and reservoir rim during the active drawdown and dam removal phase, and following storm events, for changes in ground conditions, changes in displacement of the ground surface, and changes in the reservoir level. The Renewal Corporation will conduct daily, weekly, and monthly monitoring during active drawdown and dam removal as described below.

4.2.1 Remote Sensing Technology

The Renewal Corporation will visually monitor daily displacements of the ground surface, including reservoir rims and embankments, during the drawdown period using unmanned aerial vehicle flights. This method will provide the greatest spatial coverage for daily evaluation of the response to reservoir drawdown. LiDAR data acquisition will be both airborne and ground-based at J.C. Boyle Reservoir. The Renewal Corporation will assess conditions after data acquisition and report to the Engineer of Record (EOR) any variations indicating potential displacement.

4.2.2 Visual Inspections

The Renewal Corporation will visually inspect dam embankments (upstream and downstream face and crest) daily for signs of slope instability.

4.2.3 Surveillance Monuments

The Renewal Corporation will use existing survey monuments at the dam embankments when accessible during the active drawdown phase until dam removal is complete. Additionally, the Renewal Corporation will establish overall site control through the installation of temporary control points in locations that will not be affected by dam removal activities. The Renewal Corporation will establish temporary monuments on the rock abutments on either side of the dam, as needed.

4.2.4 Other Monitoring

The Renewal Corporation will monitor the reservoir by level sensors and stream gauges during drawdown. Once the reservoir drops below its normal operating range, water level gauges will no longer be operational. The USGS stream gauge monitoring requirements (11509500 below Keno Reservoir and 11510700 below J.C. Boyle powerhouse) are included in the Oregon Water Quality Management Plan.

The Renewal Corporation will perform daily checks of the dam, monitor water levels, and coordinate with the Bureau of Reclamation with respect to potential storm events. Downstream flows will be estimated to provide adequate response time to implement emergency procedures as detailed in the Emergency Response Plan for the Proposed Action (Kiewit 2020).

4.3 Post-Drawdown Phase

In the post-drawdown phase, the dam embankment will have been removed so dam embankment monitoring will cease. Reservoir rim instability is limited to the drawdown phase, so daily monitoring of the reservoir rims will cease after drawdown is complete. Post-drawdown monitoring of residual reservoir sediment stability during restoration is addressed in section 6.2.8 of the Reservoir Area Management Plan.

5.0 Slope Stability Measures

5.1.1 Erosion Protection

The Renewal Corporation will conduct the construction and removal work required for the Proposed Action in a manner that provides environmental protection and follows BMPs for erosion and sediment control, as outlined in the Erosion and Sediment Control Plan. In general, the Renewal Corporation will restore areas disturbed by construction of the Proposed Action components to final lines and grades as soon as practical. The Renewal Corporation will install erosion protection at various locations throughout the limits of work (e.g., river channels, scour hole, and volitional fish passage channels).

5.1.2 Proposed Measures to Address Instability

If instability issues are confirmed in the areas listed in section 3.0, the Renewal Corporation will implement the following measures:

- slope monitoring,
- structural slope stability measures, and/or
- local rerouting of roads.

5.1.3 Local Impact Mitigation Fund

To address potential impacts of slope instabilities related to reservoir drawdown, the Renewal Corporation will implement the measures stated in this plan, as required in the License Surrender Order. In order to address potential damage claims involving private properties, the Renewal Corporation will establish a Local Impact Mitigation Fund (LIMF), to be administered outside of the License Surrender Order. For property owners electing to opt into the fund, the LIMF will provide financial resources to such property owners to mitigate displacement costs and impacts to residential properties that are determined to be caused by the Proposed Action. The fund will be backstopped by insurance.

The LIMF will establish procedures and standards for determining the nature and scope of any impacts, as well as stipulated payments to affected property owners. Developing the standards and procedures will involve proactive participation and input from key stakeholders. The draft methodology for the LIMF program will be made available for public comment through townhalls and other meetings.

Under the LIMF, the Renewal Corporation will not accept responsibility for pre-existing conditions not caused by the Proposed Action. The fund administrator will be supported by a technical team but will ultimately have the discretion to determine the legitimacy of covered claims. Any affected property owners who elect not to participate in the LIMF may, instead, pursue any other remedies available to such property owners under applicable state law.

6.0 Emergency Response

PFMs identified in the STID (PacifiCorp 2015) have been used to guide previous stability evaluations and are briefly discussed in the Oregon Reservoir Drawdown and Diversion Plan. The dams covered under STIDs will continue their current operations until water levels drop below normal operating elevations during drawdown. PFMs were reevaluated as part of a Construction Potential Failure Mode Analysis (cPFMA) workshop that specifically addressed reservoir drawdown and dam removal (Kleinschmidt 2021). Details concerning the cPFMA workshop are provided in the Oregon Reservoir Drawdown and Diversion Plan.

6.1 Threshold and Action Levels

Threshold and action levels are important to assist in determining if readings taken during monitoring are approaching levels that could cause concern regarding the stability of reservoir rim or embankment areas. The threshold level is the first level requiring evaluation. When specific action levels have not been determined for an instrument reading or monitored condition, threshold levels and a range of expected (acceptable) values can be developed based on historical data.

Critical threshold and action levels for different situations or types of inspections and associated guidance for determining the proper emergency action level are covered by the existing PacifiCorp Emergency Action Plan (EAP) as well as the Emergency Response Plan for the Proposed Action (Kiewit 2020). The PacifiCorp EAP will not be applicable once normal operations have ceased; the Renewal Corporation will develop emergency procedures for the drawdown and dam removal phases of the Proposed Action. Potential remedial actions for emergency situations related to slope stability are listed in Attachment A and categorized by the emergency action level.

7.0 Equipment Maintenance Program

This section describes equipment maintenance measures, types of maintenance requirements, and the schedule for and/or frequency of maintenance activities. The Renewal Corporation will monitor equipment to ensure that the desired condition is maintained.

7.1 Survey Monuments

Survey monuments are protected by weatherproof covers and, therefore, require little maintenance. During dam removal activities, the Renewal Corporation will protect survey monuments from movement or damage from vehicles or other equipment traversing the crests. The “permanent” survey monuments will be removed along with the dam embankment, and temporary monuments installed for monitoring dam removal will be also removed once the embankment excavation reaches the monuments.

7.2 Remote Sensing Technology

The Renewal Corporation will establish specific maintenance procedures for remote sensing equipment based on the specific technology.

7.3 Other Instrumentation

Continuous measurements of reservoir levels are made using level sensors. The reservoirs also have a fixed gauge, allowing a comparison of the water levels measured by the level sensors with the levels indicated on the gauges. In the pre-drawdown phase and early in the drawdown phase, these comparisons will be made daily by PacifiCorp operators. Any significant difference in water level readings between these two measurements will initiate work to repair or recalibrate the instruments. Once powerhouse operations cease, the PacifiCorp level sensors will no longer function, and the Renewal Corporation will install and maintain new level sensors to monitor water levels during drawdown and dam removal.

8.0 Reporting

The Renewal Corporation will provide an Annual Compliance Report describing the results of slope stability monitoring of the dam embankments and reservoir rims to ODEQ and the Commission by April 1 and 15, respectively, for the preceding year. The Annual Compliance

Report will also include a summary of any measures taken to address slope instabilities, including, but not limited to, physical stabilization measures. During the drawdown phase, the Renewal Corporation will submit monthly progress reports to ODEQ and the Commission including details regarding any identified slope instabilities and actions taken to address such instabilities.

9.0 Management Plan Updates

If additional risk areas are encountered, the Renewal Corporation will revise the monitoring procedures. The Renewal Corporation will document the risk areas and associated amendments to the Management Plan and will submit all changes to the Commission and to ODEQ.

10.0 References

California State Water Resources Control Board (SWRCB). 2020. Final Environmental Impact Report for the Lower Klamath Project License Surrender. Prepared by Stillwater Sciences, Berkeley, California, for the State Water Resources, Control Board, Sacramento, California.

Kiewit Infrastructure West Co. (Kiewit). 2020. Emergency Response Plan. Prepared for Klamath River Renewal Corporation.

Kleinschmidt. 2021. Construction Potential Failure Mode Analysis Report: Klamath River Renewal Project, FERC No. 14803. Prepared for Klamath River Renewal Project. June.

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Knight Piésold. 2020b. Design Report. Prepared for Klamath River Renewal Project. November 2020.

Oregon State Department of Environmental Quality (ODEQ). 2018. Final Clean Water Act Section 401 Certification for the Klamath River Renewal Corporation License Surrender and Removal of the Lower Klamath Project (FERC No. 14803) Klamath County, Oregon. September 7.

PacifiCorp. 2015. J.C. Boyle Development, Klamath River Project, Supporting Technical Information Document (STID). April.

PanGEO. 2008. Geotechnical Report: Klamath River Dam Removal Project, California and Oregon. Project No. 07-153. Prepared for Philip Williams & Associates, Ltd., and California State Coastal Conservancy. August.

Renewal Corporation. 2019. Geotechnical Data Report. Prepared by Renewal Corporation Technical Representatives: AECOM Technical Services, Inc., and CDM Smith. June.

Attachment A

Additional Emergency Action Plan Information

Table A-1. Emergency Level 1 – Potential Remedial Actions

CONDITION	ACTION
Erosion	Locate and quantify the extent of erosion at the reservoir rim or embankment.
	Fill and, if possible, compact the eroded area(s) with course soil material, filter sand, and/or gravel/rock fill as appropriate for conditions.
	Place and crimp straw mulch and tackifier.
	Monitor the erosion area(s) weekly following the precipitation event.
	Observe the dam/embankment from the abutment and/or crest. At a minimum, inspect the entire crest, downstream slope, and downstream toe area. Observe carefully for any signs of additional erosion, seepage, or cracking.
	Record all information, observations, and actions.
Sinkhole	Locate and characterize the lateral limits and depth of the sinkhole(s).
	Fill the sinkhole with reverse filter composed of drain gravel, filter sand, and compacted coarse soil material.
	Monitor the sinkhole daily for the following week and following the next precipitation event.
	Observe the dam/embankment from the abutment and/or crest. At a minimum, inspect the entire crest, downstream slope, and downstream toe area. Observe carefully for any signs of additional erosion, seepage, or cracking.
	Measure and record applicable water level elevation and monitor daily for seepage.
	Record all information, observations, and actions.
Sand Boils	Locate and quantify the sand boil(s).
	Fill and, if possible, compact the eroded area(s) with coarse soil material, filter sand, and/or drain gravel, creating an outwardly filter compatible backfill.
	Control the movement of material from the boil by initially constructing a ring dike. The goal of the ring dike is stopping the flow of water rather than stopping movement of the material.
	When the ring reaches an elevation where the water discharging from the ring is flowing clear, the work should stop and flows monitored for changes.
	Cover sand boil area(s) with non-woven geotextile fabric and a reverse filter composed of 2 to 3 feet of filter sand and drain gravel. A drain pipe or filter may be added.
	Monitor the sand boil daily for the following week.
	Observe the dam/embankment from the abutment and/or crest. At a minimum, inspect the entire crest, downstream slope, and downstream toe area. Observe carefully for any signs of additional erosion, seepage, or cracking.
	Measure and record applicable water level elevation and monitor daily for seepage.
	Record all information, observations, and actions.
Seepage	Install a flow-measuring device.
	Measure the flow periodically. Note changes in quality or clarity.
	Locate and quantify the new seepage area(s) that have cloudy seepage.

CONDITION	ACTION
	Monitor the new seepage area(s) daily for at least one week. More frequent monitoring and reporting may be required.
	Observe the dam/embankment from the abutment and/or crest. At a minimum, inspect the entire crest, downstream slope, and downstream toe area. Observe carefully for any signs of additional erosion, seepage, or cracking.
	Measure and record applicable water level elevations and monitor daily for seepage.
	Record all information, observations, and actions.
Piping	Fill and, if possible, compact the eroded area(s) with coarse soil material, filter sand, and/or drain gravel, creating an outwardly filter compatible backfill.
	Control the movement of material by constructing a ring dike. The goal of the ring is stopping the flow of water rather than stopping movement of material.
	When the ring reaches an elevation where the water discharging from the ring is flowing clear, the work should stop and flows monitored for changes.
	Cover area(s) with non-woven geotextile fabric and reverse filter composed of 2 to 3 feet of filter sand and drain gravel. A drain pipe or filter may be added.
	Monitor daily for the following week. Measure the rate of leakage and clarity of the water (e.g., muddy appearance).
	Record all information, observations, and actions.
Flooding	Monitor flood conditions in the reservoir.
	Observe the dam/embankment from the abutment and/or crest. At a minimum, inspect the entire crest, downstream slope, and downstream toe and measure elevations of water and seepage daily.
	Record all information, observations, and actions.
Embankment Movement	Mark the movement area(s). Consider contracting a surveyor to survey the movement area(s).
	Visually monitor the movement area(s).
	Develop, evaluate, and implement measures to resolve the observed condition(s).
	Observe the dam/embankment from the abutment and/or crest. At a minimum, inspect the entire crest, downstream slope, and downstream toe area. Observe carefully for any signs of additional erosion, seepage, or cracking.
	Measure and record applicable water level elevation and monitor daily for seepage.
	Record all information, observations, and actions.
Earthquake	Monitor conditions at the reservoir rim and embankment daily for at least one week.
	Observe the dam/embankment from the abutment and/or crest. At a minimum, inspect the entire crest, downstream slope, and downstream toe area. Observe carefully for any signs of additional erosion, seepage, or cracking.
	Measure and record applicable water level elevation and monitor daily for seepage.
	Record all information, observations, and actions.

CONDITION	ACTION
Instruments	Re-measure the reading and verify the reading was made correctly. Once human error is ruled out, verify the instrument is operating properly.
	After human error and instrument error is ruled out, contact engineering support for additional technical assistance if needed.
	Record all information, observations, and actions.
Bulge	Install a flow-measuring device.
	Measure the flow periodically. Observe and note changes in quality or clarity.
	Locate and quantify the new seepage area(s) that have cloudy seepage.
	Monitor the new seepage area(s) daily for at least one week. More frequent monitoring and reporting may be required.
	Observe the dam/embankment from the abutment and/or crest. At a minimum, inspect the entire crest, downstream slope, and downstream toe area. Observe carefully for any signs of additional erosion, seepage, or cracking.
	Measure and record applicable water level elevation and monitor daily for seepage.
	Record all information, observations, and actions.
Sabotage	Develop, evaluate, and implement measures to resolve the situation.
	Monitor the situation at the reservoir rim or embankment daily for the following week, or until the situation has ended.
	Record all information, observations, and actions.

Table A-2. Emergency Level 2 – Potential Remedial Actions

CONDITION	ACTION
All Conditions	Mobilize personnel and equipment necessary to address ongoing conditions.
Erosion	Locate and quantify the extent of erosion at the reservoir rim or embankment.
	Fill and, if possible, compact the eroded area(s) with course soil material, filter sand, and/or gravel/rock fill as appropriate for conditions.
	Place and crimp straw mulch and tackifier.
	Monitor the erosion area(s) weekly following the precipitation event.
	Observe the dam/embankment from the abutment and/or crest. At a minimum, inspect the entire crest, downstream slope, and downstream toe area. Observe carefully for any signs of additional erosion, seepage, or cracking.
	Record all information, observations, and actions.
Sinkhole	Locate and characterize the lateral limits and depth of the sinkhole(s).
	Fill the sinkhole with reverse filter composed of drain gravel, filter sand, and compacted coarse soil material.
	Monitor the sinkhole daily for the following week and following the next precipitation event.
	Observe the dam/embankment from the abutment and/or crest. At a minimum, inspect the entire crest, downstream slope, and downstream toe area. Observe carefully for any signs of additional erosion, seepage, or cracking.
	Measure and record applicable water level elevation and monitor daily for seepage.
	Record all information, observations, and actions.
Sand Boils	Locate and quantify the sand boil(s).
	Fill and, if possible, compact the eroded area(s) with coarse soil material, filter sand, and/or drain gravel, creating an outwardly filter compatible backfill.
	Control the movement of material from the boil by initially constructing a ring dike. The goal of the ring dike is stopping the flow of water rather than stopping movement of the material.
	When the ring reaches an elevation where the water discharging from the ring is flowing clear, the work should stop and flows monitored for changes.
	Cover sand boil area(s) with non-woven geotextile fabric and a reverse filter composed of 2 to 3 feet of filter sand and drain gravel. A drain pipe or filter may be added.
	Monitor the sand boil daily for the following week.
	Observe the dam/embankment from the abutment and/or crest. At a minimum, inspect the entire crest, downstream slope, and downstream toe area. Observe carefully for any signs of additional erosion, seepage, or cracking.
	Measure and record applicable water level elevation and monitor daily for seepage.
	Record all information, observations, and actions.
Seepage	Install a flow-measuring device.
	Measure the flow periodically. Note changes in quality or clarity.

CONDITION	ACTION
	Fill and, if possible, compact the eroded area(s) with coarse soil material, filter sand, and/or drain gravel, creating an outwardly filter compatible backfill
	Control the movement of material by constructing a ring dike. The goal of the ring dike is stopping the flow of water rather than stopping movement of material.
	When the ring reaches an elevation where the water discharging from the ring is flowing clear, the work should stop and the flows monitored for changes.
	Cover area(s) with non-woven geotextile fabric and a reverse filter composed of 2 to 3 ft of filter sand and drain gravel. A drain pipe or filter may be added.
	Locate and quantify the new seepage area(s) that have cloudy seepage.
	Monitor the new seepage area(s) daily for at least one week. More frequent monitoring and reporting may be required.
	Observe the dam/embankment from the abutment and/or crest. At a minimum, inspect the entire crest, downstream slope, and downstream toe area. Observe carefully for any signs of additional erosion, seepage, or cracking.
	Measure and record applicable water level elevations and monitor daily for seepage.
	Record all information, observations, and actions.
Piping	Fill and, if possible, compact the eroded area(s) with coarse soil material, filter sand, and/or drain gravel, creating an outwardly filter compatible backfill.
	Control the movement of material by constructing a ring dike. The goal of the ring is stopping the flow of water rather than stopping movement of material.
	When the ring reaches an elevation where the water discharging from the ring is flowing clear, the work should stop and flows monitored for changes.
	Cover area(s) with non-woven geotextile fabric and reverse filter composed of 2 to 3 feet of filter sand and drain gravel. A drain pipe or filter may be added.
	Monitor daily for the following week. Measure the rate of leakage and clarity of the water (e.g. muddy appearance).
	Record all information, observations, and actions.
Flooding	If possible, lower the water level in the reservoir by activating pumps or diverting through spillways.
	Monitor flood conditions in the reservoir.
	Observe the dam/embankment from the abutment and/or crest. At a minimum, inspect the entire crest, downstream slope, and downstream toe and measure elevations of water and seepage daily.
	Observe carefully for any signs of additional erosion, seepage, or cracking.
	Record all information, observations, and actions.
Embankment Movement	Mark the movement area(s). Consider contracting a surveyor to survey the movement area(s).
	Visually monitor the movement area(s).

CONDITION	ACTION
	Fill and, if possible, compact the area(s) with coarse soil material, filter sand, and/or drain gravel, creating an outwardly filter compatible backfill.
	Observe the dam/embankment from the abutment and/or crest. At a minimum, inspect the entire crest, downstream slope, and downstream toe area. Observe carefully for any signs of additional erosion, seepage, or cracking.
	Measure and record applicable water level elevation and monitor daily for seepage.
	Record all information, observations, and actions.
Earthquake	Immediately conduct a general overall visual inspection of the reservoir rim and embankment.
	Perform field survey to determine if there has been any settlement and movement of the rim, dam crest, embankment, downstream slope, and downstream toe area. Observe for any signs of additional erosion, seepage, or cracking.
	Activate pump(s) to dewater the reservoir.
	Measure and record applicable water level elevation and monitor daily for seepage.
	Record all information, observations, and actions.
Instruments	Re-measure the reading and verify the reading was made correctly. Once human error is ruled out, verify the instrument is operating properly.
	After human error and instrument error is ruled out, contact engineering support for additional technical assistance if needed.
	Record all information, observations, and actions.
Bulge	Install a flow-measuring device.
	Measure the flow periodically. Observe and note changes in quality or clarity.
	Place a stability berm to buttress the bulge.
	Monitor the new seepage area(s) daily for at least one week. More frequent monitoring and reporting may be required.
	Observe the dam/embankment from the abutment and/or crest. At a minimum, inspect the entire crest, downstream slope, and downstream toe area. Observe carefully for any signs of additional erosion, seepage, or cracking.
	Measure and record applicable water level elevation and monitor daily for seepage.
	Record all information, observations, and actions.
Whirlpool	Control the movement of material by constructing a ring dike. The goal of the ring dike is stopping the flow of water rather than slowing the movement of material.
	Observe the dam from the abutment and/or crest. At a minimum, inspect the entire crest, downstream slope, and downstream toe area. Observe carefully for any signs of additional erosion, seepage, or cracking.
	Record all information, observations, and actions.
Slides	Contact the EOR for assistance in evaluating the surface feature (e.g. tension crack). If the feature does not extend across the dam, and the reservoir elevation is more than 10 ft below the base of the feature, fill with soil and/or rock and compact to help stabilize the slope/toe.

CONDITION	ACTION
	If the surface feature extends across the dam and the reservoir level is less than 10 ft, install a filter overlain by a berm.
	Stabilize damaged areas on the downstream slope by weighting the toe area below the slide with additional soil, rock, or gravel.
	Record all information, observations, and actions.
Embankment Overtopping	If possible, lower the water level in the reservoir by activating pumps or diverting through spillways.
	Increase freeboard by placing sandbags or other erosion-resistant material on the dam crest.
	Cover the dam crest and downstream slope with riprap, sandbags, plastic sheeting, or other materials to provide erosion-resistant protection.
	Monitor the depth, duration, and location of the overtopping. Watch for erosion, backcutting, and slides.
	Record all information, observations, and actions.
Embankment Cracking	Fill and, if possible, compact the eroded area(s) with coarse soil material, filter sand, and/or drain gravel, creating an outwardly filter compatible backfill.
	Observe the dam/embankment from the abutment and/or crest. At a minimum, inspect the entire crest, downstream slope, and downstream toe area. Observe carefully for any signs of additional erosion, seepage, or cracking.
	Measure elevations of applicable water levels and seepage daily.
	Continuously monitor the cracking. Mark the extent of the cracking with stakes, to monitor any increase or change in pattern.
	Record all information, observations, and actions.
Sabotage	Develop, evaluate, and implement measures to resolve the situation.
	Monitor the situation at the reservoir rim or embankment daily for the following week, or until the situation has ended.
	Record all information, observations, and actions.

