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# 2021 Fish Passage Plan

## Chapter 4 – John Day Dam

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<b>John Day Dam *</b>	
<b>Project Acronym</b>	JDA
<b>River Mile (RM)</b>	Columbia River – RM 215.6
<b>Reservoir</b>	Lake Umatilla
<b>Minimum Instantaneous Flow (kcfs)</b>	Dec–Feb: 12.5 kcfs \ Mar–Nov: 50 kcfs
<b>Forebay Normal Operating Range (ft)</b>	Nov–Jun: 260'–265' \ Jul–Oct: 265'–268'
<b>Tailrace Rate of Change Limit (ft)</b>	3'/hr
<b>Powerhouse Length (ft)</b>	1,975'
<b>Powerhouse Hydraulic Capacity (kcfs)</b>	322 kcfs
<b>Turbine Units (#)</b>	16 (Units 1-16 BLH Kaplan)
<b>Turbine Generating Capacity (MW)</b>	Rated: 2,160 MW (135 MW/unit) \ Maximum: 2,480 MW (155 MW/unit)
<b>Gatewell Orifice Diameter (in)</b>	One 14" orifice per gatewell (3 per unit) = 48 total
<b>Spillway Length (ft)</b>	1,228'
<b>Spillway Hydraulic Capacity (kcfs)</b>	2,250 kcfs
<b>Spillbays (#)</b>	20
<b>Spillway Weirs (#)</b>	2 Temporary Spillway Weirs (TSW) Bays 18, 19
<b>Navigation Lock Length x Width (ft)</b>	650' x 86'
<b>Navigation Lock Max. Lift (ft)</b>	113'

\* More information is available on the Corps Portland District website for John Day Dam at:  
[www.nwp.usace.army.mil/Locations/Columbia-River/John-Day/](http://www.nwp.usace.army.mil/Locations/Columbia-River/John-Day/)