Table A-3. Emergency Level 3 – Potential Remedial Actions

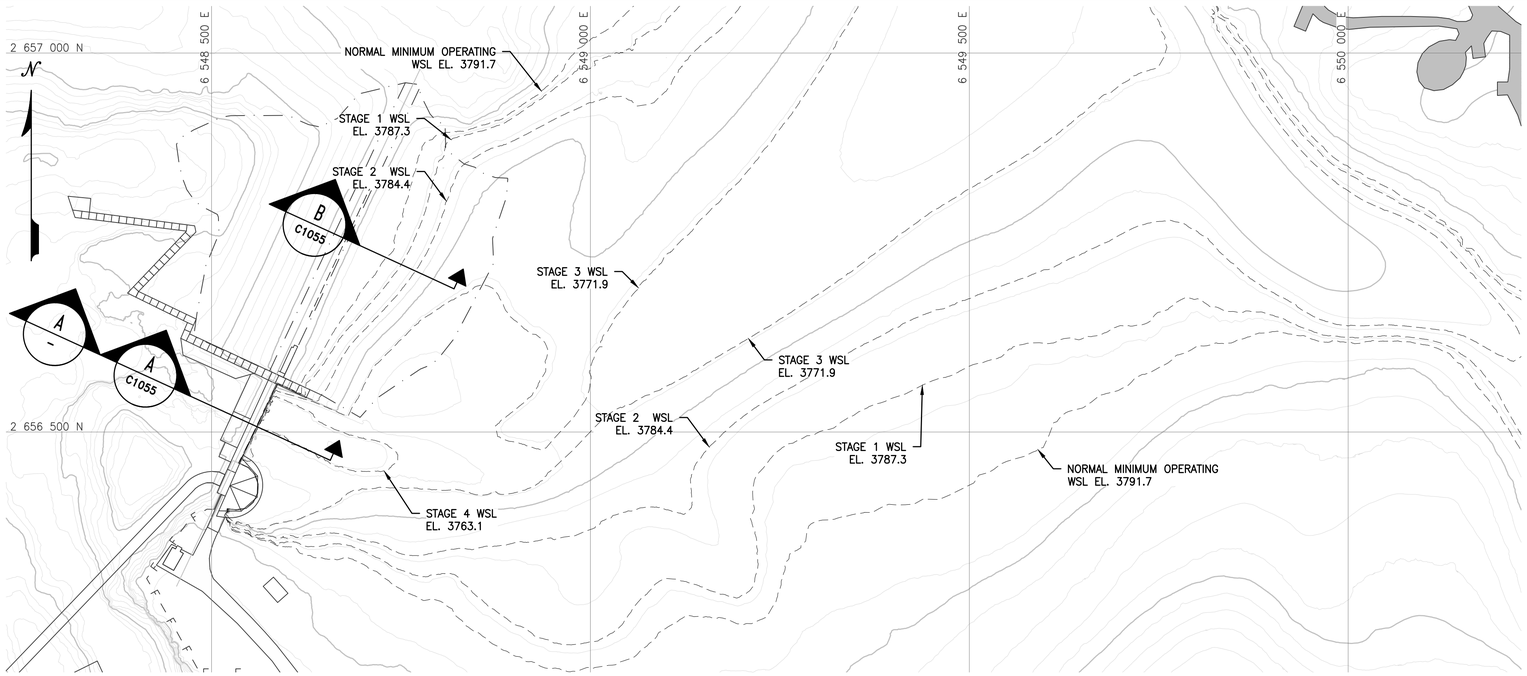
CONDITION	ACTION
All Conditions	Mobilize personnel and equipment necessary to stabilize or at least minimize impacts downstream.
Erosion	Observe and continually monitor conditions at the reservoir rim or embankment, where safe. The situation should be well documented with photographs and videotape if possible.
	Record all information, observations, and actions.
Sinkhole	Contact the Renewal Corporation Owners Representative and the Local Emergency Responders.
	Observe and continually monitor conditions at the dam/embankment, where safe. The situation should be well documented with photographs and videotape if possible.
	Record all information, observations, and actions.
Sand Boils	Contact the Renewal Corporation Owners Representative and the Local Emergency Responders.
	Take actions noted under piping (below).
	Observe and continually monitor conditions at the dam, where safe. The situation should be well documented with photographs and videotape if possible.
	Record all information, observations, and actions.
Piping	If the entrance to the leak can be found in the reservoir, then on the embankment or abutments (sinkhole), try to plug the leak with whatever materials are available, such as plastic sheeting, straw bales, gravel and cobbles, etc.
	Document and photograph the location for future comparison.
	Record all information, observations, and actions.
Seepage	If the entrance to the leak can be found in the reservoir, then on the embankment or abutments (sinkhole), try to plug the leak with whatever materials are available, such as plastic sheeting, straw bales, gravel and cobbles, etc.
	Document and photograph the location for future comparison.
	Record all information, observations, and actions.
Flooding	If possible, lower the water level in the reservoir by activating pumps or diverting through spillways.
	Monitor flood conditions in the reservoir.
	Observe and continuously monitor the conditions at the dam/embankment from high ground. The situation should be documented with photographs and videotape if possible.
	Record all information, observations, and actions.
Embankment Movement	Observe the dam/embankment from the abutment and/or crest. At a minimum, inspect the entire crest, downstream slope, and downstream toe area. Observe carefully for any signs of additional erosion, seepage, or cracking.
	Observe and continuously monitor conditions at the dam/embankment from high ground. The situation should be documented with photographs and videotape if possible. Times of key events should be noted.

CONDITION	ACTION
	Record all information, observations, and actions.
Earthquake	Observe the dam/embankment from the abutment and/or crest. At a minimum, inspect the entire crest, downstream slope, and downstream toe area. Observe carefully for any signs of additional erosion, seepage, or cracking.
	Observe and continuously monitor conditions at the dam/embankment from high ground. The situation should be documented with photographs and videotape if possible. Times of key events should be noted.
	Record all information, observations, and actions.
Bulge	Contact personnel to immediately evacuate downstream of the dam.
	If possible, lower the water level in the reservoir by activating pumps or diverting through spillways.
	Install a flow-measuring device.
	Observe condition constantly for any further changes in flow rates or clarity, unless notified otherwise by the EOR.
	Observe and continuously monitor conditions at the dam from high ground. The situation should be documented with photographs and videotape if possible. Times of key events should also be noted.
	Record all information, observations, and actions.
Whirlpool	Contact the Renewal Corporation Owners Representative and the Local Emergency Responders.
	Take actions noted under piping (above).
	If possible, lower the water level in the reservoir by activating pumps or diverting through spillways.
	Observe and continually monitor conditions at the dam, where safe. The situation should be well documented with photographs and videotape if possible.
	Record all information, observations, and actions.
Slides	Observe the dam/embankment from the abutment and/or crest. At a minimum, inspect the crest, downstream slope, and downstream toe area. Observe carefully for any signs of additional erosion, seepage, or cracking.
	If the slide is on the downstream slope, stabilize the toe of the slide by constructing a berm with additional soil and rock. If there is significant leakage (indicated by muddy ground), install a filter overlain by a berm (see Piping above).
	Monitor settlement, rate of settlement, and extent of slide.
	Observe and continually monitor conditions at the dam from high ground. The situation should be documented with photographs and videotape if possible. Times of key events should also be noted.
	Record all information, observations, and actions.
	Contact personnel to immediately evacuate downstream of the dam.

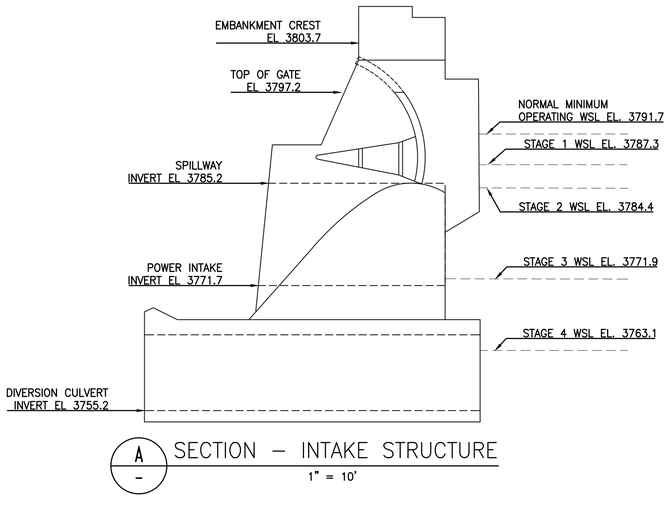
CONDITION	ACTION
Embankment Overtopping	If possible, lower the water level in the reservoir by activating pumps or diverting through spillways.
	Observe and continuously monitor conditions from high ground.
	Increase freeboard by placing sandbags or other erosion resistant materials on the dam crest. Use riprap or other materials to provide erosion protection for the crest and downstream slope.
	Monitor the depth, duration, and location of the overtopping. Watch for erosion, backcutting, and slides.
	Record all information, observations, and actions.
Sabotage	Contact personnel to immediately evacuate downstream of the dam.
	If possible, lower the water level in the reservoir by activating pumps or diverting through spillways.
	Record all information, observations, and actions.

Appendix B

Design Report Drawings



PLAN
1" = 100'



A
–
SECTION – INTAKE STRUCTURE
1" = 10'

PRE–DRAWDOWN PRODEDURE:

1. OPERATE THE FACILITY BETWEEN RESERVOIR WATER SURFACE LEVELS AS PER FERC APPROVAL.
   1.1. NORMAL MAXIMUM RESERVOIR OPERATING SURFACE LEVEL: 3796.7 ft.
   1.2. NORMAL MINIMUM RESERVOIR OPERATING SURFACE LEVEL: 3791.7 ft.

2. LOWER RESERVOIR TO NORMAL MINIMUM OPERATING LEVEL PRIOR TO JANUARY 1 OF THE DRAWDOWN YEAR BY CONTROLLED SPILLWAY RELEASES OR BY UTILIZING THE POWER INTAKE, AND MAINTAIN AT THIS LEVEL UNTIL DRAWDOWN IS INITIATED.

DRAWDOWN PRODEDURE:

1. STAGE 1 – DRAWDOWN USING SPILLWAY GATES:
   1.1. DRAWDOWN IS INITIATED ON JANUARY 1.
   1.2. THE SPILLWAY GATES ARE TO BE UTILIZED TO DRAWDOWN THE RESERVOIR WATER LEVEL AT A TARGET RATE OF 5 ft/DAY.

2. STAGE 2 – DRAWDOWN USING POWER INTAKE TO LOWER THE RESERVOIR LEVEL TO BELOW THE SPILLWAY CREST.
   2.1. STAGE 2 IS INITIATED ON JANUARY 2. THE POWER INTAKE OPENS TO DRAW THE RESERVOIR LEVEL TO 2 ft BELOW THE SPILLWAY CREST.
   2.2. SET CHARGES ON DIVERSION CULVERT #1 STOPLOG FROM DOWNSTREAM SIDE OF DIVERSION CULVERT #1 ONCE THE RESERVOIR WATER LEVEL IS 2 ft BELOW THE SPILLWAY CREST. RIVER FORECASTING AND COORDINATION WITH THE UPSTREAM PROJECT IS REQUIRED TO VERIFY THAT THE RESERVOIR WATER LEVEL WILL REMAIN BELOW THE SPILLWAY CREST WHILE CREWS ARE ACTIVELY WORKING ON THE DOWNSTREAM SIDE OF THE DIVERSION CULVERTS. THE RESERVOIR WATER LEVEL 2 ft BELOW THE SPILLWAY CREST IS ASSOCIATED WITH A STEADY–STATE INFLOW OF 1260 cfs.

3. STAGE 3 – REMOVE DIVERSION CULVERT #1 STOPLOG:
   3.1. STAGE 3 CAN BEGIN ONCE STAGE 2 CHARGES HAVE BEEN SET AND STAGE 2 IS COMPLETE.
   3.2. BLAST DIVERSION CULVERT #1 STOPLOG TO INITIATE FLOW THROUGH DIVERSION CULVERT #1.
   3.3. THE POWER INTAKE IS CLOSED ONCE DIVERSION CULVERT #1 IS OPENED. ONCE THE POWER INTAKE IS CLOSED, IT IS TO REMAIN CLOSED TO ISOLATE THE DOWNSTREAM FACILITY COMPONENTS.
   3.4. SET CHARGES ON DIVERSION CULVERT #2 STOPLOG FROM DOWNSTREAM SIDE OF DIVERSION CULVERT #2 ONCE THE RESERVOIR WATER LEVEL IS 2 ft BELOW THE SPILLWAY CREST AND BEFORE JUNE 10 OF THE DRAWDOWN YEAR. RIVER FORECASTING AND COORDINATION WITH THE UPSTREAM PROJECT IS REQUIRED TO VERIFY THAT THE RESERVOIR WATER LEVEL WILL REMAIN BELOW THE SPILLWAY CREST WHILE CREWS ARE ACTIVELY WORKING ON THE DOWNSTREAM SIDE OF THE DIVERSION CULVERT. THE RESERVOIR WATER LEVEL 2 ft BELOW THE SPILLWAY CREST IS ASSOCIATED WITH A STEADY–STATE INFLOW OF 2120 cfs.

4. STAGE 4 – REMOVE DIVERSION CULVERT #2 STOPLOG:
   4.1. STAGE 4 CAN BEGIN ONCE STAGE 3 CHAGES HAVE BEEN SET ONCE STAGE 3 IS COMPLETE. STAGE 4 INITIATION CAN BE DELAYED UNTIL JUNE 10 AT THE LATEST.
   4.2. BLAST DIVERSION CULVERT #2 STOPLOG TO INITIATE FLOW THROUGH DIVERSION CULVERT #2.

POST–DRAWDOWN/RIVER DIVERSION PRODEDURE:

1. RIVER DIVERSION IS ACHIEVED ONCE THE INFLOWS INTO THE RESERVOIR ARE EQUAL TO THE DISCHARGE CAPACITY WITH NO RESERVOIR IMPOUNDMENT.

2. DIVERSION OF ALL INFLOWS THROUGH THE DIVERSION CULVERTS REQUIRE RE–ESTABLISHMENT OF THE HISTORIC COFFERDAM.

FOR INFORMATION ONLY

LEGEND:

– – – – – – – WATER SURFACE LEVEL

NOTES:

1. REFER TO GENERAL NOTES ON DRAWING G0006 FOR INFORMATION REGARDING TOPOGRAPHIC AND BATHYMETRIC DATA SOURCES.
2. THE STAGED ELEVATIONS REPRESENT FINAL ELEVATIONS AFTER COMPLETION OF EACH STAGE ASSUMING AVERAGE INFLOWS AND THE CORRESPONDING WATER SURFACE ELEVATIONS HIGHLIGHTED ON DRAWING C1055.
3. RESERVOIR DRAWDOWN MONITORING SHALL BE ESTABLISHED BY THE CONTRACTOR TO MEASURE WATER SURFACE LEVELS AS REQUIRED BY THE JCB STID AND TECHNICAL SPECIFICATIONS.

0 100 200 300
1" = 100'

0 10 20 30
1" = 10'

REV	DESCRIPTION	BY	CHK	APP	DATE
E	ISSUED WITH DRAFT 100% DESIGN REPORT	CBN	NB	SRM	11/13/20
D	ISSUED WITH DRAFT 100% DESIGN REPORT	CBN	NB	SRM	10/07/20
C	ISSUED WITH 90% DESIGN REPORT	CBN	NB	SRM	08/05/20
B	ISSUED WITH 60% DESIGN REPORT	CBN	NB	SRM	02/07/20
A	ISSUED WITH DRAFT 60% DESIGN REPORT	CBN	NB	SRM	12/17/19

WARNING
0 1/2 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

PREPARED BY: Knight Piésold CONSULTING; Kiewit

DESIGNED	C. NIAMIR
DRAWN	A. NASIRI
REVIEWED	H. ELWIN
IN CHARGE	N. BISHOP
APPROVED	S. MOTTRAM

PREPARED FOR: KLAMATH RIVER RENEWAL CORPORATION

PROJECT: KLAMATH RIVER RENEWAL PROJECT
PROJ # VA103-640/1
DATE 11/13/2020
SHEET TITLE: J.C. BOYLE FACILITY DRAWDOWN STAGES AVERAGE INFLOW - PLAN AND SECTION
DWG C1050

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Flow Condition		Discharge (cfs)																
		Jan	Feb	Mar	Apr	May	Jun 1 - 15	Jun 16 - 30	Jul 1 -15	Jul 16 - 30	Aug	Sep 1 - 15	Sep 16 - 30	Oct 1 -15	Oct 16 - 31	Nov 1 - 15	Nov 16 - 30	Dec
Statistical High Water (Flood Conditions)	1% Probable Flood	14,000	14,200	14,200	13,600	9,900	7,300	4,400	3,200	1,800	1,800	2,500	3,000	3,800	4,600	5,500	7,200	10,500
	5% Probable Flood	8,000	9,700	10,900	9,400	6,800	4,400	2,800	2,100	1,700	1,700	2,100	2,400	2,900	3,300	3,800	4,400	6,300
	20% Probable Flood	4,400	4,900	8,000	6,800	4,300	2,800	1,800	1,400	1,500	1,500	1,700	1,900	2,200	2,400	2,600	2,900	3,900
	50% Probable Flood	2,600	2,700	6,300	4,500	2,700	1,800	1,400	1,000	1,400	1,400	1,400	1,500	1,700	1,700	1,800	2,000	2,500
Monthly Flow Duration 25% of Time Equaled or Exceeded		1,850	2,540	3,880	3,390	2,330	1,670	1,020	810	830	810	880	880	890	950	1,020	820	1,240
Mean Monthly Flow		1,500	1,900	2,800	2,370	1,760	1,330	960	740	760	760	800	790	810	890	980	950	1,110
Monthly Flow Duration 75% of Time Equaled or Exceeded		600	630	1,220	1,040	980	820	730	660	670	630	730	710	750	760	780	650	590

Flow Condition		Water Surface Levels at Intake Structure - Stage 2 (Spillway and Power Intake Open) (ft)																
		Jan	Feb	Mar	Apr	May	Jun 1 - 15	Jun 16 - 30	Jul 1 -15	Jul 16 - 30	Aug	Sep 1 - 15	Sep 16 - 30	Oct 1 -15	Oct 16 - 31	Nov 1 - 15	Nov 16 - 30	Dec
Statistical High Water (Flood Conditions)	1% Probable Flood	3793.6	3793.7	3793.7	3793.4	3791.4	3789.8	3787.9	3787.0	3785.4	3785.4	3786.3	3786.8	3787.5	3788.1	3788.7	3789.7	3791.7
	5% Probable Flood	3790.2	3791.3	3792.0	3791.1	3789.5	3787.9	3786.6	3785.9	3785.3	3785.3	3785.9	3786.2	3786.7	3787.1	3787.5	3787.9	3789.2
	20% Probable Flood	3787.9	3788.3	3790.2	3789.5	3787.9	3786.6	3785.4	3783.9	3784.4	3784.4	3785.3	3785.6	3786.0	3786.2	3786.4	3786.7	3787.6
	50% Probable Flood	3786.4	3786.5	3789.2	3788.0	3786.5	3785.4	3783.9	3781.8	3783.9	3783.9	3783.9	3784.4	3785.3	3785.3	3785.4	3785.8	3786.3
Monthly Flow Duration 25% of Time Equaled or Exceeded		3785.5	3786.3	3787.5	3787.1	3786.1	3785.2	3782.0	3780.7	3780.9	3780.7	3781.1	3781.1	3781.2	3781.6	3782.0	3780.8	3783.1
Mean Monthly Flow		3784.4	3785.6	3786.6	3786.2	3785.4	3783.6	3781.6	3780.3	3780.4	3780.4	3780.7	3780.6	3780.7	3781.2	3781.7	3781.6	3782.5
Monthly Flow Duration 75% of Time Equaled or Exceeded		3779.3	3779.6	3783.0	3782.1	3781.7	3780.8	3780.2	3779.8	3779.8	3779.6	3780.2	3780.1	3780.3	3780.4	3780.5	3779.7	3779.3

Flow Condition		Water Surface Levels at Intake Structure - Stage 3 (Diversion Culvert #1 Open, Power Intake Closed) (ft)																
		Jan	Feb	Mar	Apr	May	Jun 1 - 15	Jun 16 - 30	Jul 1 -15	Jul 16 - 30	Aug	Sep 1 - 15	Sep 16 - 30	Oct 1 -15	Oct 16 - 31	Nov 1 - 15	Nov 16 - 30	Dec
Statistical High Water (Flood Conditions)	1% Probable Flood	3793.7	3793.8	3793.8	3793.5	3791.6	3790.0	3787.9	3786.8	3776.8	3776.8	3785.8	3786.5	3787.4	3788.1	3788.8	3790.0	3791.9
	5% Probable Flood	3790.5	3791.5	3792.1	3791.3	3789.7	3787.9	3786.3	3782.8	3775.1	3775.1	3782.8	3785.7	3786.4	3786.9	3787.4	3787.9	3789.4
	20% Probable Flood	3787.9	3788.3	3790.5	3789.7	3787.8	3786.3	3776.8	3770.4	3765.8	3770.4	3770.4	3771.9	3775.1	3775.1	3776.8	3780.7	3785.8
	50% Probable Flood	3786.0	3786.1	3789.4	3788.0	3786.1	3776.8	3770.4	3765.8	3770.4	3770.4	3770.4	3771.9	3775.1	3775.1	3776.8	3780.7	3785.8
Monthly Flow Duration 25% of Time Equaled or Exceeded		3777.8	3785.9	3787.5	3787.0	3785.5	3774.6	3765.9	3764.3	3764.4	3764.3	3764.8	3764.8	3764.9	3765.3	3765.9	3764.3	3768.3
Mean Monthly Flow		3771.9	3778.7	3786.3	3785.6	3776.1	3769.5	3765.4	3763.7	3763.9	3763.9	3764.2	3764.1	3764.3	3764.9	3765.6	3765.3	3766.8
Monthly Flow Duration 75% of Time Equaled or Exceeded		3762.6	3762.9	3768.1	3766.1	3765.6	3764.3	3763.7	3763.1	3763.2	3762.9	3763.7	3763.5	3763.8	3763.9	3764.0	3763.0	3762.5

Flow Condition		Water Surface Levels at Intake Structure Diversion - Stage 4 (Culverts #1 and #2 Open, Power Intake Closed) (ft)																
		Jan	Feb	Mar	Apr	May	Jun 1 - 15	Jun 16 - 30	Jul 1 -15	Jul 16 - 30	Aug	Sep 1 - 15	Sep 16 - 30	Oct 1 -15	Oct 16 - 31	Nov 1 - 15	Nov 16 - 30	Dec
Statistical High Water (Flood Conditions)	1% Probable Flood						3788.4	3784.9	3773.4	3765.0	3765.0	3768.4	3771.9	3778.7	3785.6	3786.8	3788.3	3790.5
	5% Probable Flood						3784.9	3770.4	3766.2	3764.6	3764.6	3766.2	3767.8	3771.1	3774.2	3778.7	3784.9	3787.6
	20% Probable Flood						3770.4	3765.0	3763.4	3763.8	3763.8	3764.6	3765.3	3766.7	3767.8	3769.1	3771.1	3779.7
	50% Probable Flood						3765.0	3763.4	3761.8	3763.4	3763.4	3763.4	3763.8	3764.6	3764.6	3765.0	3765.8	3768.4
Monthly Flow Duration 25% of Time Equaled or Exceeded							3764.5	3761.9	3760.9	3761.0	3760.9	3761.2	3761.2	3761.3	3761.6	3761.9	3761.0	3762.8
Mean Monthly Flow							3763.1	3761.6	3760.6	3760.7	3760.7	3760.9	3760.8	3760.9	3761.3	3761.7	3761.6	3762.2
Monthly Flow Duration 75% of Time Equaled or Exceeded							3761.0	3760.5	3760.2	3760.2	3760.0	3760.5	3760.4	3760.6	3760.7	3760.8	3760.1	3759.8

TABLE 1: MONTHLY INFLOWS AND STEADY–STATE WATER LEVELS AT INTAKE STRUCTURE FOR DRAWDOWN AND POST–DRAWDOWN

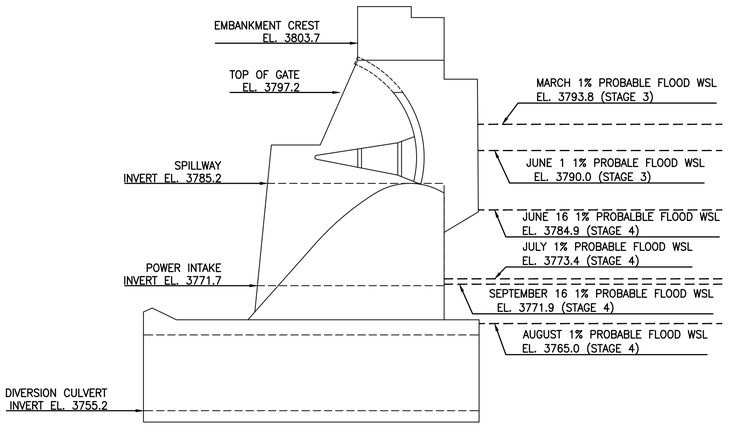
Flow Condition		Discharge (cfs)																
		Jan	Feb	Mar	Apr	May	Jun 1 - 15	Jun 16 - 30	Jul 1 -15	Jul 16 - 30	Aug	Sep 1 - 15	Sep 16 - 30	Oct 1 -15	Oct 16 - 31	Nov 1 - 15	Nov 16 - 30	Dec
Statistical High Water (Flood Conditions)	1% Probable Flood	14,000	14,200	14,200	13,600	9,900	7,300	4,400	3,200	1,800	1,800	2,500	3,000	3,800	4,600	5,500	7,200	10,500
	5% Probable Flood	8,000	9,700	10,900	9,400	6,800	4,400	2,800	2,100	1,700	1,700	2,100	2,400	2,900	3,300	3,800	4,400	6,300
	20% Probable Flood	4,400	4,900	8,000	6,800	4,300	2,800	1,800	1,400	1,500	1,500	1,700	1,900	2,200	2,400	2,600	2,900	3,900
	50% Probable Flood	2,600	2,700	6,300	4,500	2,700	1,800	1,400	1,000	1,400	1,400	1,400	1,500	1,700	1,700	1,800	2,000	2,500
Monthly Flow Duration 25% of Time Equaled or Exceeded		1,850	2,540	3,880	3,390	2,330	1,670	1,020	810	830	810	880	880	890	950	1,020	820	1,240
Mean Monthly Flow		1,500	1,900	2,800	2,370	1,760	1,330	960	740	760	760	800	790	810	890	980	950	1,110
Monthly Flow Duration 75% of Time Equaled or Exceeded		600	630	1,220	1,040	980	820	730	660	670	630	730	710	750	760	780	650	590

Flow Condition		Water Surface Level at Embankment - Stage 4 (Culverts #1 and #2 Open, Power Intake Closed) (ft)																
		Jan	Feb	Mar	Apr	May	Jun 1 - 15	Jun 16 - 30	Jul 1 -15	Jul 16 - 30	Aug	Sep 1 - 15	Sep 16 - 30	Oct 1 -15	Oct 16 - 31	Nov 1 - 15	Nov 16 - 30	Dec
Statistical High Water (Flood Conditions)	1% Probable Flood						3789.1	3781.7	3773.7	3768.0	3768.0	3769.7	3771.1	3777.4	3784.6	3787.7	3789.0	3791.4
	5% Probable Flood						3781.7	3769.8	3768.1	<3768	<3768	3768.1	3768.7	3770.2	3774.8	3777.4	3781.7	3788.0
	20% Probable Flood						3769.8	3768.0	<3768	<3768	<3768	<3768	3768.0	3768.2	3768.7	3769.7	3770.2	3777.8
	50% Probable Flood						3768.0	<3768	<3768	<3768	<3768	<3768	<3768	<3768	<3768	3768.0	3768.1	3769.7
Monthly Flow Duration 25% of Time Equaled or Exceeded							<3768	<3768	<3768	<3768	<3768	<3768	<3768	<3768	<3768	<3768	<3768	<3768
Mean Monthly Flow							<3768	<3768	<3768	<3768	<3768	<3768	<3768	<3768	<3768	<3768	<3768	<3768
Monthly Flow Duration 75% of Time Equaled or Exceeded							<3768	<3768	<3768	<3768	<3768	<3768	<3768	<3768	<3768	<3768	<3768	<3768

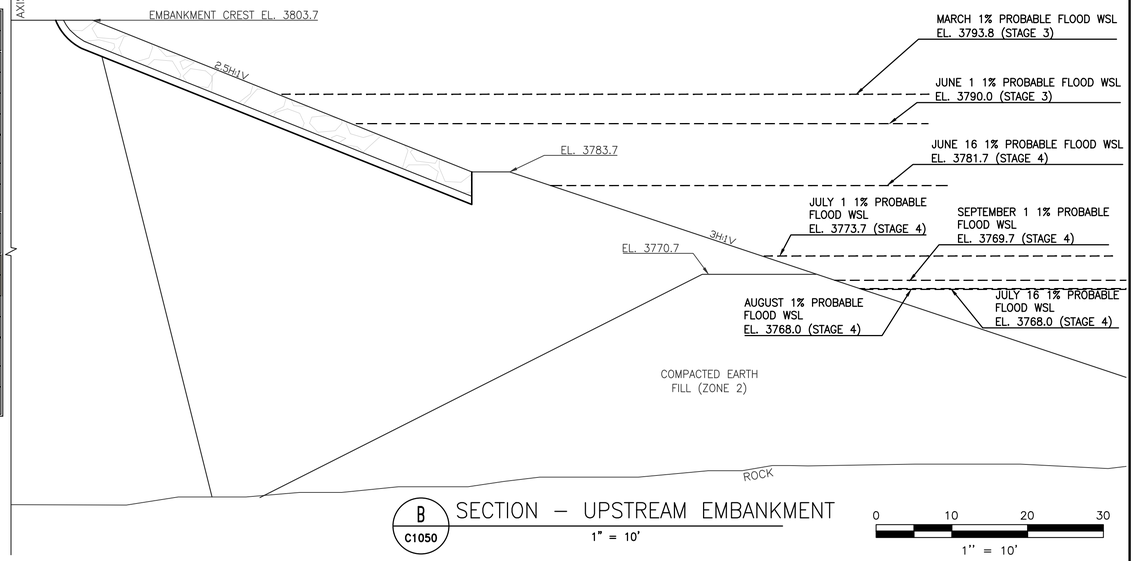
SEE NOTE 9

TABLE 2: MONTHLY INFLOWS AND STEADY–STATE WATER LEVELS AT UPSTREAM EMBANKMENT FOR DRAWDOWN AND POST–DRAWDOWN

FOR INFORMATION ONLY



A C1050 SECTION – INTAKE STRUCTURE
1" = 10'



B C1050 SECTION – UPSTREAM EMBANKMENT
1" = 10'

0 10 20 30
1" = 10'

LEGEND:

– – – – – WATER SURFACE LEVEL

NOTE:

1. REFER TO GENERAL NOTES ON DRAWING G0006 FOR INFORMATION REGARDING TOPOGRAPHIC AND BATHYMETRIC DATA SOURCES.
2. WATER SURFACE LEVELS SHOWN IN TABLE 2 AND SECTION B CORRESPOND TO LEVELS AT THE UPSTREAM FACE OF THE EMBANKMENT.
3. SELECT LEVELS SHOWN ON SECTIONS. ADDITIONAL LEVELS SHOWN ON TABLE 1.
4. THE WATER LEVELS IN TABLE 1 AND TABLE 2 ARE DETERMINED USING STEADY–STATE FLOWS IN TABLE 1 AND THE RATING CURVES SHOWN ON DRAWING C1056.
5. SHADED VALUES IN TABLE 1 AND TABLE 2 REPRESENT WATER SURFACE LEVELS WITH SPILLWAY FLOW.
6. BOLDED CELLS CORRESPOND TO RESERVOIR ELEVATIONS SHOWN ON DRAWING C1050.
7. STARTING JUNE 1 OF THE DRAWDOWN YEAR, EMBANKMENT MATERIALS CAN BE REMOVED ACCORDING TO THE STAGING DRAWINGS SHOWN ON C1234 TO C1239, SUCH THAT:
   - 7.1. 3 ft FREEBOARD IS MAINTAINED ON THE RELEVANT FLOOD EVENT PRIOR TO JULY 16.
   - 7.2. 1 ft FREEBOARD IS MAINTAINED ON THE RELEVANT FLOOD EVENT POST JULY 16.
8. CONTRACTOR TO ASSESS THE FLOOD RISK BASED ON USBR FORECAST REPORT AND CURRENT WATER CONDITIONS WHICH WILL INFLUENCE REMOVAL SCHEDULE.
9. ALL WATER LEVELS DENOTED BY <3768 INDICATE THAT THE INFLOW IS FULLY DIVERTED BY THE HISTORIC COFFERDAM. IN THESE CASES, THERE IS NO WATER SURFACE ELEVATION AT THE EMBANKMENT BUT ONLY AT THE INTAKE STRUCTURE.
10. WATER LEVELS SHOWN ON THIS DRAWING ARE NO LONGER VALID ONCE THE CONTROL IS REVISED AND THE INTAKE/SPILLWAY STRUCTURE IS DEMOLISHED.

REV	DESCRIPTION	BY	CHK	APP	DATE
C	ISSUED WITH DRAFT 100% DESIGN REPORT	CBN	NB	SRM	11/13/20
B	ISSUED WITH DRAFT 100% DESIGN REPORT	CBN	NB	SRM	10/07/20
A	ISSUED WITH 90% DESIGN REPORT	CBN	NB	SRM	08/05/20

WARNING
0 1/2 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

PREPARED BY: Knight Piésold CONSULTING; Kiewit

DESIGNED	V. MARTIN
DRAWN	A. NASIRI
REVIEWED	H. ELWIN
IN CHARGE	N. BISHOP
APPROVED	S. MOTTRAM

PREPARED FOR: KLAMATH RIVER RENEWAL CORPORATION

PROJECT: KLAMATH RIVER RENEWAL PROJECT
SHEET TITLE: J.C. BOYLE FACILITY HYDROLOGIC AND HYDRAULIC INFORMATION POST-DRAWDOWN WATER SURFACE LEVELS

PROJ #	VA103-640/1
DATE	11/13/2020
DWG	C1055

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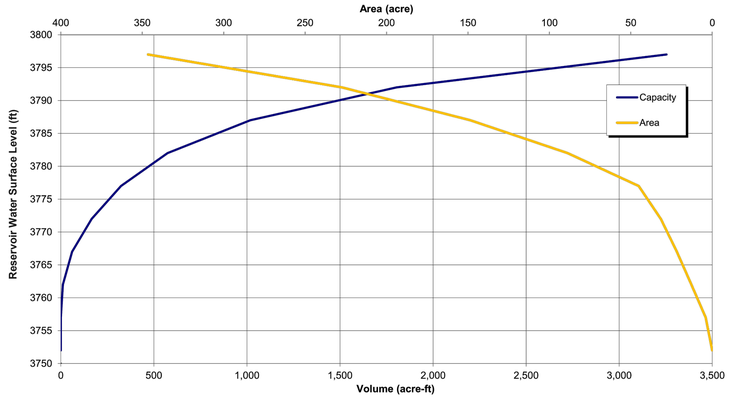

FIGURE 1: J.C. BOYLE DEPTH AREA CAPACITY CURVE

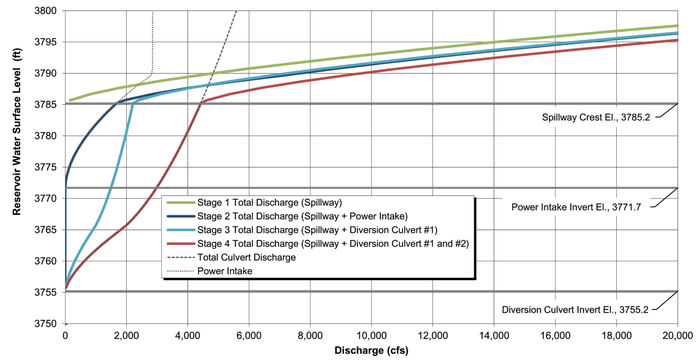

FIGURE 2: J.C. BOYLE RESERVOIR DISCHARGE RATING CURVE (INTAKE STRUCTURE)

FOR INFORMATION ONLY

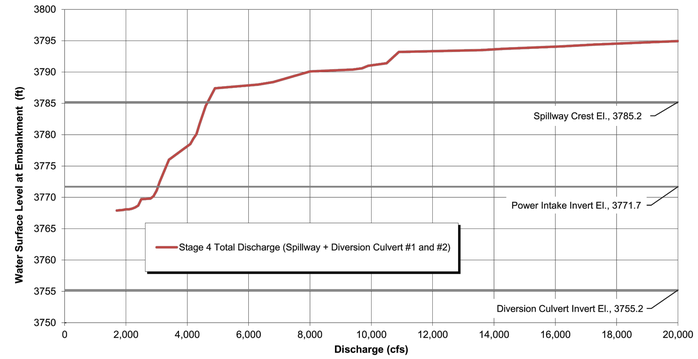

FIGURE 3: J.C. BOYLE RESERVOIR DISCHARGE RATING CURVE (EMBANKMENT)

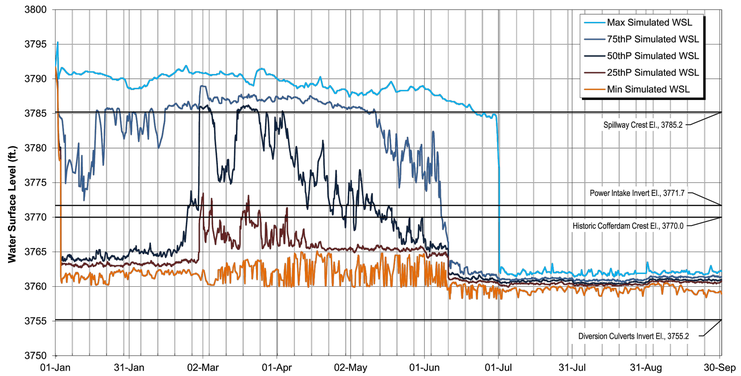

FIGURE 4: J.C. BOYLE RESERVOIR DRAWDOWN PERCENTILE WATER SURFACE LEVELS

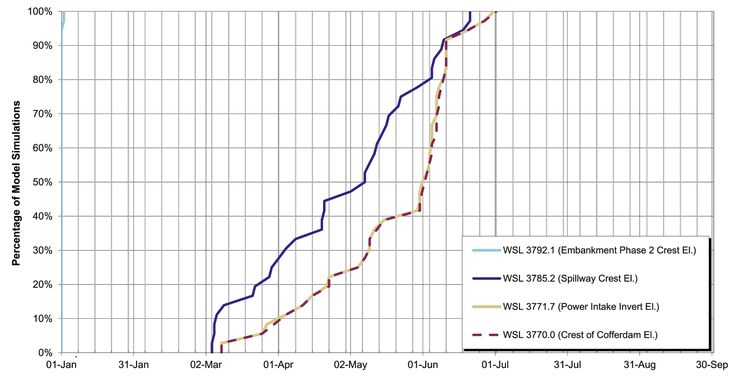

FIGURE 5: J.C. BOYLE SUSTAINED RESERVOIR DRAWDOWN AT SELECTED ELEVATIONS OVER PERIOD OF RECORD MODEL RUNS BY DATE

NOTES:

1. FOR RESERVOIR DRAWDOWN OPERATIONS NOTES SEE DRAWING C1050.
2. RESERVOIR STORAGE AREA CAPACITY CURVE (FIGURE 1) IS BASED ON THE 2018 BATHYMETRIC SURVEY AS NOTED ON DRAWING G0006.
3. DISCHARGE CAPACITY OF SPILLWAY ON FIGURE 2 IS FOR ALL THREE GATES OPEN.
4. DISCHARGE CAPACITY OF DIVERSION CULVERTS ON FIGURE 2 ARE FOR FREE DISCHARGE CONDITIONS. DIVERSION CULVERT #1 AND #2 HAVE THE SAME INVERT ELEVATION AND DISCHARGE RATING CURVE CAPACITY. A SINGLE DISCHARGE RATING CURVE IS SHOWN THAT REPRESENTS THE CAPACITY OF A SINGLE CULVERT.
5. DISCHARGE RATING CURVE ON FIGURE 2 IS FOR WATER LEVELS IMMEDIATELY UPSTREAM OF THE INTAKE STRUCTURE.
6. DISCHARGE RATING CURVE ON FIGURE 3 IS FOR WATER LEVELS AT THE CENTER OF THE UPSTREAM EMBANKMENT UNDER STAGE 4 OF DRAWDOWN CONDITIONS (THREE SPILLWAY GATES OPEN AND DIVERSION CULVERTS OPEN).
7. RESERVOIR WATER LEVELS SHOWN IN FIGURE 4 ARE THE RESERVOIR WATER SURFACE LEVEL MODEL RUN RESULTING PERCENTILES IMMEDIATELY UPSTREAM OF THE DAM USING DRAWDOWN MODEL. THE PERCENTILES ARE CALCULATED BASED ON THE ENTIRE 36 YEAR RECORD OF 2019 JOINT BIOLOGICAL OPINION FLOWS FOR THE USBR'S KLAMATH PROJECT. THE RESERVOIR WATER LEVELS ARE SIMULATED USING THE RESERVOIR DRAWDOWN OPERATIONS ON DRAWING C1055. WATER LEVELS CAN BE OUTSIDE OF THE VALUES DEPENDING ON THE HYDROLOGICAL CONDITIONS DURING THE DRAWDOWN YEAR.
8. THE CURVES SHOWN ON FIGURE 5 REPRESENT THE PERCENTAGE OF MODEL SIMULATIONS AT WHICH RESERVOIR DRAWDOWN WATER SURFACE LEVELS ARE SUSTAINED BELOW SELECTED ELEVATIONS BASED ON THE DRAWDOWN MODEL USING THE ENTIRE 36 YEAR RECORD OF 2019 JOIN BIOLOGICAL OPINION FLOWS FOR THE USBR'S KLAMATH PROJECT. THE ACTUAL DATE A WATER SURFACE LEVEL IS SUSTAINED AT A CERTAIN ELEVATION CAN BE DIFFERENT THAN SHOWN DEPENDING ON THE HYDROLOGICAL CONDITIONS DURING THE DRAWDOWN YEAR AND THE DRAWDOWN SEQUENCING SHOWN ON DRAWING C1055.

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A	ISSUED WITH 90% DESIGN REPORT	CBN	NB	SRM	08/05/20

WARNING
0 1/2 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

PREPARED BY: Knight Piésold CONSULTING / Kiewit

DESIGNED	V. MARTIN
DRAWN	A. NASIRI
REVIEWED	H. ELWIN
IN CHARGE	N. BISHOP
APPROVED	S. MOTTRAM

PREPARED FOR: KLAMATH RIVER RENEWAL CORPORATION

PROJECT: KLAMATH RIVER RENEWAL PROJECT
PROJ # VA103-640/1
DATE 11/13/2020
SHEET TITLE: J.C. BOYLE FACILITY HYDROLOGIC AND HYDRAULIC INFORMATION FIGURES
DWG C1056

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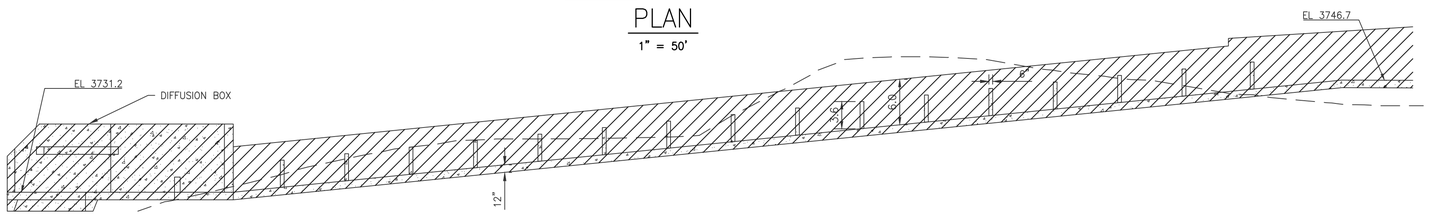
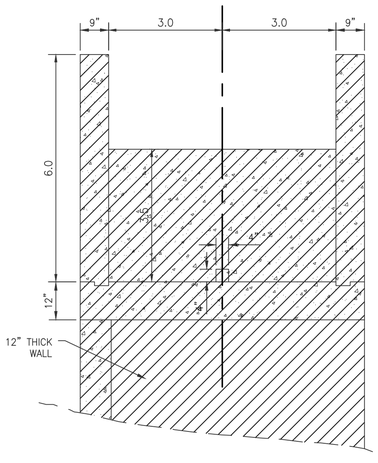
PLAN
1" = 50'



A SECTION
1" = 2'



C SECTION
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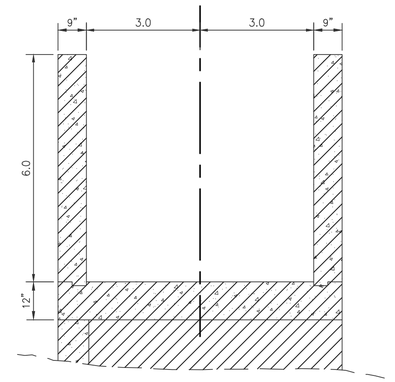

D SECTION
1" = 2'

WORK POINTS TABLE			
WORK POINTS	EASTING	NORTHING	ELEVATION
SOP-1	6,548,227.6	2,656,860.8	3735.0
SOP-2	6,548,312.3	2,656,964.8	3778.0
SOP-3	6,548,553.2	2,656,914.0	3762.0
SOP-4	6,548,529.0	2,656,696.3	3766.5
SOP-5	6,548,475.1	2,656,853.6	3735.5
SOP-6	6,548,133.5	2,656,618.4	3731.0
SOP-7	6,548,261.3	2,656,756.7	3736.0
SOP-8	6,548,277.2	2,656,619.1	3734.0
SOP-9	6,548,085.0	2,656,532.2	3724.5
SOP-10	6,548,298.4	2,656,557.9	3736.5
SOP-11	6,548,219.7	2,656,517.9	3730.5
SOP-12	6,548,249.2	2,656,330.5	3723.0

LEGEND:

- (E) CONCRETE
- DEMOLITION / REMOVAL
- F — F — FENCE
- EXTENT OF EMBANKMENT
- BORROW SOURCE LIMITS
- TO BE REMOVED
- 1 FISH LADDER
- 2 EMBANKMENT CREST
- 3 DIVERSION CULVERTS
- 4 GATED SPILLWAY
- 5 INTAKE STRUCTURE
- 6 DAM COMMUNICATIONS BLDG
- 7 14' PIPELINE

NOTES:

1. REFER TO GENERAL NOTES ON DRAWING G0006 FOR INFORMATION REGARDING TOPOGRAPHIC AND BATHYMETRIC DATA SOURCES.
2. LOCATION AND EXTENT OF HISTORIC COFFERDAM IS BASED ON HISTORIC PHOTOS AND MAY VARY. THE CONTRACTOR SHALL LOCATE AND ASSESS THE HISTORIC COFFERDAM PRIOR TO COMMENCING EXCAVATION SO EXCAVATION LIMITS CAN BE UPDATED AS REQUIRED.
3. POTENTIAL BORROW SOURCE LOCATED IN CULTURALLY SENSITIVE AREA.
4. REMOVE FISH LADDER COMPLETELY.
5. DIMENSIONS BASED ON HISTORIC DRAWING 78112.