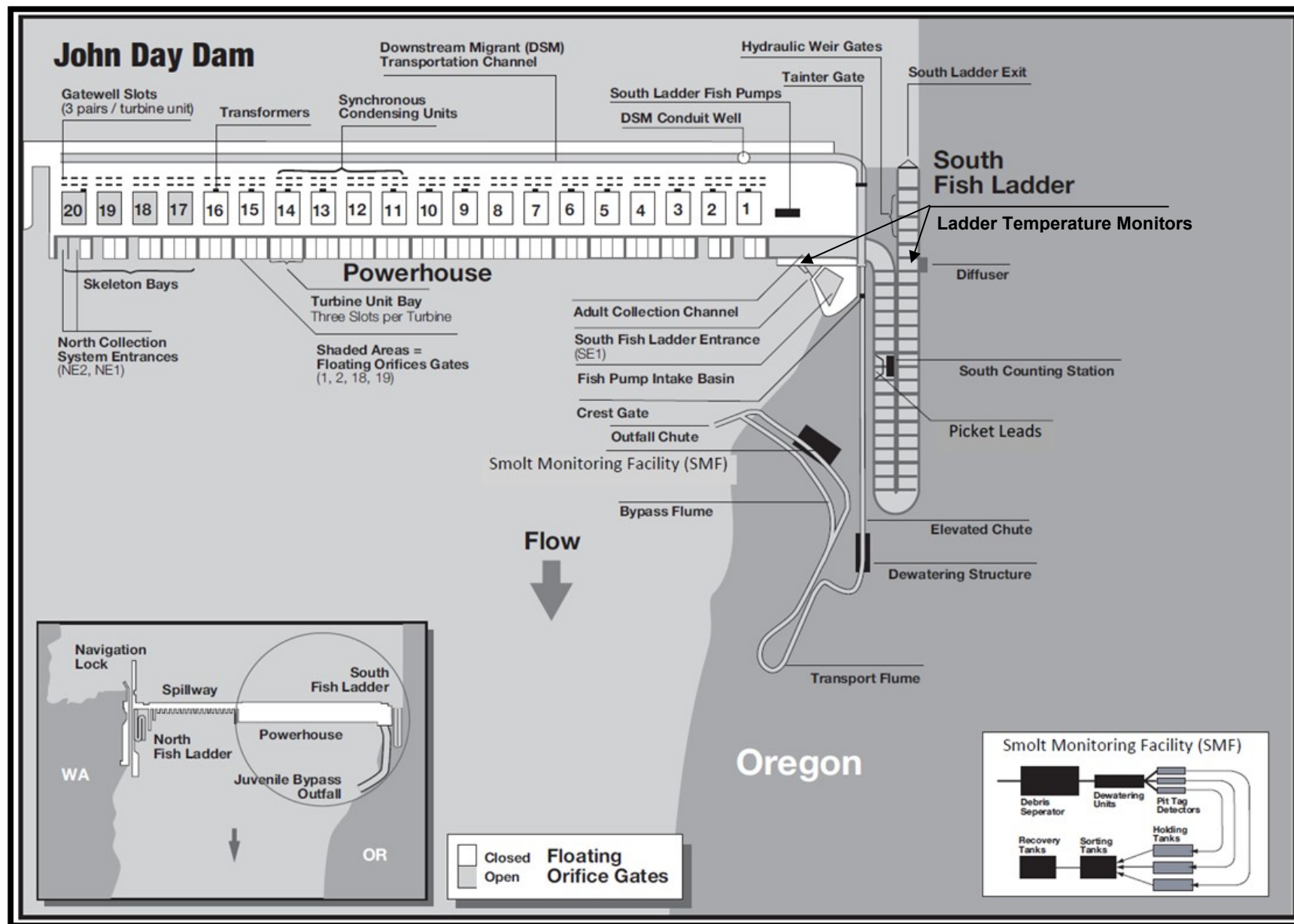


Figure JDA-1. John Day Dam South Fish Ladder, Powerhouse Collection System, and Juvenile Bypass System.

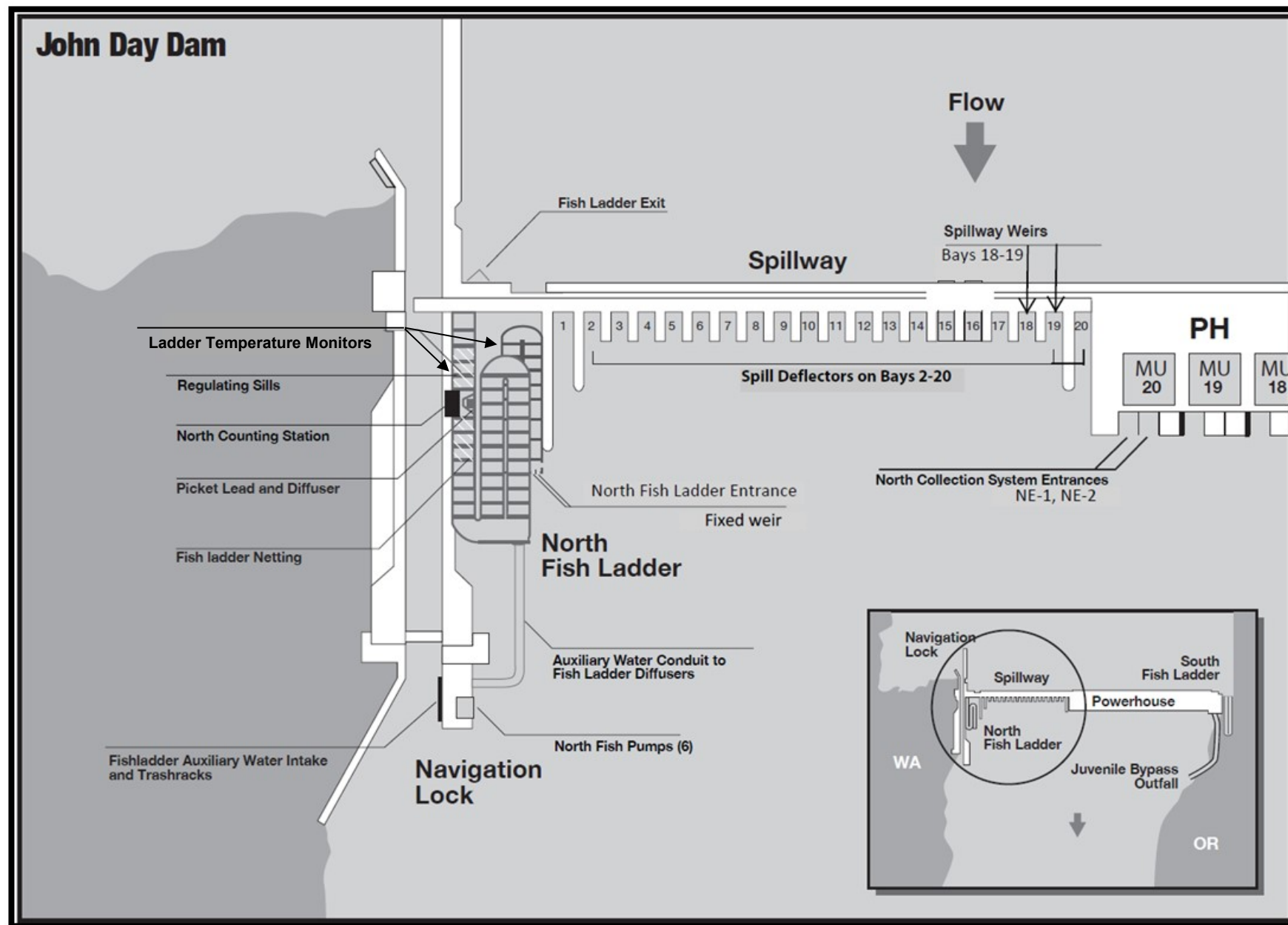


Figure JDA-2. John Day Dam Spillway and North Fish Ladder.