0 2 4 6
1" = 2'

0 10 20 30
1" = 10'

0 50 100 150
1" = 50'

FOR INFORMATION ONLY

REV	DESCRIPTION	BY	CHK	APP	DATE
C	ISSUED WITH DRAFT 100% DESIGN REPORT	CBN	NB	SRM	11/13/20
B	ISSUED WITH DRAFT 100% DESIGN REPORT	CBN	NB	SRM	10/07/20
A	ISSUED WITH 90% DESIGN REPORT	CBN	NB	SRM	08/05/20

WARNING
0 1/2 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

PREPARED BY: Knight Piésold CONSULTING, Kiewit

DESIGNED	C. NIAMIR
DRAWN	A. NASIRI
REVIEWED	N. BISHOP
IN CHARGE	N. BISHOP
APPROVED	S. MOTTRAM

PREPARED FOR: KLAMATH RIVER RENEWAL CORPORATION

PROJECT: KLAMATH RIVER RENEWAL PROJECT
PROJ # VA103-640/1
DATE 11/13/2020
SHEET TITLE: J.C. BOYLE FACILITY EMBANKMENT, INTAKE AND FISH LADDER REMOVAL PLAN AND SECTIONS
DWG C1210

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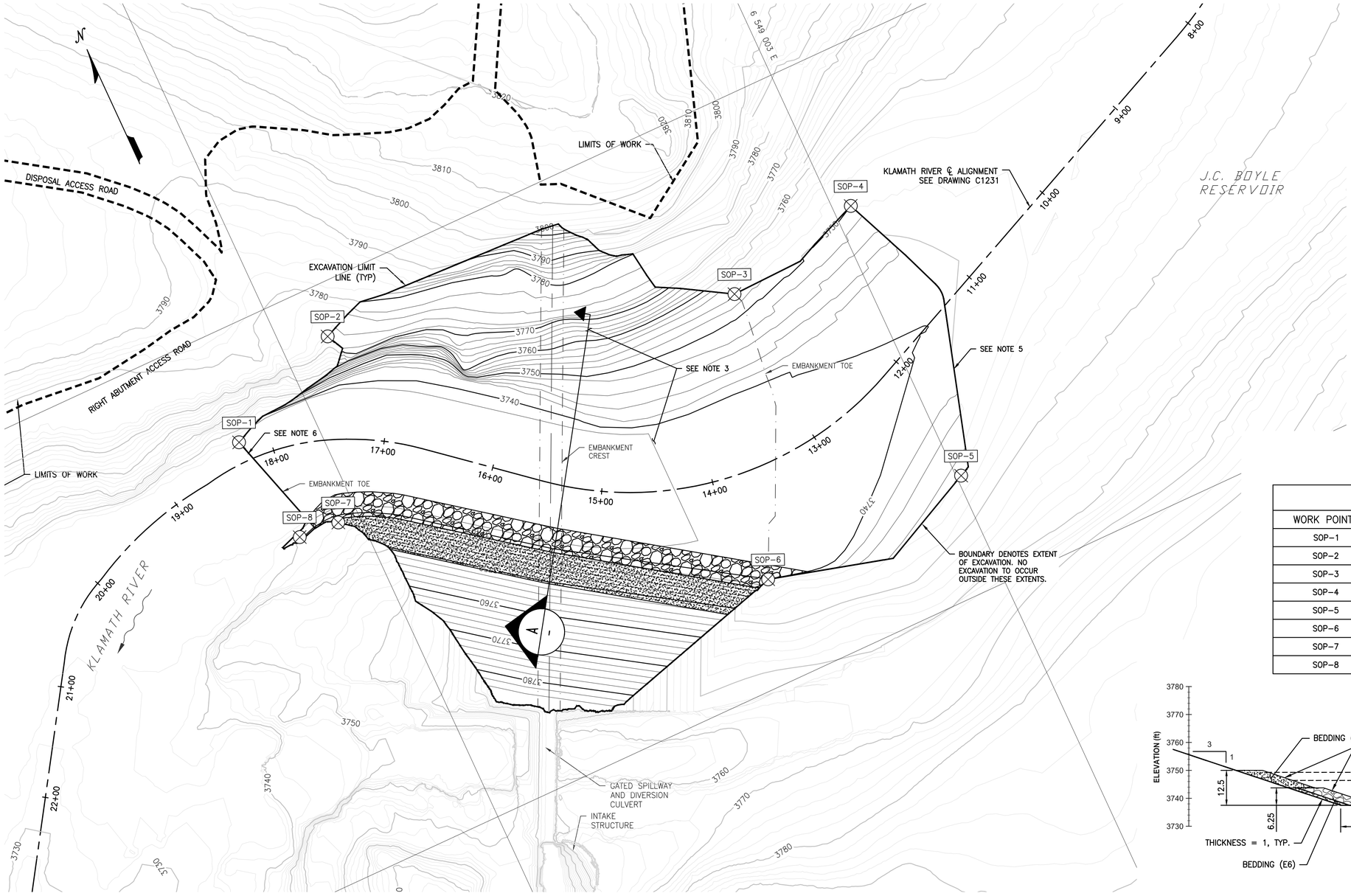
PUBLIC VERSION

CRITICAL ENERGY/ELECTRIC INFRASTRUCTURE INFORMATION (CEII)

REDACTED

DESIGNSHEET C1220: SPILLWAY AND INTAKE REMOVAL



PLAN
1" = 50'

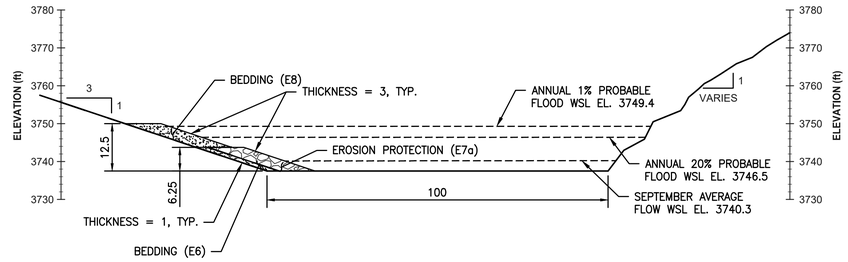
NOTES:

1. REFER TO GENERAL NOTES ON DRAWING G0006 FOR INFORMATION REGARDING TOPOGRAPHIC AND BATHYMETRIC DATA SOURCES.
2. REMOVE DAM EMBANKMENT FILL TO LINES AND GRADES SHOWN. EROSION PROTECTION AND BEDDING MATERIALS TO BE PLACED PRIOR TO COFFERDAM BREACH.
3. FINAL RIVER CHANNEL EXCAVATED TO BEDROCK ALONG THE RIGHT BANK AND BOTTOM. DO NOT EXCAVATE INTO BEDROCK SURFACE.
4. EXCAVATED FILL TO BE PLACED IN DISPOSAL AREAS SHOWN ON C1240 OR USED AS COVER MATERIAL.
5. EXTENT OF REMAINING SEDIMENT AND DEBRIS TO BE EVALUATED FOLLOWING DRAWDOWN. REMOVAL LIMIT CORRESPONDS TO HISTORIC COFFERDAM UPSTREAM TOE. ADDITIONAL SEDIMENT AND DEBRIS REMOVAL MAY BE NECESSARY TO ACCESS THIS POINT. REMOVAL OF MATERIAL UPSTREAM OF THIS POINT, UNLESS TO ACCESS TO THE HISTORIC COFFERDAM TOE, WILL BE COMPLETED BY OTHERS AND IS OUTSIDE THE SCOPE OF THIS DESIGN.
6. FOLLOWING EMBANKMENT REMOVAL, EVALUATE ROCKFILL AT DOWNSTREAM TOE AND GRADE AS REQUIRED.
7. CHANNEL SECTIONS BY STATION SHOWN ON C1232.
8. THE ANTICIPATED WATER SURFACE LEVELS AT SECTION A FOR VARIOUS FLOW CONDITIONS DURING CONSTRUCTION ARE SUMMARIZED IN APPENDIX B1.
9. EXCAVATION EXTENTS ARE INTERPRETED BASED ON THE HISTORIC DRAWINGS AND ARE INTENDED TO ILLUSTRATE THE GROUND SURFACE ONCE THE EMBANKMENT IS REMOVED. HOWEVER, ADDITIONAL EXCAVATION MAY BE REQUIRED. BEDROCK DEPTH MAY VARY.

LEGEND:

- EROSION PROTECTION (E7a)
- BEDDING (E6/E8)
- WATER SURFACE LEVEL
- LIMITS OF WORK

WORK POINTS TABLE			
WORK POINTS	EASTING	NORTHING	ELEVATION
SOP-1	6,548,430.0	2,656,901.0	3736.5
SOP-2	6,548,542.0	2,656,954.0	3773.0
SOP-3	6,548,888.5	2,656,835.5	3774.5
SOP-4	6,549,016.0	2,656,864.0	3777.5
SOP-5	6,549,004.5	2,656,603.0	3770.5
SOP-6	6,548,808.5	2,656,591.5	3765.0
SOP-7	6,548,480.7	2,656,798.9	3744.0
SOP-8	6,548,444.0	2,656,801.5	3740.0



A — A' SECTION
1" = 20'

FOR INFORMATION ONLY

0 20 40 60
1" = 20'

0 50 100 150
1" = 50'

REV	DESCRIPTION	BY	CHK	APP	DATE
G	ISSUED WITH DRAFT 100% DESIGN REPORT	CBN	NB	SRM	11/13/20
F	ISSUED WITH DRAFT 100% DESIGN REPORT	CBN	NB	SRM	10/07/20
E	ISSUED WITH 90% DESIGN REPORT	CBN	NB	SRM	08/05/20
D	ISSUED WITH 60% DESIGN REPORT	CBN	NB	SRM	02/07/20
C	ISSUED WITH DRAFT 60% DESIGN REPORT	CBN	NB	SRM	12/17/19

WARNING
0 1/2 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

PREPARED BY: Knight Piésold CONSULTING; Kiewit

DESIGNED	C. NIAMIR
DRAWN	R. McLELLAN
REVIEWED	H. ELWIN
IN CHARGE	N.BISHOP
APPROVED	S. MOTTRAM

PREPARED FOR: KLAMATH RIVER RENEWAL CORPORATION

PROJECT: KLAMATH RIVER RENEWAL PROJECT
PROJ # VA103-640/1
DATE 11/13/2020
SHEET TITLE: J.C. BOYLE FACILITY EMBANKMENT REMOVAL PLAN
DWG C1230

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(CEII)

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DESIGN SHEET C1231:EMBANKMENT REMOVAL

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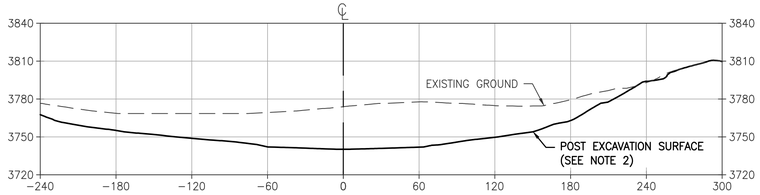

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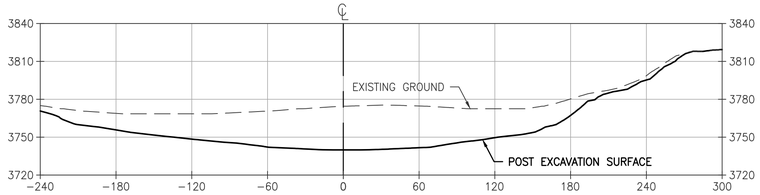

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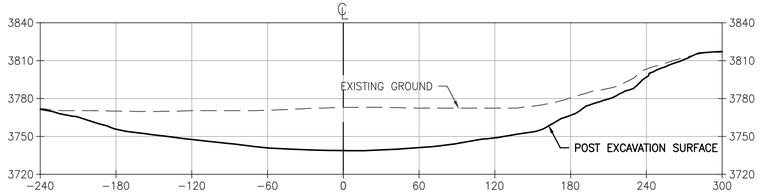

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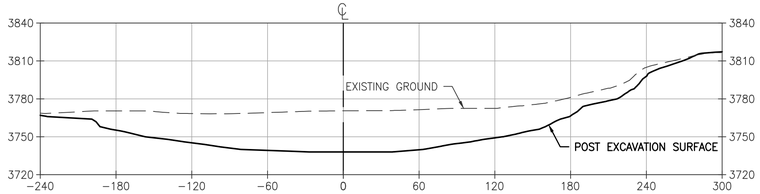
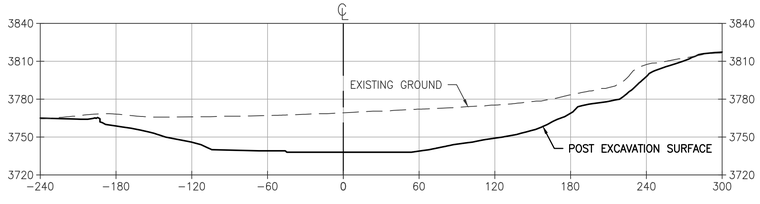


STA 13+50



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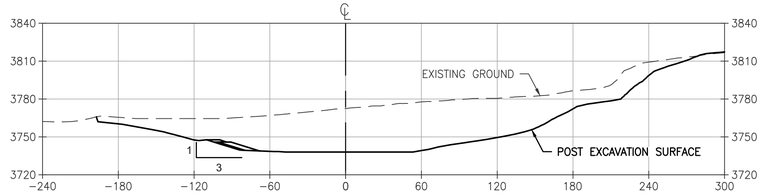

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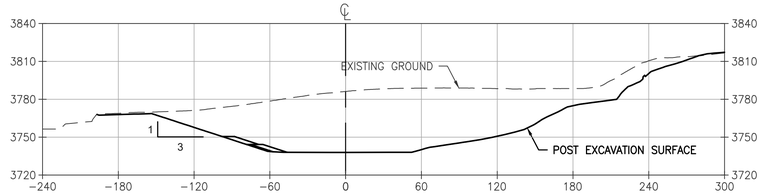

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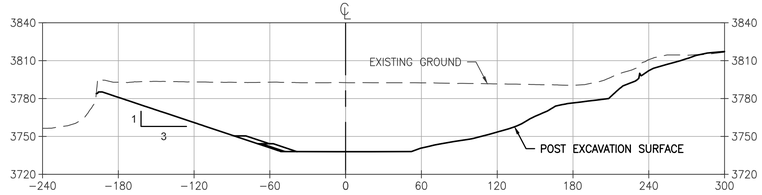

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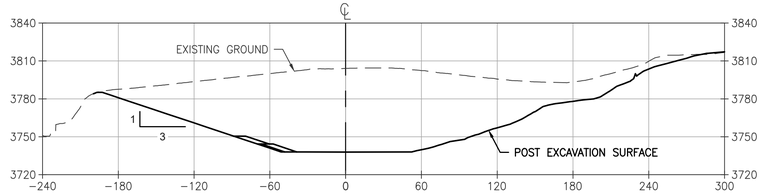

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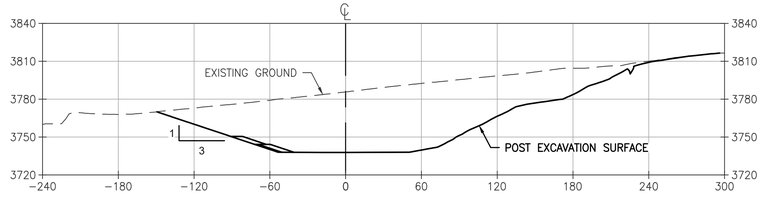

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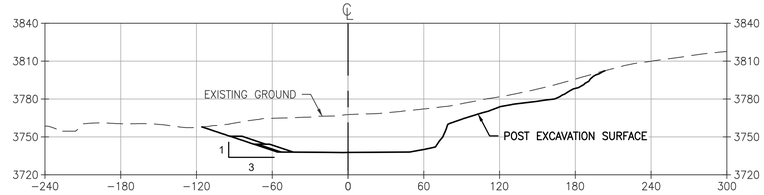

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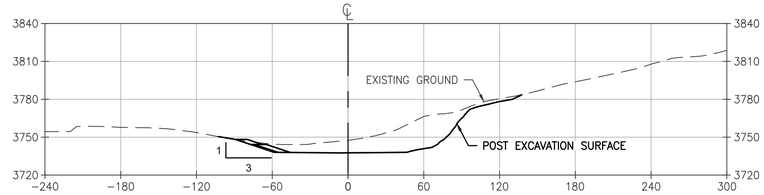
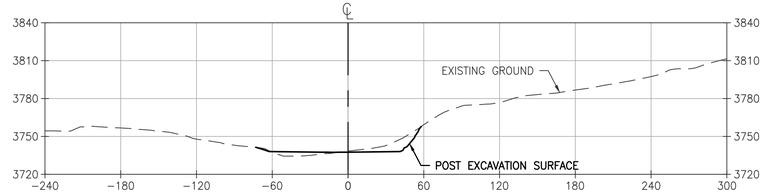


STA 17+50



NOTES:

1. REFER TO GENERAL NOTES ON DRAWING G0006 FOR INFORMATION REGARDING TOPOGRAPHIC AND BATHYMETRIC DATA SOURCES.
2. ACTUAL BEDROCK ELEVATION TO DETERMINE POST EXCAVATION SURFACE. NO EXCAVATION IS TO OCCUR INTO BEDROCK OR ROCKFILL.
3. REMOVE DAM EMBANKMENT FILL TO LINES AND GRADES SHOWN OR UNTIL BEDROCK/ROCKFILL IS ENCOUNTERED. EROSION PROTECTION AND BEDDING MATERIALS TO BE PLACED ON LEFT BANK POST EXCAVATION SURFACE.
4. FINAL RIVER CHANNEL ROCK SURFACE BOTTOM WIDTH AND RIGHT BANK ERODIBLE FILLS TO BE REMOVED PRIOR TO HISTORIC COFFERDAM BREACH.
5. EXCAVATION EXTENTS ARE INTERPRETED BASED ON THE HISTORIC DRAWINGS AND ARE INTENDED TO ILLUSTRATE THE GROUND SURFACE ONCE THE EMBANKMENT IS REMOVED. HOWEVER, ADDITIONAL EXCAVATION MAY BE REQUIRED. BEDROCK DEPTH MAY VARY.

FOR INFORMATION ONLY

0 60 120 180

1" = 60'

REV	DESCRIPTION	BY	CHK	APP	DATE
G	ISSUED WITH DRAFT 100% DESIGN REPORT	CBN	NB	SRM	11/13/20
F	ISSUED WITH DRAFT 100% DESIGN REPORT	CBN	NB	SRM	10/07/20
E	ISSUED WITH 90% DESIGN REPORT	CBN	NB	SRM	08/05/20
D	ISSUED WITH 60% DESIGN REPORT	CBN	NB	SRM	02/07/20
C	ISSUED WITH DRAFT 60% DESIGN REPORT	CBN	NB	SRM	12/17/19

WARNING
0 1/2 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

PREPARED BY
Knight Piésold CONSULTING
Kiewit

DESIGNED	C. NIAMIR
DRAWN	R. McLELLAN
REVIEWED	H. ELWIN
IN CHARGE	N. BISHOP
APPROVED	S. MOTTRAM

PREPARED FOR
KLAMATH RIVER RENEWAL CORPORATION

PROJECT
KLAMATH RIVER RENEWAL PROJECT

SHEET TITLE
J.C. BOYLE FACILITY
EMBANKMENT REMOVAL
EXCAVATION SECTIONS

PROJ #	VA103-640/1
DATE	11/13/2020
DWG	C1232

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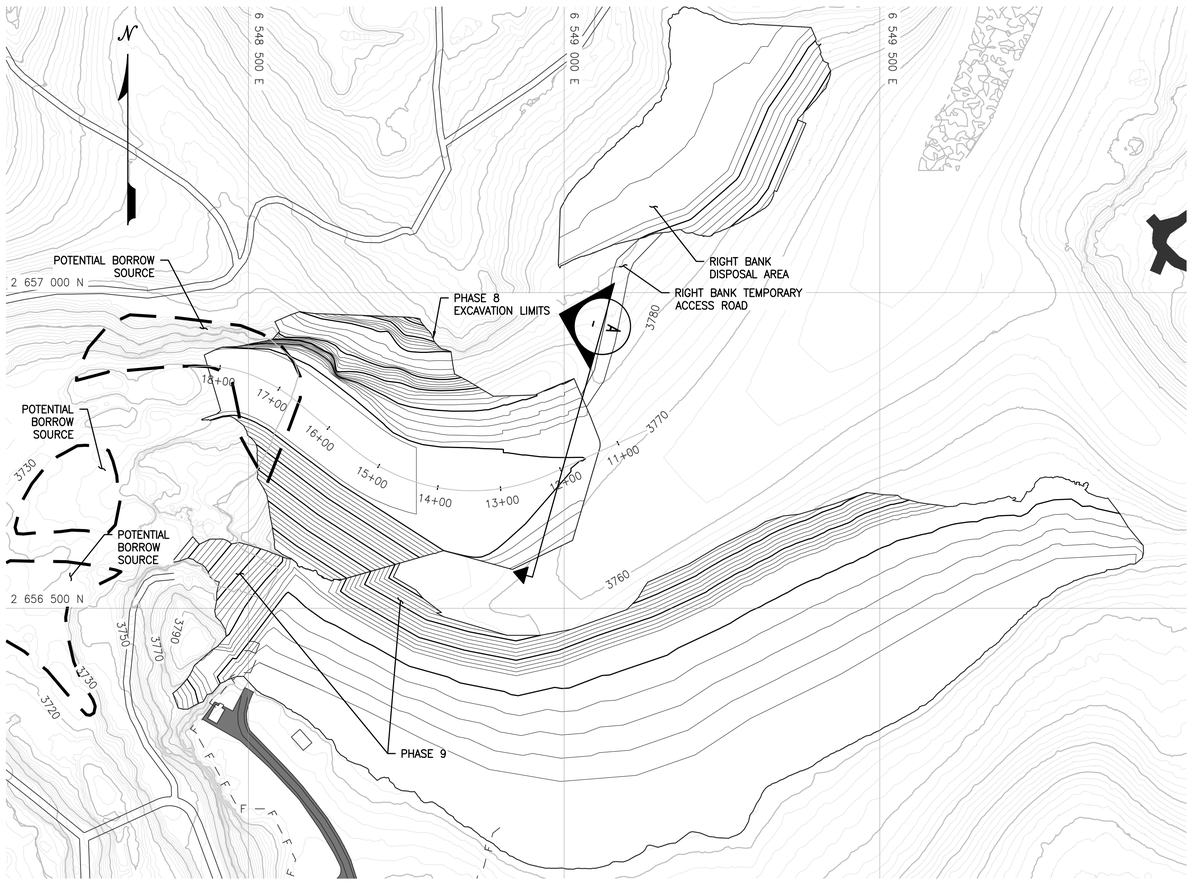
PUBLIC VERSION

CRITICAL ENERGY/ELECTRIC INFRASTRUCTURE INFORMATION

(CEII)

REDACTED

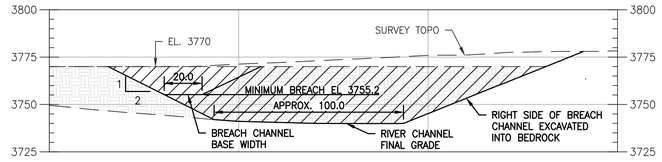
DESIGN SHEETS C1234-C1238: EMBANKMENT REMOVAL



PLAN

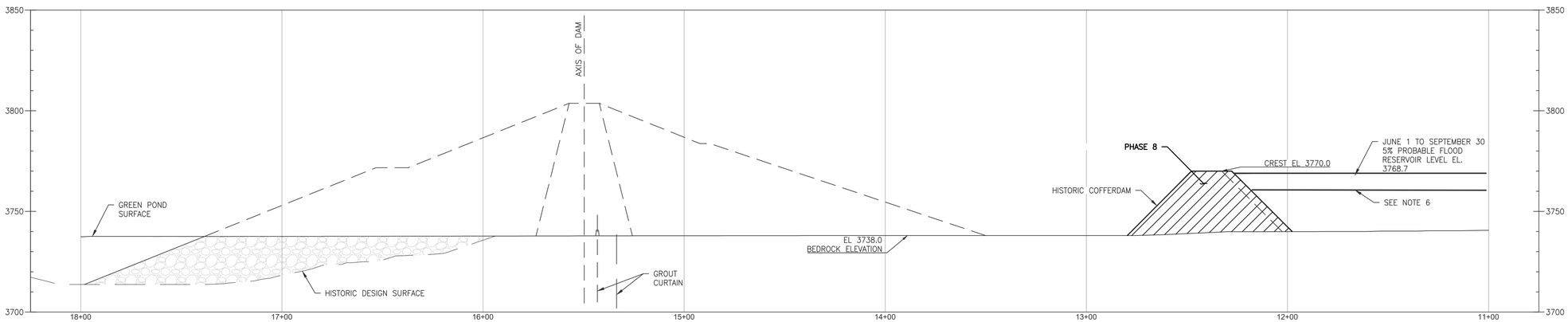
1" = 120'

FOR INFORMATION ONLY



A – SECTION – HISTORIC COFFERDAM BREACH

NTS



PROFILE – EMBANKMENT REMOVAL MAXIMUM

1" = 30'

REMOVAL SEQUENCE NOTES – GENERAL ARRANGEMENT SEQUENCE NOTES (SEE DRAWINGS C1234 TO C1239):

1. PHASE 8 BREACH TO MATCH FINAL CHANNEL SLOPE ONCE FINAL RIVER CHANNEL IS SUBSTANTIALLY COMPLETE.
2. PHASE 9 PLACE STOCKPILED MATERIAL IN DIVERSION CULVERT CHANNEL AND BURY LEFT–IN–PLACE CONCRETE.

NOTES:

1. REFER TO GENERAL NOTES ON DRAWING G0006 FOR INFORMATION REGARDING TOPOGRAPHIC AND BATHYMETRIC DATA SOURCES.
2. LOCATION AND EXTENT OF HISTORIC COFFERDAM IS BASED ON HISTORIC PHOTOS AND MAY VARY. THE CONTRACTOR SHALL LOCATE AND ASSESS THE HISTORIC COFFERDAM PRIOR TO COMMENCING EXCAVATION SO EXCAVATION LIMITS CAN BE UPDATED AS REQUIRED.
3. HISTORIC COFFERDAM REMOVAL EXTENTS AS SHOWN ON SECTION A ARE APPROXIMATE AND WILL BE FIELD FIT BASED ON ENCOUNTERED CONDITIONS DURING REMOVAL.
4. BREACH DEPTH OF 3755.2 ft REQUIRED TO DIVERT FLOWS FROM THE DIVERSION CULVERTS TO THE FINAL RIVER CHANNEL.
5. EXCAVATE TO BREACH FROM RIGHT BANK. AVOID HAVING EXCAVATOR WORK FROM ERODIBLE FILLS
6. RESERVOIR ELEVATION AT TIME OF BREACH WILL DEPEND ON DIVERSION CULVERT INFLOW HYDRAULICS. TO BE EVALUATED POST DRAWDOWN.

LEGEND:

DEMOLITION / REMOVAL

(E) RIPRAP

0 30 60 90

1" = 30'

0 120 240 360

1" = 120'

REV	DESCRIPTION	BY	CHK	APP	DATE
C	ISSUED WITH DRAFT 100% DESIGN REPORT	CBN	NB	SRM	11/13/20
B	ISSUED WITH DRAFT 100% DESIGN REPORT	CBN	NB	SRM	10/07/20
A	ISSUED WITH 90% DESIGN REPORT	CBN	NB	SRM	08/05/20

WARNING
0 1/2 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

PREPARED BY
Knight Piésold CONSULTING
Kiewit

DESIGNED	C. NIAMIR
DRAWN	A. NASIRI
REVIEWED	H. ELWIN
IN CHARGE	N. BISHOP
APPROVED	S. MOTTRAM

PREPARED FOR
KLAMATH RIVER RENEWAL CORPORATION

PROJECT
KLAMATH RIVER RENEWAL PROJECT

SHEET TITLE
J.C. BOYLE FACILITY
EMBANKMENT REMOVAL
GENERAL ARRANGEMENT SEQUENCE - (SHEET 6 OF 6)

PROJ #	VA103-640/1
DATE	11/13/2020
DWG	C1239

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Source: Northwest Hydraulic Consultants Drawdown Model Report for the Klamath River Renewal Project in Appendix G of the 100% Design Report (Knight Piésold, 2020b).