**Table JDA-1. John Day Dam Schedule of Operations and Actions Defined in the 2021 Fish Passage Plan.**

Task Name	Start	End	FPP Section	2021												2022		
				Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
<b>FISH PASSAGE FACILITIES</b>	<b>Mon 3/1/21</b>	<b>Thu 3/31/22</b>																
Adult Facilities - Fish Passage Season	Mon 3/1/21	Tue 11/30/21	2.4.2															
Adult Facilities - Winter Maintenance	Tue 11/30/21	Sun 2/27/22	2.4.1															
Juvenile Facilities - Fish Passage Season	Thu 4/1/21	Tue 11/30/21	2.3.2															
Juvenile Facilities - Winter Maintenance	Mon 3/1/21	Wed 3/31/21	2.3.1															
	Wed 12/1/21	Thu 3/31/22																
<b>PROJECT OPERATIONS FOR FISH PASSAGE</b>	<b>Mon 3/1/21</b>	<b>Wed 12/15/21</b>																
Turbine unit priority order	Mon 3/1/21	Tue 11/30/21	Table JDA-6															
STS Operation for Juveniles	Thu 4/1/21	Tue 11/30/21	2.3.2.1															
STS Operation for Adult Fallbacks	Wed 12/1/21	Wed 12/15/21																
Turbine unit 1% operating range	Sat 4/10/21	Tue 8/31/21	4.2															
TSW Operation	Sat 4/10/21	Tue 8/31/21	2.3.2.16															
Spring Spill	Sat 4/10/21	Tue 6/15/21	Appendix E															
Avian Wires installed NLT April 10	Sat 4/10/21	Sat 4/10/21	Appendix L															
Avian Hazing	Sat 4/10/21	Sat 7/31/21	Appendix L															
Summer Spill	Wed 6/16/21	Tue 8/31/21	Appendix E															
Spillbay 2 for adult attraction	Sun 8/15/21	Tue 11/30/21	2.2.3															
<b>TDG MONITORING</b>	<b>Mon 3/1/21</b>	<b>Mon 2/28/22</b>	<b>2.2.2</b>															
TDG Monitoring - Tailrace (year-round)	Mon 3/1/21	Mon 2/28/22																
TDG Monitoring - Forebay	Thu 4/1/21	Tue 8/31/21																
<b>ADULT FISH COUNTING</b>	<b>Thu 4/1/21</b>	<b>Sun 10/31/21</b>	<b>Table JDA-3</b>															
Day Visual 0500-2100 PDT	Thu 4/1/21	Sun 10/31/21																
Night Video 2100-0500 PDT	Tue 6/15/21	Thu 9/30/21																
<b>REPORTS</b>	<b>Mon 3/1/21</b>	<b>Mon 2/28/22</b>	<b>3.3</b>															
Weekly Reports (year-round)	Mon 3/1/21	Mon 2/28/22																
Annual Report due NLT Jan 31	Mon 1/31/22	Mon 1/31/22																
<b>SPECIAL OPERATIONS</b>	<b>Sat 4/10/21</b>	<b>Tue 6/1/21</b>	<b>Appendix A</b>															
Blalock Island Operation	Sat 4/10/21	Tue 6/1/21																

## **1. FISH PASSAGE INFORMATION**

Fish passage facilities at John Day Lock & Dam are shown in **Figures JDA-1** and **JDA-2**. The annual schedule of project operations, maintenance, and other actions that are described in the Fish Passage Plan (FPP) and Appendices is in **Table JDA-1**.

### **1.1. Juvenile Fish Facilities and Migration Timing**

**1.1.1. Juvenile Facilities.** The Juvenile Bypass System (JBS) at John Day Dam was completed in 1987 and the Smolt Monitoring Facility (SMF) was completed in 1998. Maintenance of juvenile fish facilities is scheduled from approximately December 16 through March 31 to minimize impact on downstream migrants and reduce the possibility of adult fallbacks through turbine units. During this time, the JBS will be dewatered.

**1.1.2.** Each of the project's 16 turbine units include one vertical barrier screen (VBS), one submersible traveling screen (STS), and three 14"-diameter orifices (one per gatewell).

**1.1.3.** During SMF juvenile fish sampling, flow with collected fish from the SMF is sent over the crest gate and down an elevated chute to the dewatering structure that reduces flow to 30 cubic feet per second (cfs) before entering the transport flume. A switch gate diverts fish to either the SMF or directly to the outfall (emergency bypass only). Fish diverted for sampling pass a fish/debris separator that directs debris and adult fish into a separate flume to the outfall. Juvenile fish are interrogated by PIT-tag detectors and diverted either to the SMF for sampling or the outfall. When the SMF is not in operation, the bypass collection conduit connects to a transport channel that carries fish to the tailrace (bypass mode). The differential between the forebay and bypass conduit is controlled by the tainter gate.

**1.1.4. Juvenile Migration Timing & Counting.** Juvenile salmonid passage timing at John Day Dam has been determined by gatewell and SMF sampling (**Table JDA-2**). Sample collection will continue through September 15 and PIT-tag interrogation will continue through November 30 (weather permitting). The JBS will operate through December 15. Bull trout, lamprey, juvenile sturgeon, and non-listed fish are recorded as by-catch in the SMF report.