Drawdown Plots for J.C. Boyle Reservoir

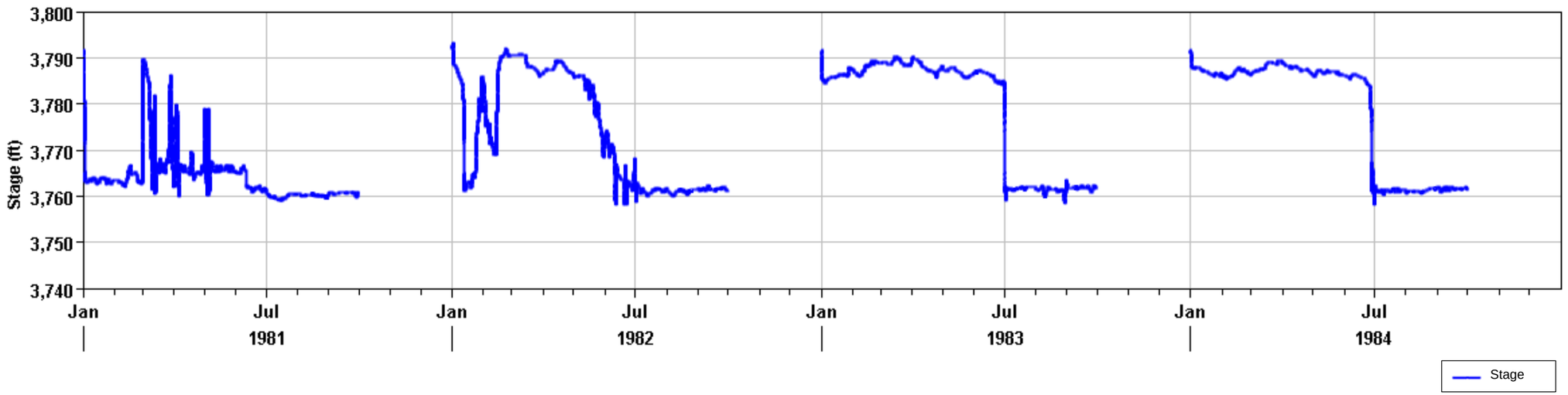


Figure 1: J.C. Boyle Drawdown Stage for years 1981 through 1984

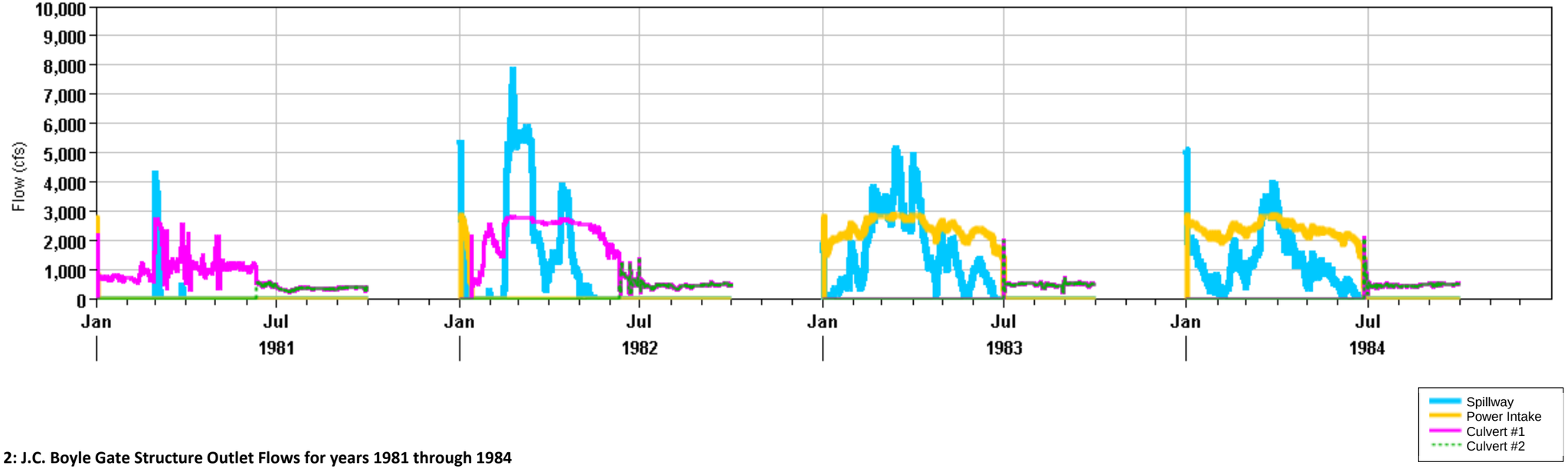


Figure 2: J.C. Boyle Gate Structure Outlet Flows for years 1981 through 1984

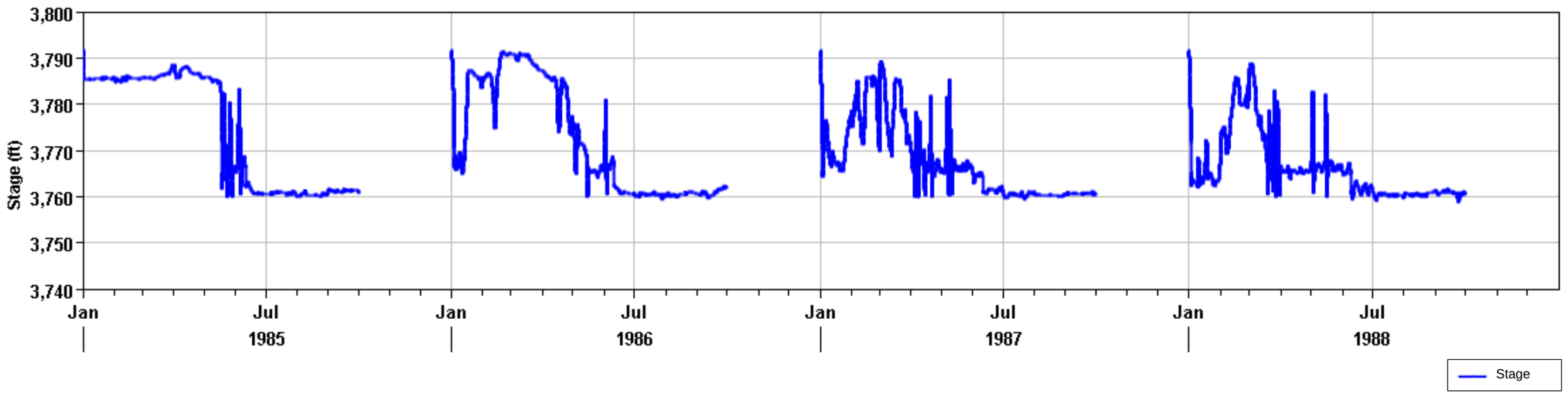


Figure 3: J.C. Boyle Drawdown Stage for years 1985 through 1988

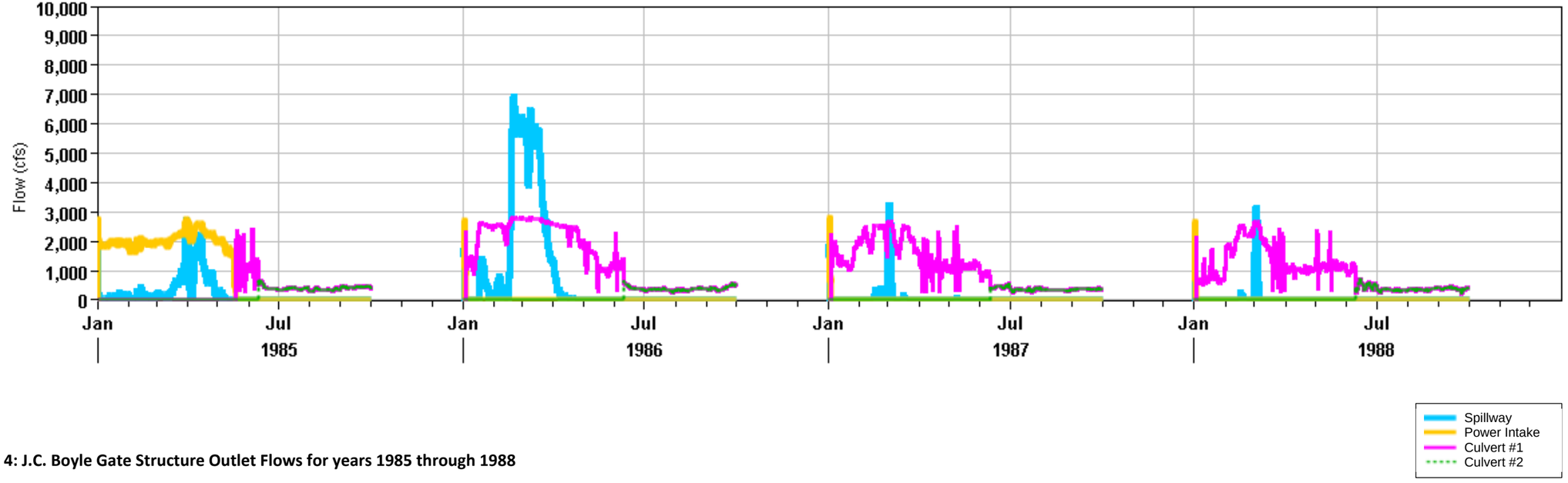


Figure 4: J.C. Boyle Gate Structure Outlet Flows for years 1985 through 1988

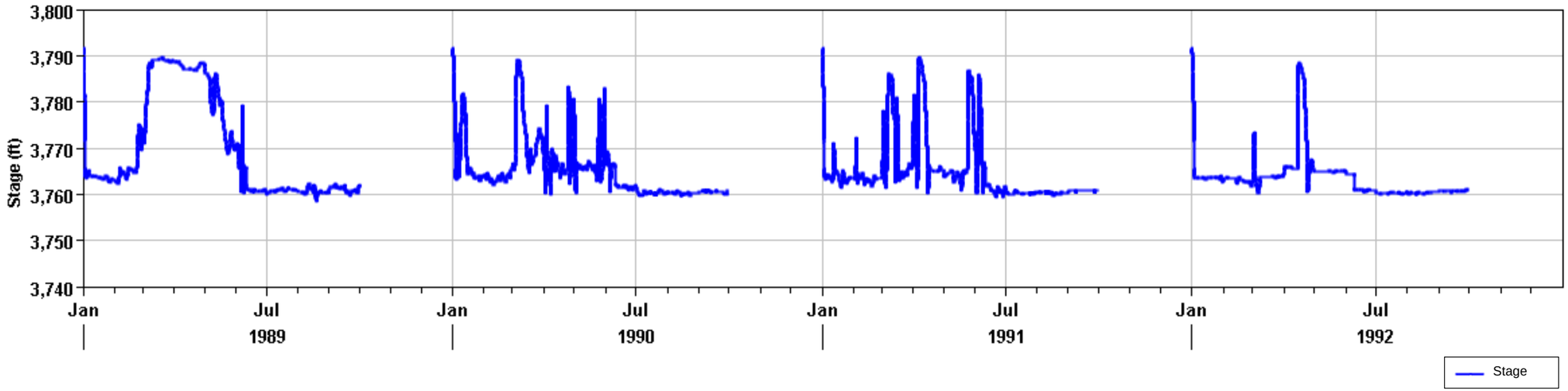


Figure 5: J.C. Boyle Drawdown Stage for years 1989 through 1992

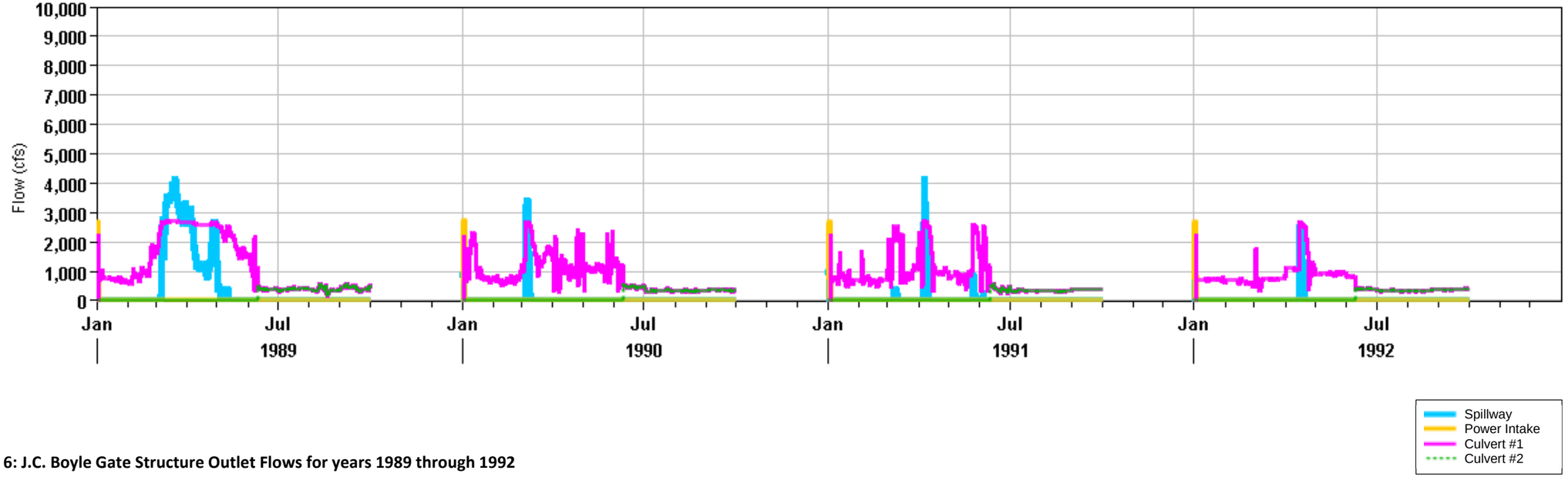


Figure 6: J.C. Boyle Gate Structure Outlet Flows for years 1989 through 1992

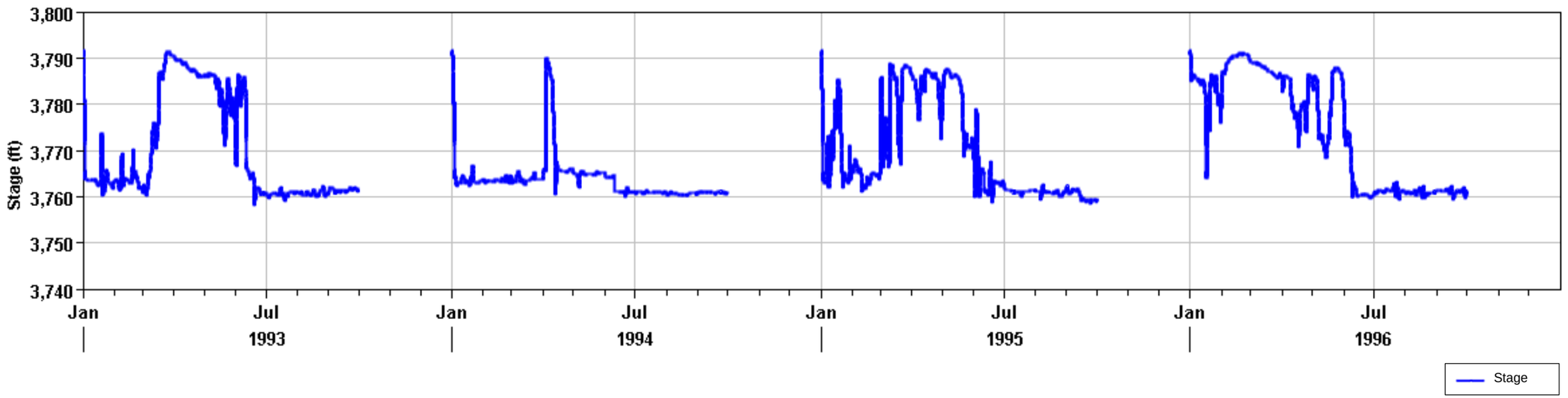


Figure 7: J.C. Boyle Drawdown Stage for years 1993 through 1996

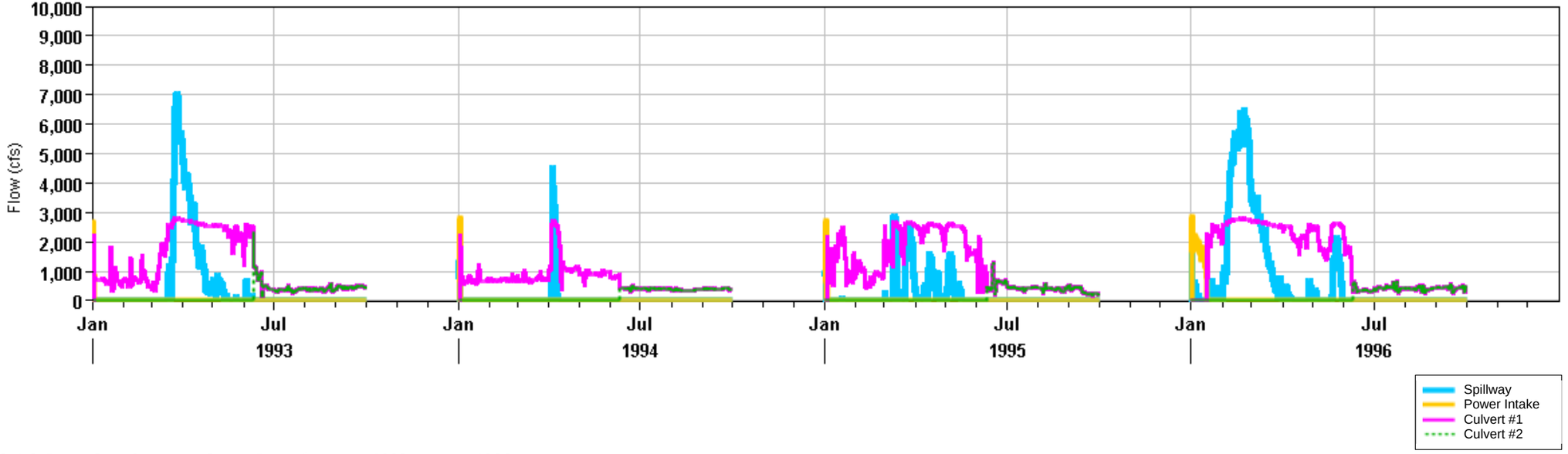


Figure 8: J.C. Boyle Gate Structure Outlet Flows for years 1993 through 1996

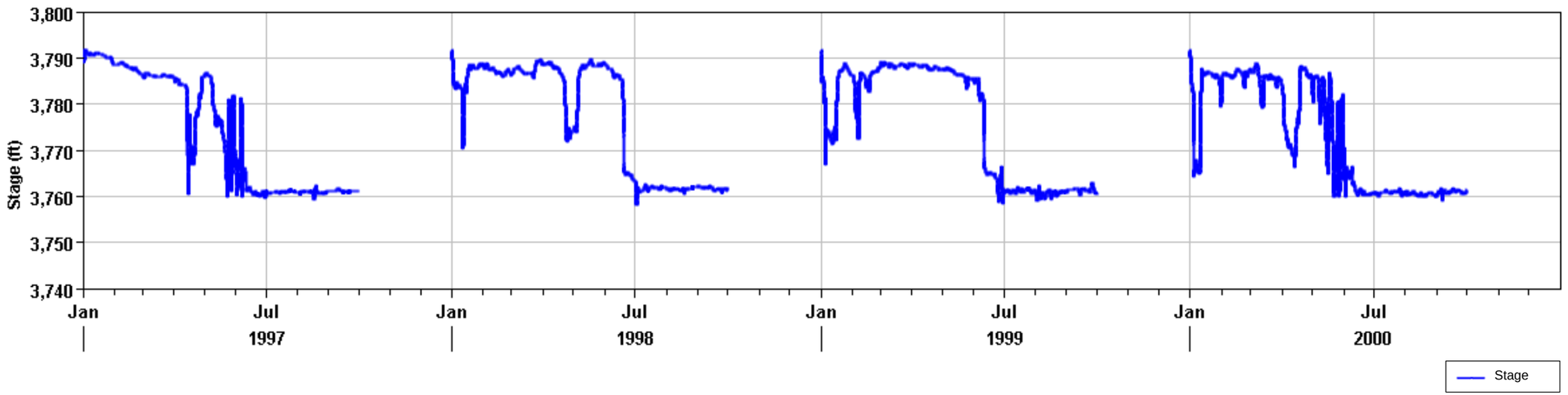


Figure 9: J.C. Boyle Drawdown Stage for years 1997 through 2000

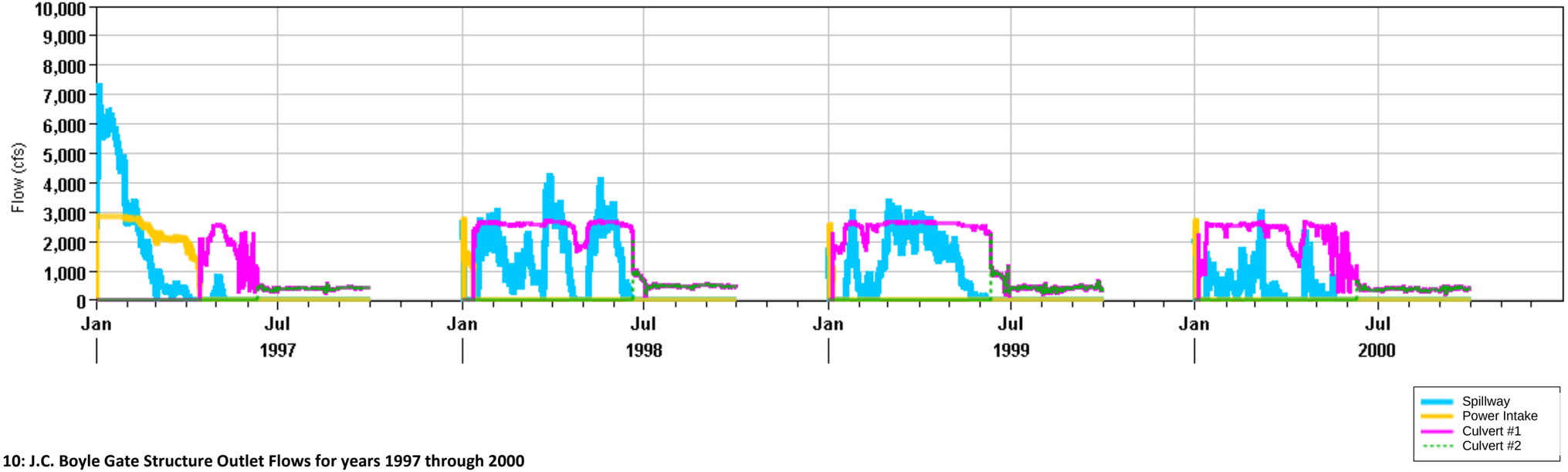


Figure 10: J.C. Boyle Gate Structure Outlet Flows for years 1997 through 2000

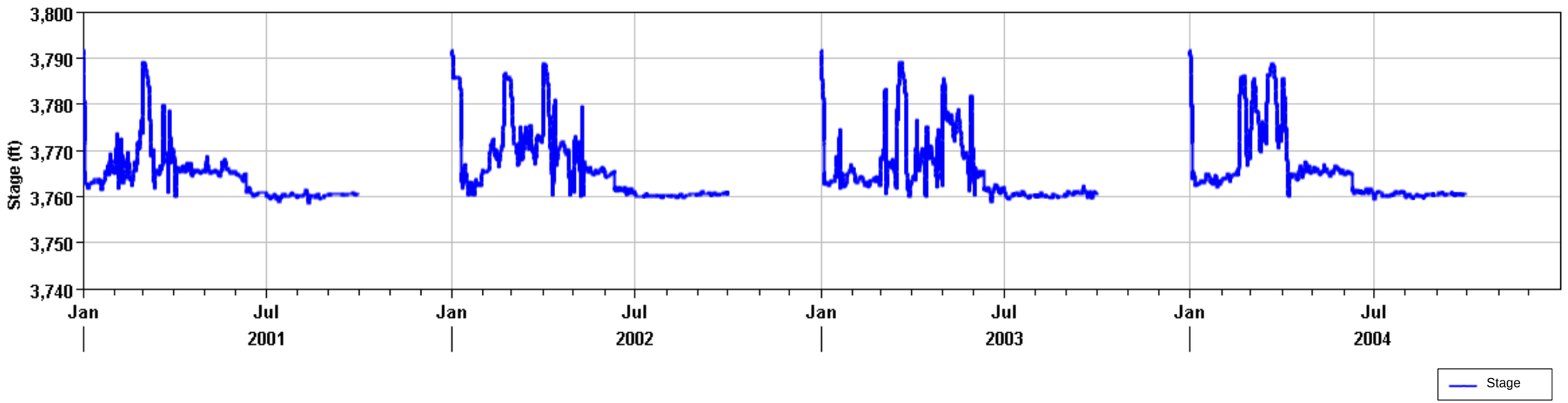


Figure 11: J.C. Boyle Drawdown Stage for years 2001 through 2004

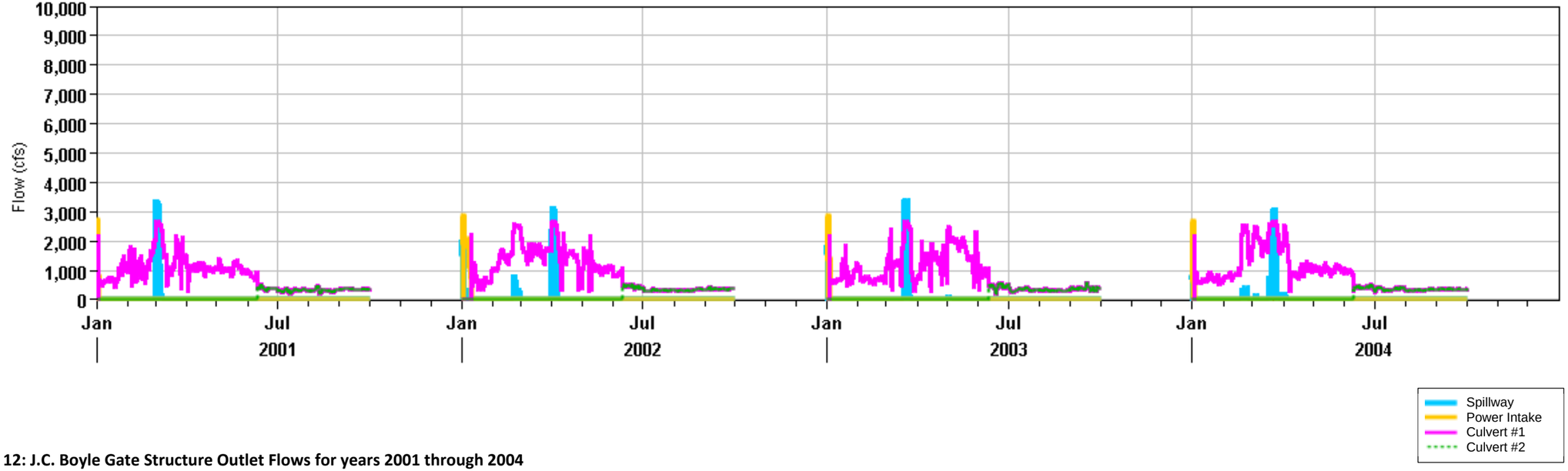


Figure 12: J.C. Boyle Gate Structure Outlet Flows for years 2001 through 2004

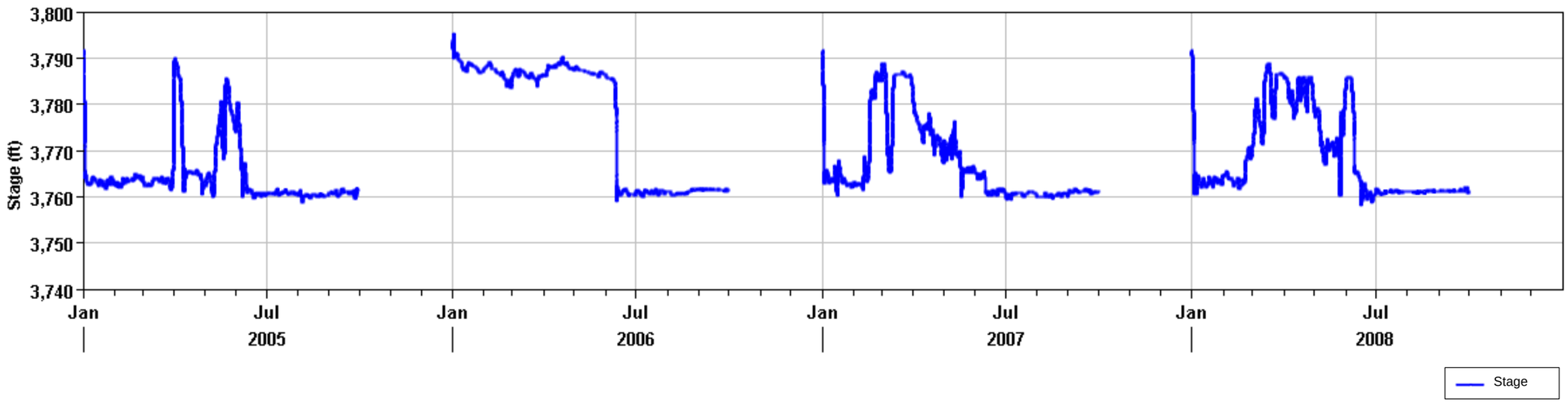


Figure 13: J.C. Boyle Drawdown Stage for years 2005 through 2008

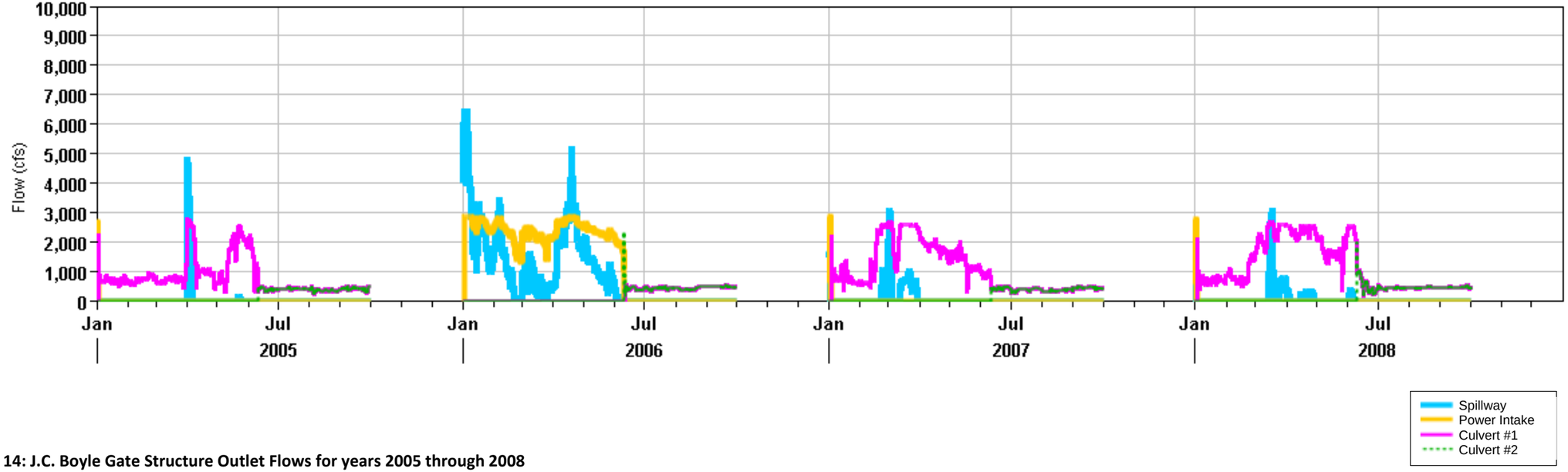


Figure 14: J.C. Boyle Gate Structure Outlet Flows for years 2005 through 2008

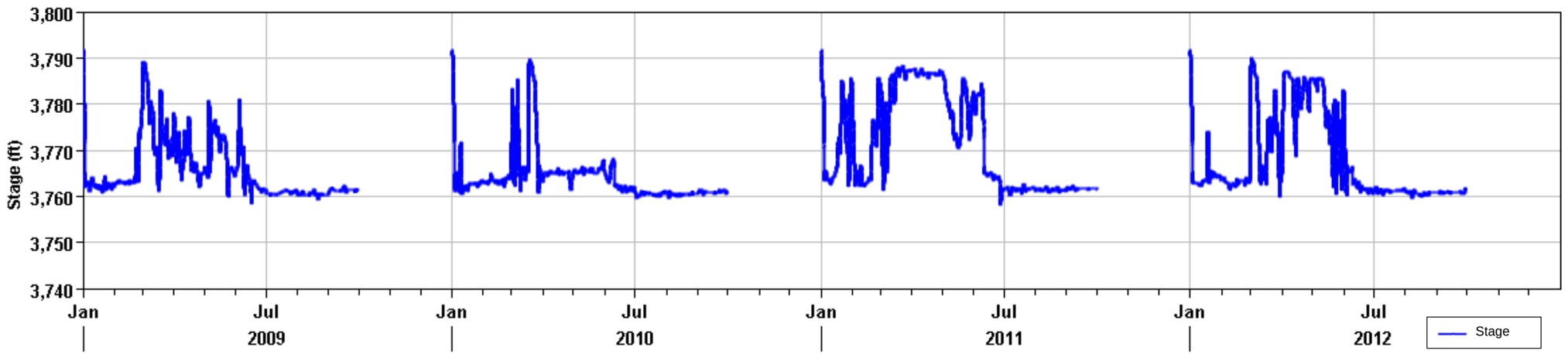


Figure 15: J.C. Boyle Drawdown Stage for years 2009 through 2012

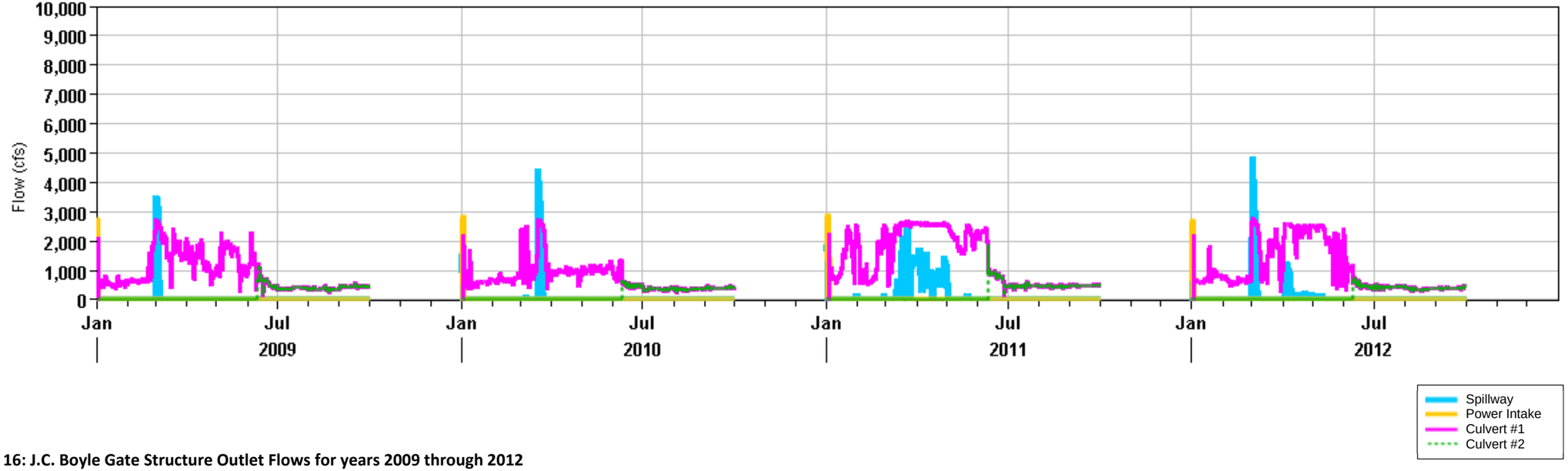


Figure 16: J.C. Boyle Gate Structure Outlet Flows for years 2009 through 2012

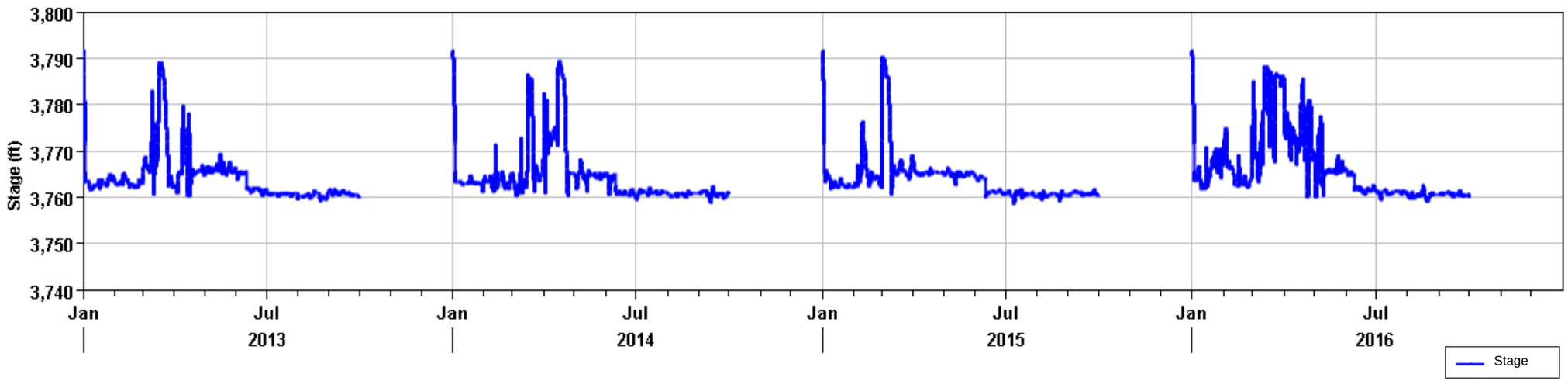


Figure 17: J.C. Boyle Drawdown Stage for years 2013 through 2016

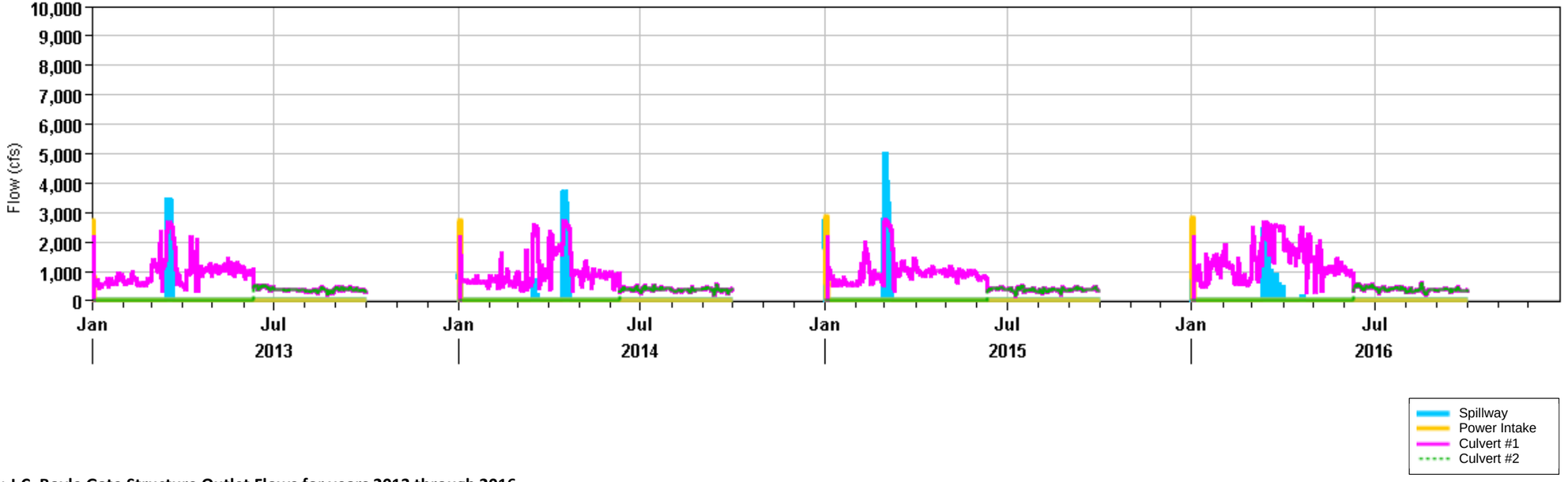
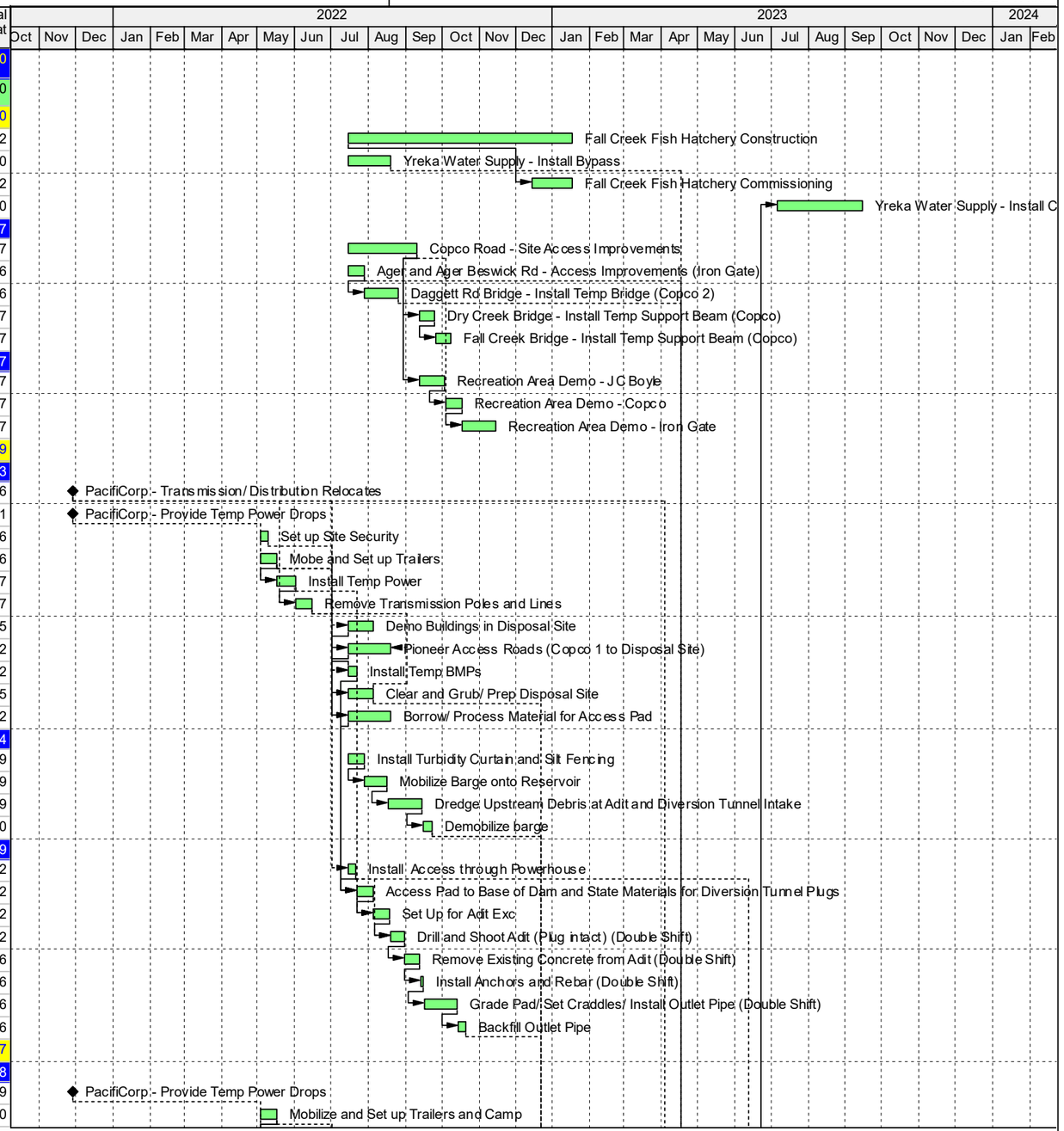