**1.1.5.** Results to-date of ongoing research show significant daytime passage during daytime operations. Juvenile fish passage increases dramatically at dusk and peaks around 2300–2400 hours with a long period of elevated passage until dawn when passage decreases. Gatewell sampling data<sup>1</sup> indicate that roughly 80% of juvenile migrants pass John Day Dam between 2100 and 0600 hours. During the peak spring juvenile migration period at John Day Dam, 40% of spring Chinook and steelhead passage occurred between 0700 and 2200 hours.

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<sup>1</sup> Data are for powerhouse passage only. Recent radio-tracking and hydroacoustic data indicate different passage patterns for the spillway and project when spill is occurring 24 hours/day.

**Table JDA-2. Juvenile Salmonid Passage Timing at John Day Dam for Most Recent 10 Years (based on daily & yearly collection data).\***

Year	10%	50%	90%	# Days	10%	50%	90%	# Days
	Yearling Chinook				Subyearling Chinook			
<b>2011</b>	2-May	17-May	28-May	27	16-Jun	14-Jul	3-Aug	49
<b>2012</b>	27-Apr	6-May	22-May	26	27-Jun	13-Jul	29-Jul	33
<b>2013</b>	27-Apr	12-May	24-May	28	20-Jun	3-Jul	15-Jul	26
<b>2014</b>	28-Apr	9-May	24-May	27	21-Jun	5-Jul	20-Jul	30
<b>2015</b>	20-Apr	13-May	24-May	35	10-Jun	23-Jun	30-Jun	21
<b>2016</b>	18-Apr	30-Apr	10-May	23	13-Jun	29-Jun	7-Jul	25
<b>2017</b>	24-Apr	8-May	18-May	25	9-Jun	1-Jul	15-Jul	37
<b>2018 (March 1 start)</b>	20-Apr	8-May	20-May	31	4-Jun	29-Jun	19-Jul	46
<b>2019 (March 1 start)</b>	19-Apr	7-May	23-May	35	8-Jun	30-Jun	16-Jul	39
<b>2020</b>	26-Apr	12-May	24-May	29	7-Jun	27-Jun	22-Jul	46
<b>MEDIAN*</b>	<b>28-Apr</b>	<b>14-May</b>	<b>29-May</b>	<b>32</b>	<b>16-Jun**</b>	<b>29-Jun**</b>	<b>28-Jul**</b>	<b>43**</b>
<b>MIN*</b>	<b>20-Apr</b>	<b>6-May</b>	<b>22-May</b>	<b>24</b>	<b>6-Jun**</b>	<b>27-Jun**</b>	<b>20-Jul**</b>	<b>31**</b>
<b>MAX*</b>	<b>6-May</b>	<b>27-May</b>	<b>20-Jun</b>	<b>46</b>	<b>27-Jun**</b>	<b>30-Jul**</b>	<b>22-Aug**</b>	<b>59**</b>
	Unclipped Steelhead				Clipped Steelhead			
<b>2011</b>	25-Apr	19-May	31-May	37	19-Apr	19-May	30-May	42
<b>2012</b>	25-Apr	1-May	19-May	25	25-Apr	3-May	15-May	21
<b>2013</b>	21-Apr	13-May	27-May	37	29-Apr	8-May	21-May	23
<b>2014</b>	23-Apr	9-May	27-May	35	30-Apr	8-May	21-May	22
<b>2015</b>	16-Apr	18-May	28-May	43	28-Apr	14-May	28-May	31
<b>2016</b>	18-Apr	28-Apr	12-May	25	22-Apr	30-Apr	10-May	19
<b>2017</b>	24-Apr	6-May	28-May	35	24-Apr	4-May	22-May	29
<b>2018 (March 1 start)</b>	22-Apr	8-May	30-May	39	20-Apr	2-May	22-May	33
<b>2019 (March 1 start)</b>	21-Apr	27-Apr	21-May	31	19-Apr	25-Apr	11-May	23
<b>2020</b>	4-May	25-May	30-May	27	2-May	12-May	28-May	27
<b>MEDIAN*</b>	<b>26-Apr</b>	<b>13-May</b>	<b>29-May</b>	<b>34</b>	<b>29-Apr</b>	<b>14-May</b>	<b>29-May</b>	<b>31</b>
<b>MIN*</b>	<b>16-Apr</b>	<b>1-May</b>	<b>19-May</b>	<b>24</b>	<b>15-Apr</b>	<b>2-May</b>	<b>15-May</b>	<b>21</b>
<b>MAX*</b>	<b>6-May</b>	<b>28-May</b>	<b>8-Jun</b>	<b>51</b>	<b>7-May</b>	<b>29-May</b>	<b>10-Jun</b>	<b>44</b>
	Coho				Sockeye (Wild & Hatchery)			
<b>2011</b>	10-May	23-May	6-Jun	28	10-May	22-May	2-Jun	24
<b>2012</b>	6-May	21-May	5-Jun	31	2-May	11-May	25-May	24
<b>2013</b>	6-May	19-May	1-Jun	27	10-May	19-May	28-May	19
<b>2014</b>	3-May	17-May	31-May	29	14-May	22-May	31-May	18
<b>2015</b>	23-Apr	20-May	4-Jun	43	11-May	20-May	27-May	17
<b>2016</b>	26-Apr	8-May	24-May	29	30-Apr	10-May	22-May	23
<b>2017</b>	2-May	18-May	1-Jun	31	30-Apr	14-May	24-May	25
<b>2018 (March 1 start)</b>	6-May	20-May	2-Jun	28	6-May	12-May	26-May	21
<b>2019 (March 1 start)</b>	27-Apr	17-May	6-Jun	41	5-May	19-May	31-May	27
<b>2020</b>	26-Apr	4-May	30-May	35	10-May	20-May	30-May	21
<b>MEDIAN*</b>	<b>8-May</b>	<b>22-May</b>	<b>5-Jun</b>	<b>30</b>	<b>10-May</b>	<b>21-May</b>	<b>2-Jun</b>	<b>24</b>
<b>MIN*</b>	<b>23-Apr</b>	<b>13-May</b>	<b>31-May</b>	<b>24</b>	<b>30-Apr</b>	<b>11-May</b>	<b>25-May</b>	<b>16</b>
<b>MAX*</b>	<b>17-May</b>	<b>3-Jun</b>	<b>14-Aug</b>	<b>90</b>	<b>1-Jun</b>	<b>14-Jun</b>	<b>27-Jun</b>	<b>41</b>

\* **MEDIAN, MIN, MAX** for spring migrants based on 1998-2015 data only. Data from 2016-present excluded due to potential bias from every-other-day sampling and March sampling in 2018 and 2019.

\*\* Subyearling Chinook based on 1998-2005 data only. Data from 2006-present excluded due to potential bias from missed sample days during high water temperature sampling protocols (per **Appendix K**).



## 1.2. Adult Fish Facilities and Migration Timing.

**1.2.1. Adult Fish Passage Facilities.** The John Day Dam adult fish facilities include a north shore ladder to pass fish from entrances at the north end of the spillway, and a south shore ladder to pass fish from entrances along a collection channel extending the full length of the powerhouse. Auxiliary water is pumped from the tailrace to all collection systems. South auxiliary water also includes forebay water from the fish turbines. Counting stations are provided in both fishways. Annual maintenance of adult fish facilities is scheduled December 1 through the end of February (winter maintenance period) to minimize impacts on upstream migrants.

### 1.2.2. Adult Fish Migration Timing & Counting.

**1.2.2.1.** Upstream migrants are present throughout the year and adult passage facilities are operated year-round. Counting of adult salmon, steelhead, bull trout, lamprey, and shad occurs during the dates defined for the current year in **Table JDA-3** and daily counts are posted online.<sup>2</sup> The presence of other species (i.e., sturgeon, grass carp, Atlantic salmon, etc.) are recorded as comments and reported in the *Annual Fish Passage Report*.

**1.2.2.2.** Yearly counts through the most recent passage year are used to determine the earliest and latest dates of peak adult fish passage defined in **Table JDA-4**.

**1.2.2.3.** Time-of-day (diel) distributions of adult salmonid activity at John Day Dam fishway entrances and exits are shown in **Figure JDA-2**.

**Table JDA-3. John Day Dam Adult Fish Count Schedule in 2021.**

Count Period	Counting Method and Hours*
April 1 – October 31	Day Visual 0500–2100 hours (PDT)
June 15 – September 30	Night Video 2100–0500 hours (PDT)