Figure 18: J.C. Boyle Gate Structure Outlet Flows for years 2013 through 2016

Appendix C

Implementation Schedule

Activity ID	Activity Name	Original Duration	Start	Finish	Total Float
Klamath River Reconstruction Project - Implementation Work Sc		356	29-Nov-21	16-Nov-23	0
PRE-DRAWDOWN YEAR		316	29-Nov-21	14-Sep-23	40
Project Wide		230	15-Jul-22	14-Sep-23	40
PW1104	Fall Creek Fish Hatchery Construction	153	15-Jul-22	16-Jan-23	152
PW1010	Yreka Water Supply - Install Bypass	30	15-Jul-22	19-Aug-22	250
PW1114	Fall Creek Fish Hatchery Commissioning	25	15-Dec-22	16-Jan-23	152
PW1184	Yreka Water Supply - Install Cut and Cover	60	06-Jul-23	14-Sep-23	40
Roads and Bridges		73	15-Jul-22	08-Oct-22	197
PW0044	Copco Road - Site Access Improvements	49	15-Jul-22	10-Sep-22	37
PW1003	Ager and Ager Beswick Rd - Access Improvements (Iron Gate)	12	15-Jul-22	28-Jul-22	56
PW1004	Daggett Rd Bridge - Install Temp Bridge (Copco 2)	24	29-Jul-22	25-Aug-22	56
PW1001	Dry Creek Bridge - Install Temp Support Beam (Copco)	12	12-Sep-22	24-Sep-22	197
PW1002	Fall Creek Bridge - Install Temp Support Beam (Copco)	12	26-Sep-22	08-Oct-22	197
Demo Recreation Sites		55	12-Sep-22	14-Nov-22	37
PW1008	Recreation Area Demo - J C Boyle	19	12-Sep-22	03-Oct-22	37
PW1020	Recreation Area Demo - Copco	12	04-Oct-22	17-Oct-22	37
PW1030	Recreation Area Demo - Iron Gate	24	18-Oct-22	14-Nov-22	37
Copco 1		169	29-Nov-21	20-Oct-22	9
Site Prep		116	29-Nov-21	19-Aug-22	53
CO12222	PacifiCorp - Transmission/ Distribution Relocates	0		29-Nov-21*	86
CO12240	PacifiCorp - Provide Temp Power Drops	0		29-Nov-21	181
CO10290	Set up Site Security	6	03-May-22	10-May-22	106
CO10062	Mobe and Set up Trailers	12	03-May-22	17-May-22	76
CO10600	Install Temp Power	12	17-May-22	01-Jun-22	77
CO10620	Remove Transmission Poles and Lines	12	01-Jun-22	15-Jun-22	77
CO10800	Demo Buildings in Disposal Site	18	15-Jul-22	05-Aug-22	65
CO10021	Pioneer Access Roads (Copco 1 to Disposal Site)	30	15-Jul-22	19-Aug-22	52
CO10040	Install Temp BMPs	6	15-Jul-22	22-Jul-22	52
CO10031	Clear and Grub/ Prep Disposal Site	18	15-Jul-22	05-Aug-22	65
CO10700	Borrow/ Process Material for Access Pad	30	15-Jul-22	19-Aug-22	52
Upstream Work		58	15-Jul-22	22-Sep-22	34
CO10030	Install Turbidity Curtain and Silt Fencing	12	15-Jul-22	28-Jul-22	39
CO10010	Mobilize Barge onto Reservoir	16	29-Jul-22	16-Aug-22	39
CO10210	Dredge Upstream Debris at Adit and Diversion Tunnel Intake	24	17-Aug-22	14-Sep-22	39
CO10052	Demobilize barge	6	15-Sep-22	22-Sep-22	120
Downstream Work		83	15-Jul-22	20-Oct-22	9
CO10034	Install Access through Powerhouse	6	15-Jul-22	21-Jul-22	52
CO16010	Access Pad to Base of Dam and State Materials for Diversion Tunnel Plugs	12	22-Jul-22	04-Aug-22	52
CO10380	Set Up for Adit Exc	12	05-Aug-22	18-Aug-22	52
CO10071	Drill and Shoot Adit (Plug intact) (Double Shift)	10	19-Aug-22	30-Aug-22	52
CO10340	Remove Existing Concrete from Adit (Double Shift)	10	31-Aug-22	12-Sep-22	96
CO10360	Install Anchors and Rebar (Double Shift)	3	13-Sep-22	15-Sep-22	96
CO10451	Grade Pad/ Set Craddles/ Install Outlet Pipe (Double Shift)	23	16-Sep-22	13-Oct-22	96
CO11010	Backfill Outlet Pipe	6	14-Oct-22	20-Oct-22	96
Copco 2		159	29-Nov-21	08-Oct-22	197
Access/Site Work		106	29-Nov-21	08-Aug-22	168
CO20521	PacifiCorp - Provide Temp Power Drops	0		29-Nov-21	409
CO20491	Mobilize and Set up Trailers and Camp	12	03-May-22	17-May-22	110

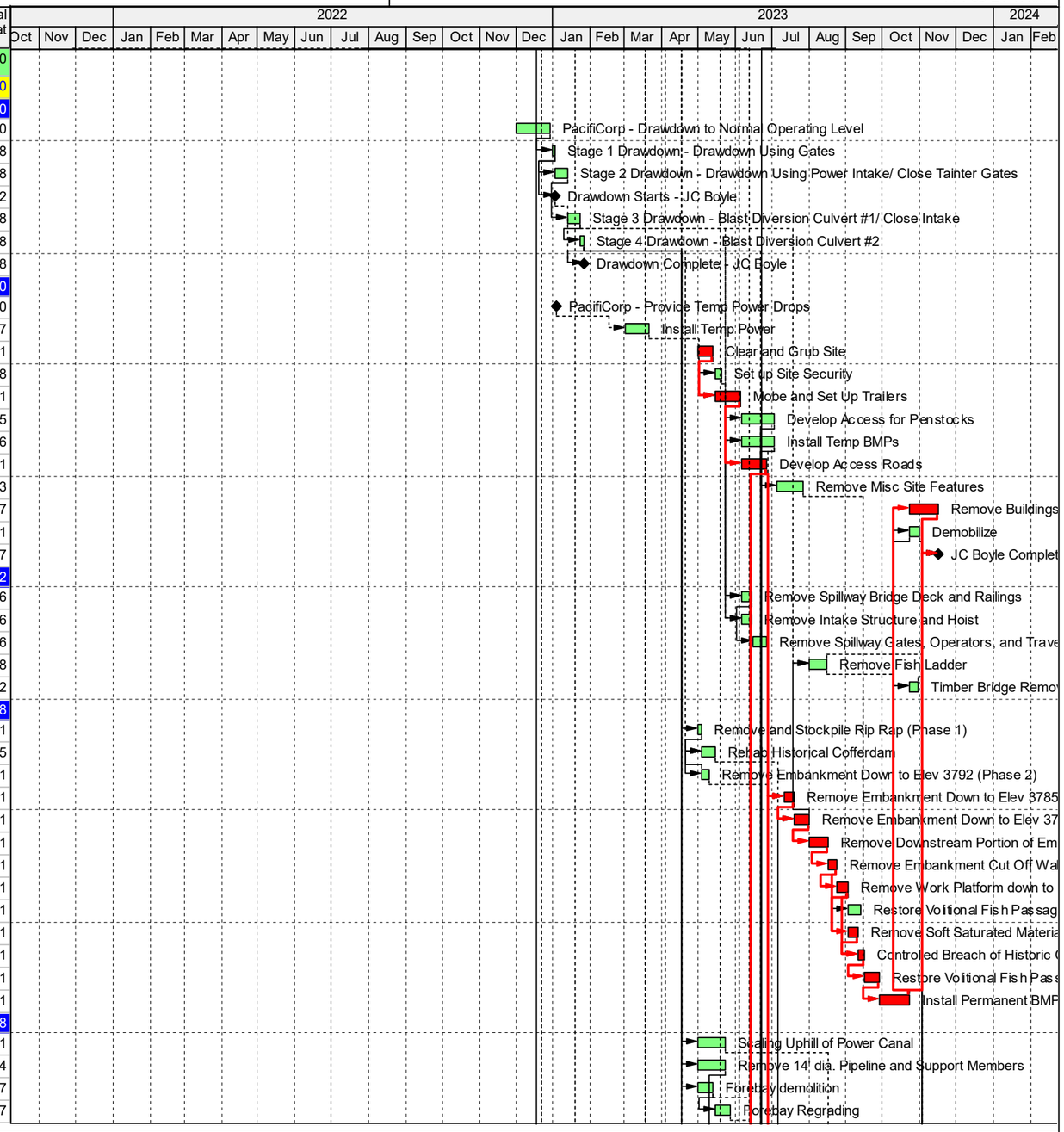


Activity ID	Activity Name	Original Duration	Start	Finish	Total Float
CO20011	Install Temp BMPs	10	17-May-22	28-May-22	110
CO20501	Install Temp Power	10	17-May-22	28-May-22	226
CO20013	Prep Site and Clear and Grub	10	15-Jul-22	27-Jul-22	72
CO20012	Set Up Staging Areas	18	15-Jul-22	05-Aug-22	145
CO20014	Pioneer Access Roads	10	27-Jul-22	08-Aug-22	72
Dam Removal		53	08-Aug-22	08-Oct-22	197
Dry Period #1		25	08-Aug-22	06-Sep-22	203
CO2001	Dry Up Reservoir	1	08-Aug-22	08-Aug-22	79
CO2008	Remove Right Retaining Wall (Double Shift)	2	08-Aug-22	10-Aug-22	147
CO2026	Remove Existing Cofferdam (Double Shift)	5	08-Aug-22	13-Aug-22	223
CO2007	Remove Tainter Gates, Bridge Deck, Hoists (Double Shift)	6	09-Aug-22	15-Aug-22	142
CO2011	Demo Concrete Spillway (Double Shift)	6	09-Aug-22	15-Aug-22	142
CO20541	Refill Reservoir	18	16-Aug-22	06-Sep-22	142
Dry Period #2		28	07-Sep-22	08-Oct-22	197
CO20481	Dry Up Reservoir	1	07-Sep-22	07-Sep-22	79
CO20401	Close Caterpillar Gate	1	08-Sep-22	08-Sep-22	142
CO2004	CIP Plug for Caterpillar Gate (Double Shift)	1	09-Sep-22	09-Sep-22	197
CO20411	Demo and Remove Intake Structure (Double Shift)	3	10-Sep-22	13-Sep-22	197
CO2013	Regrade Right Bank, Remove Access Road, and Grade Area (Double Shift)	6	10-Sep-22	16-Sep-22	216
CO2002	Backfill Intake Structure with Rip Rap (Double Shift)	2	14-Sep-22	15-Sep-22	217
CO20391	Restore Volitional Fish Channel (Downstream of Dam) (Double Shift)	4	14-Sep-22	17-Sep-22	197
CO20551	Refill Reservoir	18	19-Sep-22	08-Oct-22	197
Iron Gate		178	29-Nov-21	25-Nov-22	151
Access/ Site Work		111	29-Nov-21	12-Aug-22	218
IG4000	PacifiCorp - Provide Temp Power Drops	0		29-Nov-21	182
IG2130	Set Up Site Security	6	03-May-22	10-May-22	287
IG0067	Mobe and Setup Trailers	19	03-May-22	24-May-22	68
IG0064	Install Temp BMPs	16	25-May-22	13-Jun-22	268
IG3280	Install Temp Power	16	25-May-22	13-Jun-22	70
IG2140	Install Piping at Fish Facilities	25	15-Jul-22	12-Aug-22	155
IG0051	Build Access Road to Diversion Tunnel and Holding Tanks	18	15-Jul-22	04-Aug-22	27
IG0065	Prep Site and Set Up Staging Areas	16	15-Jul-22	03-Aug-22	227
IG3290	Decommission Holding Ponds	12	15-Jul-22	28-Jul-22	33
Pre-Drawdown Modifications		74	05-Aug-22	25-Nov-22	0
Tunnel Linning		74	05-Aug-22	25-Nov-22	0
IG3050	Mobe Equipment and Set-up	10	05-Aug-22	16-Aug-22	27
IG0001	Close and Secure Hinged Blind Flange	5	17-Aug-22	22-Aug-22	27
IG3060	Demo Weir and Stop Logs/ Water Pump Down (Double Shift)	2	23-Aug-22	24-Aug-22	27
IG3070	Tunnel Inspection Scaling/ Vent/ Utilities/ Temp Support (Double Shift)	10	25-Aug-22	06-Sep-22	27
IG3080	Demo Existing Invert Concrete (double shift)	4	07-Sep-22	10-Sep-22	27
IG3090	Install Anchors for Walls/ invert (double shift)	4	12-Sep-22	15-Sep-22	27
IG3100	Mud Mat (Double Shift)	2	16-Sep-22	17-Sep-22	27
IG3110	Invert Rebar (Double Shift)	2	19-Sep-22	20-Sep-22	27
IG3120	Invert Concrete (Double Shift)	5	21-Sep-22	26-Sep-22	27
IG3130	Wall Rebar (Double Shift)	4	30-Sep-22	04-Oct-22	30
IG0013	Wall Concrete (Double Shift)	14	05-Oct-22	21-Oct-22	30
IG0028	Install Vent Lines (Double Shift)	22	22-Oct-22	17-Nov-22	30
IG3260	Remove Blind Flange (Double Shift)	6	18-Nov-22	25-Nov-22	30

Actual Work
Remaining Work
Critical Remaining Work
◆ Milestone

TASK filters: EXCLUDES MILESTONES, Excludes Permitting.

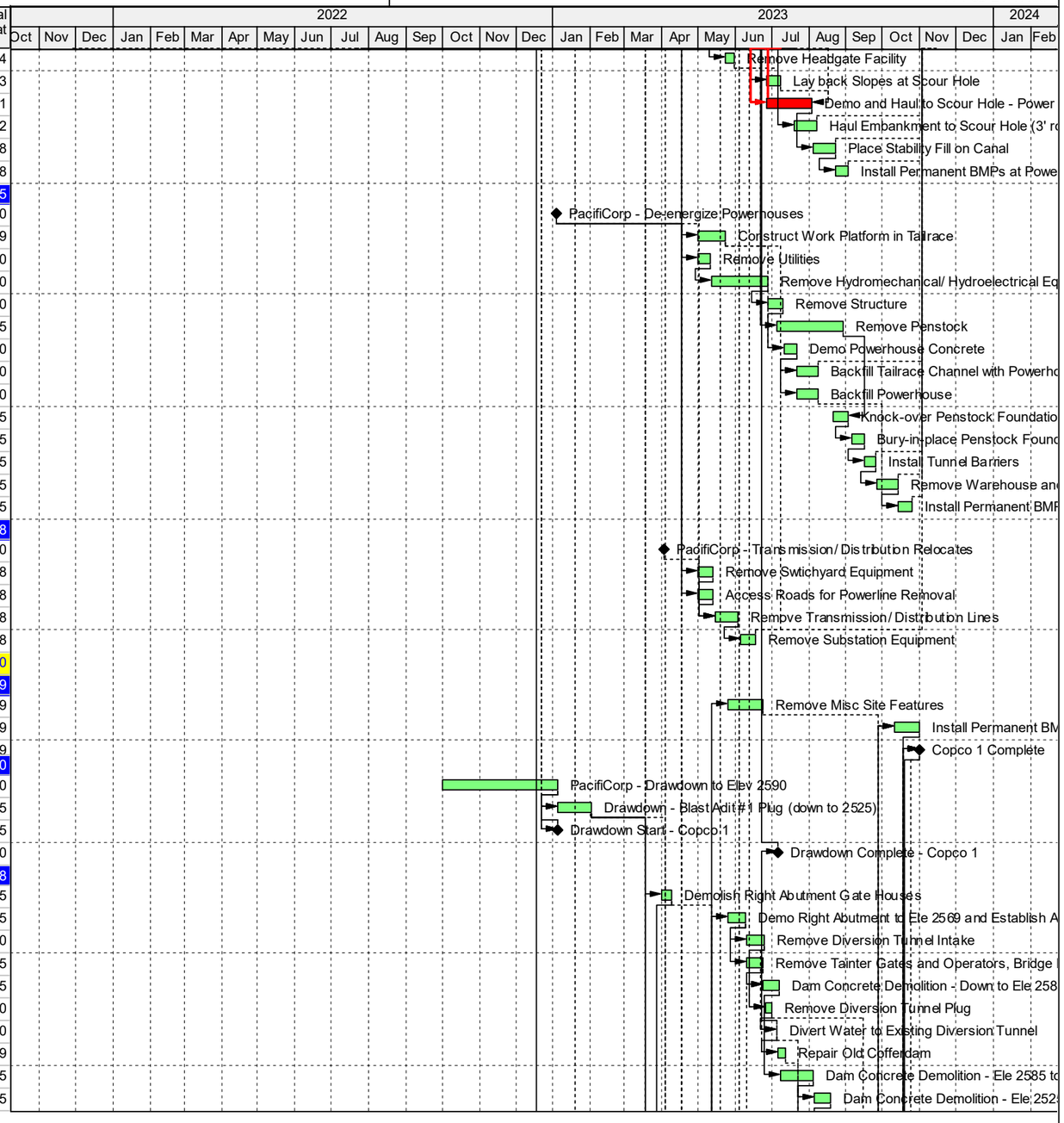
Activity ID	Activity Name	Original Duration	Start	Finish	Total Float
DRAWDOWN YEAR		204	01-Oct-22	16-Nov-23	0
JC Boyle		178	01-Dec-22	16-Nov-23	0
Drawdown		0	01-Dec-22	27-Jan-23	0
JCB1180	PacifiCorp - Drawdown to Normal Operating Level	20	01-Dec-22*	29-Dec-22	0
JCB0017	Stage 1 Drawdown - Drawdown Using Gates	2	01-Jan-23	03-Jan-23	48
JCB1220	Stage 2 Drawdown - Drawdown Using Power Intake/ Close Tainter Gates	10	03-Jan-23	13-Jan-23	48
JCB0082	Drawdown Starts - JC Boyle	0	03-Jan-23		72
JCB1230	Stage 3 Drawdown - Blast Diversion Culvert #1/ Close Intake	10	13-Jan-23	23-Jan-23	48
JCB0019	Stage 4 Drawdown - Blast Diversion Culvert #2	4	23-Jan-23	27-Jan-23	48
JCB1050	Drawdown Complete - JC Boyle	0		27-Jan-23	48
Access/ Site Work		178	03-Jan-23	16-Nov-23	0
JCB1270	PacifiCorp - Provide Temp Power Drops	0		03-Jan-23*	0
JCB1260	Install Temp Power	18	01-Mar-23*	21-Mar-23	47
JCB0057	Clear and Grub Site	12	01-May-23*	13-May-23	1
JCB1060	Set up Site Security	6	15-May-23	20-May-23	18
JCB0056	Mobe and Set Up Trailers	18	15-May-23	05-Jun-23	1
JCB1070	Develop Access for Penstocks	24	06-Jun-23	03-Jul-23	5
JCB0051	Install Temp BMPs	24	06-Jun-23	03-Jul-23	6
JCB0052	Develop Access Roads	18	06-Jun-23	26-Jun-23	1
JCB1190	Remove Misc Site Features	20	05-Jul-23	27-Jul-23	53
JCB1200	Remove Buildings and Storage Sheds at Dam	20	23-Oct-23	16-Nov-23	37
JCB0059	Demobilize	7	23-Oct-23	31-Oct-23	1
JCB0081	JC Boyle Complete	0		16-Nov-23	37
Dam/Intake/Spillway Removal		122	06-Jun-23	30-Oct-23	2
JCB0014	Remove Spillway Bridge Deck and Railings	8	06-Jun-23	14-Jun-23	106
JCB0012	Remove Intake Structure and Hoist	8	06-Jun-23	14-Jun-23	116
JCB0015	Remove Spillway Gates, Operators, and Traveling Hoist	10	15-Jun-23	26-Jun-23	106
JCB0005	Remove Fish Ladder	13	01-Aug-23	16-Aug-23	58
JCB0013	Timber Bridge Removal	6	23-Oct-23	30-Oct-23	2
Embankment Removal		146	01-May-23	23-Oct-23	8
JCB0006	Remove and Stockpile Rip Rap (Phase 1)	3	01-May-23*	03-May-23	51
JCB0003	Rehab Historical Cofferdam	10	04-May-23*	15-May-23	55
JCB1240	Remove Embankment Down to Elev 3792 (Phase 2)	6	04-May-23*	10-May-23	51
JCB0020	Remove Embankment Down to Elev 3785 (Phase 3)	8	11-Jul-23	20-Jul-23	1
JCB1120	Remove Embankment Down to Elev 3775.7 (Phase 4)	10	20-Jul-23*	01-Aug-23	1
JCB1130	Remove Downstream Portion of Embankment down to Bedrock Elev 3738 (Phase	14	01-Aug-23	17-Aug-23	1
JCB0007	Remove Embankment Cut Off Wall	6	17-Aug-23	24-Aug-23	1
JCB1170	Remove Work Platform down to Bedrock (Phase 7)	8	24-Aug-23	02-Sep-23	1
JCB1000	Restore Volitional Fish Passage (Downstream of Historic Cofferdam)	8	02-Sep-23	13-Sep-23	41
JCB1140	Remove Soft Saturated Material	6	02-Sep-23	11-Sep-23	1
JCB0009	Controlled Breach of Historic Cofferdam (down to 3740.7)	5	11-Sep-23	16-Sep-23	1
JCB1150	Restore Volitional Fish Passage (Upstream of Embamkment)	10	16-Sep-23	28-Sep-23	1
JCB1210	Install Permanent BMPs	20	28-Sep-23	23-Oct-23	1
Power Canal Removal		106	01-May-23	02-Sep-23	48
JCB1090	Scaling Uphill of Power Canal	20	01-May-23	23-May-23	61
JCB0024	Remove 14' dia. Pipeline and Support Members	20	01-May-23	23-May-23	114
JCB0029	Forebay demolition	12	01-May-23	13-May-23	37
JCB1010	Forebay Regrading	12	15-May-23	27-May-23	47



Actual Work
Remaining Work
Critical Remaining Work
Milestone

TASK filters: EXCLUDES MILESTONES, Excludes Permitting.