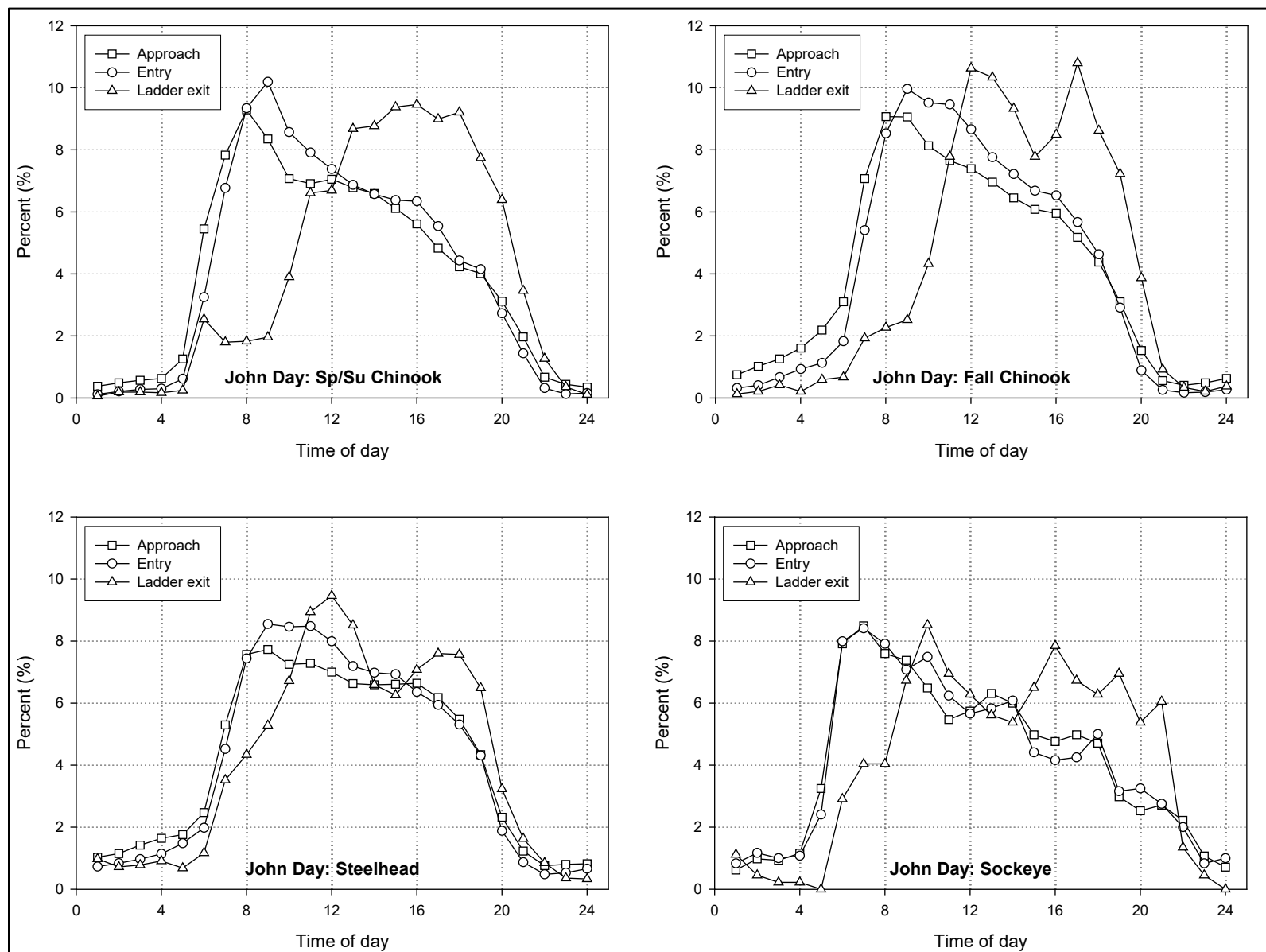
\*PST = Pacific Standard Time; PDT = Pacific Daylight Time, in effect during daylight saving time 3/14/21–11/7/21.

**Table JDA-4. John Day Dam Adult Count Period and Peak Passage Timing (based on yearly counts since 1968, except lamprey since 2000).**

Species	Count Period	Earliest Peak	Latest Peak
Spring Chinook	Apr 1 – Jun 5	Apr 14	May 24
Summer Chinook	Jun 6 – Aug 5	Jun 7	Aug 2
Fall Chinook	Aug 6 – Oct 31	Sep 2	Sep 25
Steelhead	Apr 1 – Oct 31	Aug 25	Oct 6
Sockeye	Apr 1 – Oct 31	Jun 21	Jul 10
Coho	Apr 1 – Oct 31	Sep 4	Oct 26
Lamprey	Apr 1 – Oct 31	Jun 30	Aug 12

<sup>2</sup> Daily adult salmon counts: [https://www.fpc.org/currentdaily/HistFishTwo\\_7day-ytd\\_Adults.htm](https://www.fpc.org/currentdaily/HistFishTwo_7day-ytd_Adults.htm)





**Figure JDA-3. Diel Distribution of Adult Salmonids at John Day Dam Fishway Entrances and Exits (Keefer & Caudill 2008) – report and summary letter available online at: [pweb.crohms.org/tmt/documents/FPOM/2010/2013\\_FPOM\\_MEET/2013\\_JUN/](http://pweb.crohms.org/tmt/documents/FPOM/2010/2013_FPOM_MEET/2013_JUN/)**

## 2. FISH FACILITIES OPERATION

### 2.1. General

**2.1.1.** Research, non-routine maintenance, fish-related activities, and construction will not be conducted within 100' of any fishway entrance or exit, within 50' of any other part of the adult fishway, or directly in, above, or adjacent to any fishway, unless coordinated with FPOM or FFDRWG by the Project, District Operations and/or Planning or Construction office. Alternate actions will be considered by District and Project biologists in conjunction with the Regional fish agencies on a case-by-case basis.

**2.1.2.** Yearly special operations related to research are described as currently coordinated in **Appendix A - Special Project Operations & Studies**.

**2.1.3.** Emergency situations should be dealt with immediately by the Project in coordination with the Project and/or District biologist. If unavailable, the biologists will be informed immediately following the incident of steps taken to correct the situation. On a monthly basis, as necessary, the Project Biologist will provide FPOM a summary of any emergency actions undertaken.

**2.1.4.** All activities within boat restricted zones (BRZ) will be coordinated with the Project at least two weeks in advance, unless deemed an emergency (see **Chapter 1 - Overview**).

### 2.2. Spill Management

**2.2.1.** Spring and summer spill operations for juvenile fish passage are defined in the *Fish Operations Plan* (FOP), included in the Fish Passage Plan as **Appendix E**. Spill patterns formulated with spillway deflectors in place for both adult and juvenile passage are defined in **Tables JDA-8, JDA-9**. Spill pattern modifications for barge traffic entering the navigation lock have been coordinated with the fish agencies and tribes through the proper regional fish forums (e.g., TMT, FPOM, FFDRWG). Minimum spill is 30% April 10–August 31 to provide adequate conditions in the tailrace for juvenile egress.

**2.2.2.** Excessive total dissolved gas (TDG) may harm fish and will be controlled to the extent possible, subject to river conditions. Management tools include system-wide spill distribution through the Spill Priority List issued by the Corps Northwestern Division Reservoir Control Center (RCC), night and/or day spill limits, and shaping of spill. Monitoring of TDG at John Day Dam occurs during the periods defined in **Table JDA-1**, pursuant to the Corps' annual *TDG Management Plan* and the current *Dissolved Gas Monitoring Plan of Action*.<sup>3</sup>

**2.2.3.** From August 15 through November 30, adult fish attraction flow will be provided by spilling through Bay 2 open one stop (approximately 1.6 kcfs) during daylight hours defined in **Table JDA-5**.

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<sup>3</sup> TDG Management Plan (Appendix 4 of the WMP) - [pweb.crohms.org/tmt/documents/wmp/](http://pweb.crohms.org/tmt/documents/wmp/)  
TDG Monitoring Plan of Action - [www.nwd.usace.army.mil/Missions/Water/Columbia/Water-Quality/](http://www.nwd.usace.army.mil/Missions/Water/Columbia/Water-Quality/)

**Table JDA-5. Daytime Spill Hours for Adult Attraction at John Day Dam, Aug 15–Nov 30.**

Date Range	Daytime Spill Hours	
	Begin	End
January 1–19	0700	1730
January 20 – February 14	0630	1800
February 15 – March 1	0600	1830
March 2 – Start DST <sup>a</sup>	0600	1930
Start DST <sup>a</sup> – Apr 2	0700	2030
April 3–20	0600	2130
April 21 – May 16	0600	2200
May 17 – June 30	0530	2230
July 1–31	0530	2300
August 1–15	0600	2245
August 16–31	0600	2130
September 1–16	0630	2100
September 17 – October 4	0700	2030
October 5–19	0730	2000
October 20–29	0730	1930
October 30 – End DST <sup>a</sup>	0730	1800
End DST <sup>a</sup> – December 31	0630	1700

a. DST = Daylight Saving Time, in effect from the second Sunday in March through the first Sunday in November.

## **2.3. Operating Criteria - Juvenile Fish Facilities**

### **2.3.1. Juvenile Fish Facilities - Winter Maintenance Period (December 1 – March 31)**

**2.3.1.1.** From December 1 through December 15, submersible traveling screens (STS) will remain in place and the juvenile bypass system (JBS) channel will operate for adult fallbacks, thereby shortening some aspects of the winter maintenance period by two weeks. During this period, priority units will be screened to the extent practicable (barring operational failure). STSs will only be removed from non-priority units when necessary to begin maintenance. After December 15, all STSs may be removed.

**2.3.1.2.** All units are available to meet power demands.

**2.3.1.3.** Remove debris from the forebay, all trash racks, and gatewell slots so these areas are debris-free by April 1.

**2.3.1.4.** Inspect all VBSs for damage, holes, debris accumulations, or protrusions (video inspection is acceptable). Clean and repair when necessary.

**2.3.1.5.** Inspect and operate each STS. Install STSs in each intake slot of all operational units by April 1, unless otherwise coordinated with the fish agencies and tribes.

**2.3.1.6.** Inspect all gatewell orifices and orifice lighting systems. Clean and/or repair where necessary such that these systems are debris-free and operable on April 1.

**2.3.1.7.** Check automatic control calibration/operation for the DSM tainter gate and other necessary sensors weekly. Recalibrate as necessary and report summaries of equipment recalibration in the weekly SMF operation monitoring reports.

**2.3.1.8.** Dewater the downstream migrant (DSM) channel only when required for inspection, maintenance, or structural modifications (see **section 5**). Minimize the outage duration to the extent practicable.

**2.3.1.9.** Inspect and maintain DSM conduit tainter gate. Repair where necessary.

**2.3.1.10.** Inspect walls and floor of DSM conduit, raceway, and outfall. Correct any deficiencies.

**2.3.1.11.** Inspect spillbay gates and associated control system. Repair where necessary. Spillbays must be able to achieve FPP spill patterns on April 10, unless otherwise coordinated.