Activity ID	Activity Name	Original Duration	Start	Finish	Total Float
JCB0026	Remove Headgate Facility	5	24-May-23	30-May-23	114
JCB0040	Lay back Slopes at Scour Hole	10	27-Jun-23	08-Jul-23	23
JCB0027	Demo and Haul to Scour Hole - Power Canal Downhill Wall	32	27-Jun-23	03-Aug-23	1
JCB0031	Haul Embankment to Scour Hole (3' rock cover)	15	20-Jul-23	07-Aug-23	72
JCB0028	Place Stability Fill on Canal	16	04-Aug-23	22-Aug-23	48
JCB1100	Install Permanent BMPs at Power Canal and Scour Hole	10	23-Aug-23	02-Sep-23	48
Powerhouse and Penstock Removal		173	03-Jan-23	25-Oct-23	5
JCB1040	PacifiCorp - De-energize Powerhouses	0		03-Jan-23*	0
JCB0034	Construct Work Platform in Tailrace	20	01-May-23	23-May-23	99
JCB0043	Remove Utilities	10	01-May-23*	11-May-23	60
JCB0044	Remove Hydromechanical/ Hydroelectrical Equipment	39	12-May-23	27-Jun-23	60
JCB1020	Remove Structure	10	28-Jun-23	10-Jul-23	60
JCB0022	Remove Penstock	48	05-Jul-23	29-Aug-23	5
JCB0041	Demo Powerhouse Concrete	10	11-Jul-23	21-Jul-23	60
JCB0038	Backfill Tailrace Channel with Powerhouse Concrete and Excavated Alluvial Materi	15	22-Jul-23	08-Aug-23	70
JCB0025	Backfill Powerhouse	15	22-Jul-23	08-Aug-23	60
JCB0023	Knock-over Penstock Foundations	12	21-Aug-23	02-Sep-23	5
JCB0032	Bury-in-place Penstock Foundations	10	05-Sep-23	15-Sep-23	5
JCB0033	Install Tunnel Barriers	8	16-Sep-23	25-Sep-23	5
JCB1030	Remove Warehouse and Buildings	15	26-Sep-23	13-Oct-23	5
JCB1250	Install Permanent BMP	10	14-Oct-23	25-Oct-23	5
Transmission/Distribution		64	03-Apr-23	17-Jun-23	98
JCB1110	PacifiCorp - Transmission/ Distribution Relocates	0		03-Apr-23*	0
JCB0036	Remove Swtichyard Equipment	12	01-May-23*	13-May-23	98
JCB0100	Access Roads for Powerline Removal	12	01-May-23*	13-May-23	98
JCB0042	Remove Transmission/ Distribution Lines	17	15-May-23	03-Jun-23	98
JCB0045	Remove Substation Equipment	12	05-Jun-23	17-Jun-23	98
Copco 1		204	01-Oct-22	31-Oct-23	0
Access/Site Work		132	26-May-23	31-Oct-23	39
CO11000	Remove Misc Site Features	24	26-May-23	23-Jun-23	129
CO11020	Install Permanent BMPs	18	11-Oct-23	31-Oct-23	39
CO10064	Copco 1 Complete	0		31-Oct-23	39
Drawdown		104	01-Oct-22	06-Jul-23	40
CO10018	PacifiCorp - Drawdown to Elev 2590	32	01-Oct-22*	04-Jan-23	0
CO10003	Drawdown - Blast Adit #1 Plug (down to 2525)	10	04-Jan-23	01-Feb-23	15
CO10063	Drawdown Start - Copco 1	0	04-Jan-23		15
CO10260	Drawdown Complete - Copco 1	0	06-Jul-23		40
Dam Removal		160	01-Apr-23	10-Oct-23	18
CO10005	Demolish Right Abutment Gate Houses	6	01-Apr-23	08-Apr-23	65
CO10004	Demo Right Abutment to Ele 2569 and Establish Access	12	26-May-23	09-Jun-23	35
CO10072	Remove Diversion Tunnel Intake	13	10-Jun-23	24-Jun-23	40
CO10002	Remove Tainter Gates and Operators, Bridge Deck and Piers	12	10-Jun-23	23-Jun-23	35
CO10250	Dam Concrete Demolition - Down to Ele 2585	10	24-Jun-23	07-Jul-23	35
CO10240	Remove Diversion Tunnel Plug	6	26-Jun-23	01-Jul-23	40
CO10331	Divert Water to Existing Diversion Tunnel	1	05-Jul-23	05-Jul-23	40
CO10400	Repair Old Cofferdam	6	06-Jul-23	12-Jul-23	79
CO11300	Dam Concrete Demolition - Ele 2585 to Elev 2525	24	08-Jul-23	04-Aug-23	35
CO10300	Dam Concrete Demolition - Ele 2525 to Elev 2511	12	05-Aug-23	18-Aug-23	35



Actual Work
Remaining Work
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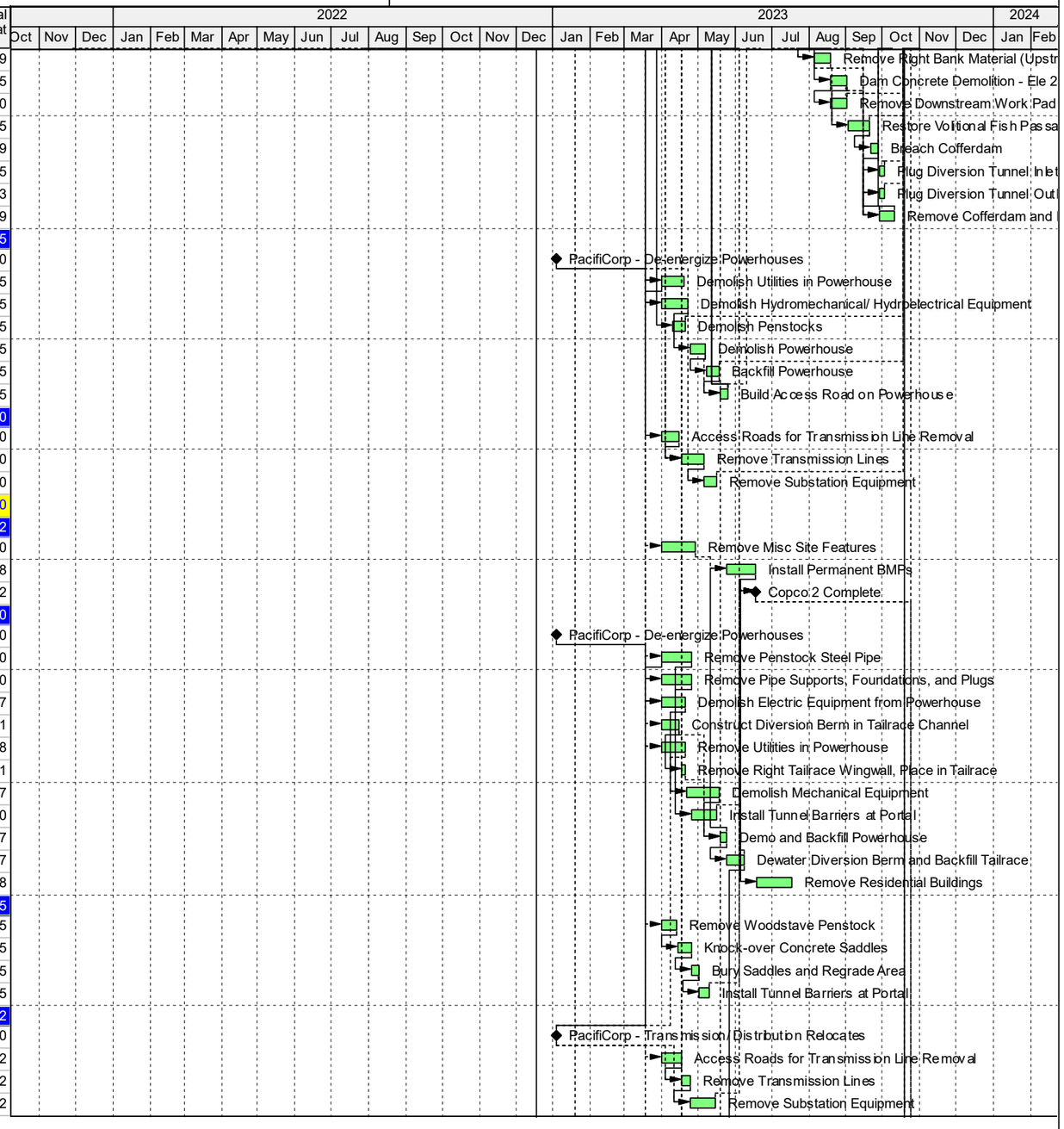
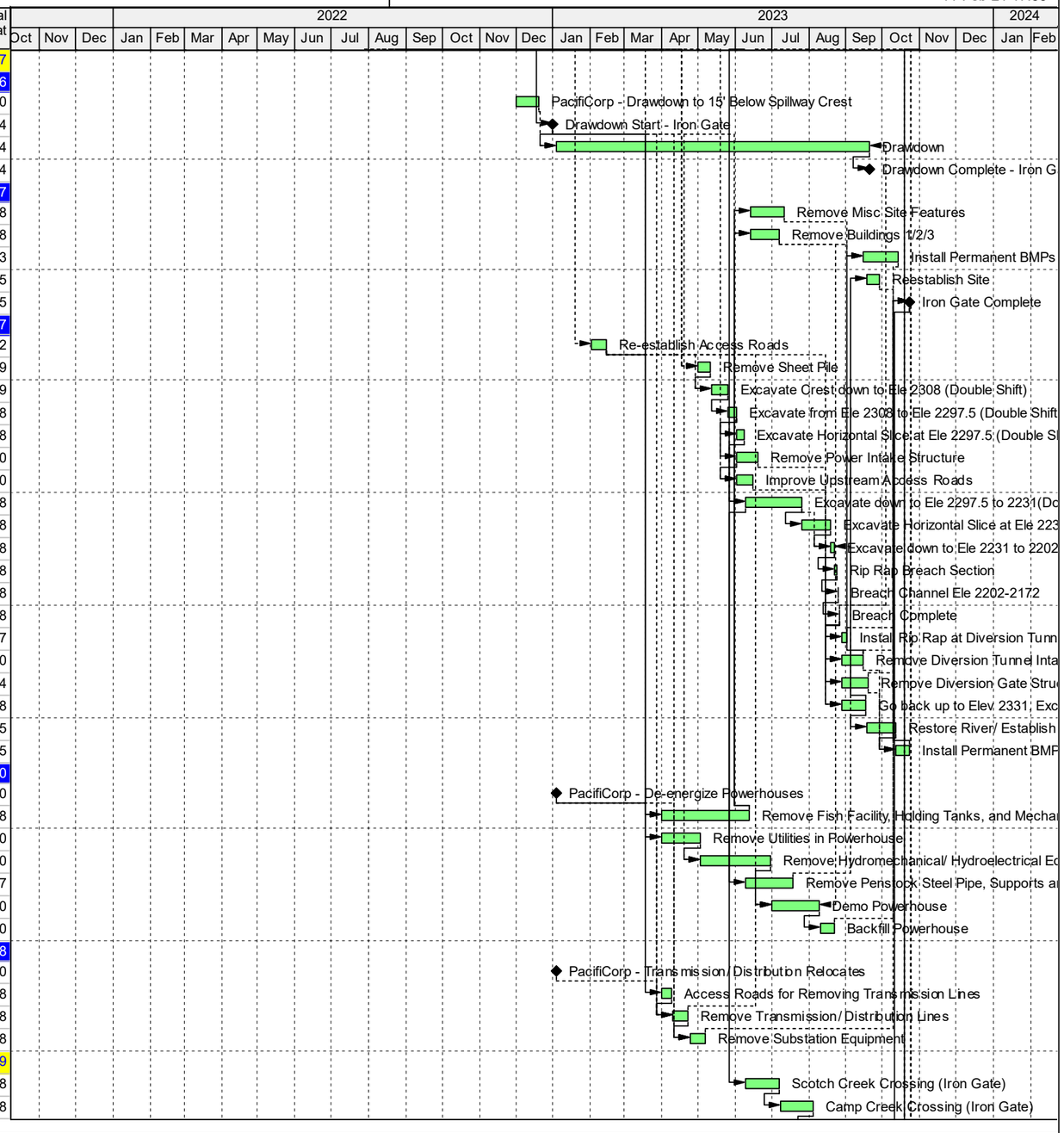
TASK filters: EXCLUDES MILESTONES, Excludes Permitting.

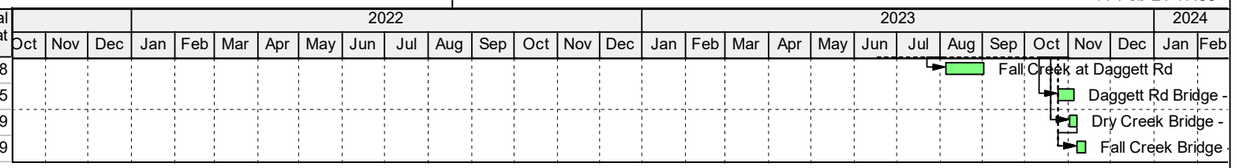
Activity ID	Activity Name	Original Duration	Start	Finish	Total Float
CO10341	Remove Right Bank Material (Upstream of Dam)	12	05-Aug-23	18-Aug-23	59
CO11200	Dam Concrete Demolition - Ele 2511 to Ele 2472	12	19-Aug-23	01-Sep-23	35
CO10017	Remove Downstream Work Pad and Pipe	12	19-Aug-23	01-Sep-23	70
CO10371	Restore Volitional Fish Passage Channel (Downstream of Historical Cofferdam)	15	02-Sep-23	20-Sep-23	35
CO11800	Breach Cofferdam	6	21-Sep-23	27-Sep-23	39
CO11030	Plug Diversion Tunnel Inlet	4	28-Sep-23	02-Oct-23	45
CO10019	Plug Diversion Tunnel Outlet	4	28-Sep-23	02-Oct-23	63
CO10351	Remove Cofferdam and Historical Construction, Volitional Fish Passage Upstream	10	28-Sep-23	10-Oct-23	39
Powerhouse and Penstock Removal		46	03-Jan-23	25-May-23	35
CO12230	PacifiCorp - De-energize Powerhouses	0		03-Jan-23*	0
CO10051	Demolish Utilities in Powerhouse	15	01-Apr-23	19-Apr-23	35
CO10053	Demolish Hydromechanical/ Hydroelectrical Equipment	18	01-Apr-23	22-Apr-23	35
CO10006	Demolish Penstocks	10	10-Apr-23	20-Apr-23	65
CO10007	Demolish Powerhouse	12	24-Apr-23	06-May-23	35
CO10022	Backfill Powerhouse	10	08-May-23	18-May-23	35
CO10390	Build Access Road on Powerhouse	6	19-May-23	25-May-23	35
Transmission/Distribution		38	01-Apr-23	16-May-23	140
CO10220	Access Roads for Transmission Line Removal	12	01-Apr-23	15-Apr-23	140
CO10054	Remove Transmission Lines	17	17-Apr-23	05-May-23	140
CO10055	Remove Substation Equipment	9	06-May-23	16-May-23	140
Copco 2 (Could Happen as Early as Pre-Drawdown Year)		88	03-Jan-23	17-Jul-23	90
Site		66	01-Apr-23	17-Jun-23	152
CO20421	Remove Misc Site Features	24	01-Apr-23*	28-Apr-23	160
CO20441	Install Permanent BMPs	20	25-May-23	17-Jun-23	138
CO2081	Copco 2 Complete	0		17-Jun-23	152
Powerhouse and Penstock Removal		88	03-Jan-23	17-Jul-23	90
CO20531	PacifiCorp - De-energize Powerhouses	0		03-Jan-23*	0
CO20190	Remove Penstock Steel Pipe	20	01-Apr-23*	25-Apr-23	140
CO20110	Remove Pipe Supports, Foundations, and Plugs	20	01-Apr-23	25-Apr-23	140
CO20051	Demolish Electric Equipment from Powerhouse	16	01-Apr-23*	20-Apr-23	97
CO20112	Construct Diversion Berm in Tailrace Channel	12	01-Apr-23*	15-Apr-23	121
CO20471	Remove Utilities in Powerhouse	15	01-Apr-23*	20-Apr-23	98
CO20010	Remove Right Tailrace Wingwall, Place in Tailrace	4	17-Apr-23	20-Apr-23	121
CO20053	Demolish Mechanical Equipment	24	21-Apr-23	18-May-23	97
CO20111	Install Tunnel Barriers at Portal	18	26-Apr-23	16-May-23	140
CO20113	Demo and Backfill Powerhouse	5	19-May-23	24-May-23	97
CO20114	Dewater Diversion Berm and Backfill Tailrace	12	25-May-23	08-Jun-23	97
CO20431	Remove Residential Buildings	24	19-Jun-23	17-Jul-23	138
Wood Stave Penstock Removal		33	01-Apr-23	10-May-23	145
CO2014	Remove Woodstave Penstock	10	01-Apr-23*	13-Apr-23	145
CO2016	Knock-over Concrete Saddles	10	14-Apr-23	25-Apr-23	145
CO2017	Bury Saddles and Regrade Area	5	26-Apr-23	01-May-23	145
CO2018	Install Tunnel Barriers at Portal	8	02-May-23	10-May-23	145
Transmission/Distribution		36	03-Jan-23	15-May-23	142
CO20511	PacifiCorp - Transmission/ Distribution Relocates	0		03-Jan-23*	0
CO20230	Access Roads for Transmission Line Removal	12	01-Apr-23*	17-Apr-23	142
CO20052	Remove Transmission Lines	6	17-Apr-23	24-Apr-23	142
CO20054	Remove Substation Equipment	18	24-Apr-23	15-May-23	142



Activity ID	Activity Name	Original Duration	Start	Finish	Total Float
Iron Gate		171	01-Dec-22	23-Oct-23	7
Drawdown		142	01-Dec-22	19-Sep-23	36
IG2000	PacifiCorp - Drawdown to 15' Below Spillway Crest	16	01-Dec-22*	20-Dec-22	0
IG0040	Drawdown Start - Iron Gate	0	01-Jan-23		14
IG0003	Drawdown	218	03-Jan-23	19-Sep-23	84
IG2110	Drawdown Complete - Iron Gate	0		19-Sep-23	84
Access/Site Work		111	13-Jun-23	23-Oct-23	7
IG1000	Remove Misc Site Features	24	13-Jun-23	11-Jul-23	108
IG0050	Remove Buildings 1/2/3	20	13-Jun-23	07-Jul-23	88
IG1020	Install Permanent BMPs	24	15-Sep-23	13-Oct-23	53
IG3160	Reestablish Site	10	18-Sep-23	28-Sep-23	65
IG0070	Iron Gate Complete	0		23-Oct-23	45
Embankment Removal		171	01-Feb-23	23-Oct-23	7
IG0033	Re-establish Access Roads	12	01-Feb-23*	14-Feb-23	112
IG0021	Remove Sheet Pile	10	01-May-23*	11-May-23	39
IG4030	Excavate Crest down to Ele 2308 (Double Shift)	12	12-May-23*	25-May-23	39
IG0022	Excavate from Ele 2308 to Ele 2297.5 (Double Shift)	5	26-May-23*	01-Jun-23	38
IG4040	Excavate Horizontal Slice at Ele 2297.5 (Double Shift)	6	02-Jun-23	08-Jun-23	38
IG3230	Remove Power Intake Structure	15	02-Jun-23	19-Jun-23	100
IG2150	Improve Upstream Access Roads	12	02-Jun-23	15-Jun-23	100
IG0024	Excavate down to Ele 2297.5 to 2231(Double Shift)	38	09-Jun-23*	25-Jul-23	38
IG4050	Excavate Horizontal Slice at Ele 2231(Double Shift)	21	26-Jul-23*	18-Aug-23	38
IG0025	Excavate down to Ele 2231 to 2202 (Double Shift)	2	19-Aug-23*	21-Aug-23	38
IG3190	Rip Rap Breach Section	3	22-Aug-23	24-Aug-23	38
IG4010	Breach Channel Ele 2202-2172	1	25-Aug-23	25-Aug-23	38
IG4020	Breach Complete	1	26-Aug-23	26-Aug-23	38
IG0080	Install Rip Rap at Diversion Tunnel Intake Structure	5	28-Aug-23	01-Sep-23	87
IG0004	Remove Diversion Tunnel Intake Structure	15	28-Aug-23	14-Sep-23	40
IG0020	Remove Diversion Gate Structure	18	28-Aug-23	18-Sep-23	64
IG3270	Go back up to Elev 2331, Exc Elev 2331 to 2164 (Remaining Embankment)	17	28-Aug-23	16-Sep-23	38
IG3210	Restore River/ Establish Volitional Fish Passage	20	18-Sep-23	11-Oct-23	45
IG3200	Install Permanent BMPs	10	12-Oct-23	23-Oct-23	45
Powerhouse/ Fish Facility Removal (Could Happen as Early as January Drawdown Year)		118	03-Jan-23	21-Aug-23	60
IG3020	PacifiCorp - De-energize Powerhouses	0		03-Jan-23*	0
IG0007	Remove Fish Facility, Holding Tanks, and Mechanical	60	01-Apr-23	12-Jun-23	88
IG0061	Remove Utilities in Powerhouse	26	01-Apr-23	02-May-23	60
IG0062	Remove Hydromechanical/ Hydroelectrical Equipment	50	03-May-23	30-Jun-23	60
IG0031	Remove Penstock Steel Pipe, Supports and Foundations	32	09-Jun-23	18-Jul-23	67
IG0032	Demo Powerhouse	32	01-Jul-23	09-Aug-23	60
IG0036	Backfill Powerhouse	10	10-Aug-23	21-Aug-23	60
Transmission/Distribution		30	03-Jan-23	06-May-23	148
IG3010	PacifiCorp - Transmission/ Distribution Relocates	0		03-Jan-23*	0
IG0210	Access Roads for Removing Transmission Lines	6	01-Apr-23	08-Apr-23	118
IG0054	Remove Transmission/ Distribution Lines	12	10-Apr-23	22-Apr-23	118
IG0063	Remove Substation Equipment	12	24-Apr-23	06-May-23	148
Project Wide		131	09-Jun-23	13-Nov-23	39
PW0042	Scotch Creek Crossing (Iron Gate)	24	09-Jun-23	07-Jul-23	98
PW1074	Camp Creek Crossing (Iron Gate)	24	08-Jul-23	04-Aug-23	98



Activity ID	Activity Name	Original Duration	Start	Finish	Total Float
PW1174	Fall Creek at Daggett Rd	24	05-Aug-23	01-Sep-23	98
PW1051	Daggett Rd Bridge - Remove Temp Bridge (Copco 2)	11	24-Oct-23	04-Nov-23	45
PW1054	Dry Creek Bridge - Remove Temp Bridge Support (Copco 1)	5	01-Nov-23	06-Nov-23	39
PW1053	Fall Creek Bridge - Remove Temp Bridge Support (Copco 1)	5	07-Nov-23	13-Nov-23	39



Appendix D

Consultation Record

Consultation Record

Reservoir Drawdown and Diversion Plan			
Sub-Plan	**Agency**	**Date of Agency Plan Submittal**	**Agency Comments Received Date**
Oregon Reservoir Drawdown and Diversion Plan	Oregon Department of Environmental Quality	January 20,2021 August 11, 2021	February 5, 2021 August 31, 2021
	Oregon Department of Fish and Wildlife	January 20,2021 August 11, 2021	February 6, 2021 September 7, 2021
	Bureau of Land Management – Klamath Falls	February 25, 2021 August 11, 2021	April 15, 2021 No Comments Received
California Reservoir Drawdown and Diversion Plan	California State Water Resources Control Board	January 20,2021 August 11, 2021	February 5, 2021 August 25, 2021
	California Department of Fish and Wildlife	January 20,2021 August 11, 2021	April 16, 2021 August 25, 2021
	California Department of Water Resources	August 11, 2021	September 9, 2021
California Slope Stability and Monitoring Plan	California State Water Resources Control Board	January 20,2021 August 11, 2021	February 5, 2021 August 25, 2021
	California Department of Fish and Wildlife	January 20,2021 August 11, 2021	No Comments Received August 25, 2021
	California Department of Water Resources	August 11, 2021	September 9, 2021