**2.3.1.12.** At the SMF, ensure all following items are fully operational:

- i.** Dewatering facilities, including weir gates, perforated plates, screens (free of holes or gaps), and screen cleaner brush system;
- ii.** All valves and auxiliary water systems;
- iii.** Flushing water valves and their perforated plates;

- iv. All gates, including the crest, tainter, switch, and rotating gates;
- v. Fish/debris separator, including perforated plates and adult passage chamber;
- vi. PIT-tag detectors;
- vii. All sampling building systems, including holding tanks, valves, and conduits (see specific list in the *SMF Operation & Maintenance Manual*).

**2.3.1.13.** Avian abatement measures shall be in place by April 1 or as soon as weather permits. For more information, see the *Predation Monitoring & Deterrence Action Plans* for John Day Dam in **Appendix L** Table 2 and section 5.

## **2.3.2. Juvenile Fish Facilities – Fish Passage Season (April 1 – November 30)**

### **2.3.2.1. STSs and VBSs.**

- i. Operate STSs from April 1 through November 30 for juvenile fish passage, and from December 1 through December 15 for adult fallbacks. Do not operate units without a full complement of rotating STSs except to comply with other coordinated fish measures.
- ii. Inspect each STS, VBS, and orifice once per month or every 720 hours run-time. Video inspections are acceptable. More frequent inspections may be required under the following conditions: deterioration of fish condition, increased debris load in JBS, or other indications of STS or VBS malfunction or failure.
- iii. Operate Unit 2 when Unit 1 is out of service for STS inspection.
- iv. Monitor each STS amp and/or watt meter readings at least once per shift.
- v. If an STS or VBS is damaged, plugged or non-operational, follow procedures in **section 3**.
- vi. Include inspection reports in weekly fishway reports and provide to FPOM.

### **2.3.2.2. Gatewells and Orifices.**

- i. Open all gatewell orifices April 1 through December 15.
- ii. Inspect all STS gatewells daily.
- iii. Clean gatewells before the gatewell water surface becomes 50% covered with debris. If due to the debris volume it is not possible to keep the gatewell surface at least 50% clear, clean gatewells at least once daily. Do not operate turbines that have a gatewell fully covered with debris except to comply with other coordinated fish measures, and then only on a “last-on/first-off” basis. During cleaning, close the powerhouse gatewell orifices. After gatewell de-barking, cycle the orifice in that gatewell. Check gatewell drawdown.

- iv. When using a dip basket for gatewell cleaning, coordinate with SMF staff.
- v. Monitor and record juvenile mortality numbers in all gatewells as potential indicators of gatewell environment problems. Include mortality estimates in the weekly status reports.
- vi. Measure gatewell drawdown across the trashrack at least once per week. Remove debris from forebay and trashracks as required to maintain gatewell drawdown  $< 1.5'$ . If VBS drawdown reaches  $1.2'$ , inspect the screen and prepare to clean as necessary.
- vii. Close and open each orifice three times daily, or more frequently as determined by the Project Biologist if necessary due to debris accumulation in gatewells.
- viii. If a unit goes out of service, keep orifices open in the associated gatewells unless that gatewell is dewatered.
- ix. Inspect orifice lights daily to ensure they are operating. Replace all burned out orifice lights within 24 hours.
- x. From April 1 through August 1, rake Units 1–5 monthly and Units 6–10 *or* 11–16 every other month. After August 1, rake units as determined necessary by ROV inspection or as needed to maintain gatewell drawdown in criteria. Perform additional raking whenever trash accumulations are suspected because of increased differential  $\geq 1.5'$  across the trash racks, or as determined by the Project Biologist in response to increased juvenile fish descaling at the dam, deteriorating fish condition at the SMF, or increased tumbleweeds in the forebay.
- xi. During raking, close the gatewell orifices of the unit being raked.
- xii. If debris loads are obvious in the forebay, rake trash in front of the affected unit(s) weekly until the debris is removed. Debris accumulations in the forebay of 300 feet or more in any direction from the face of the dam will be removed within 48 hours. Continue debris removal efforts until the debris is cleared.
- xiii. Make best efforts to keep all petroleum out of gatewells. Project environmental section will determine cleanup efforts if needed. Regardless of unit operating status, oil accumulations will be dealt with promptly.
- xiv. Maintain the water level in the bypass conduit between  $4.0'$  and  $5.0'$  as measured at Unit 16.

**2.3.2.3. Smolt Monitoring Facility (SMF).** From April 1–September 15, Project fish personnel will monitor the SMF 24 hours/day, 7 days/week, to ensure proper functioning and to respond quickly in the event of an emergency. On-duty staff will perform a walking inspection of the entire SMF system every two hours to ensure safe fish passage conditions. The system will be fully staffed while the SMF is in operation (i.e., crest gate deployed and

secondary dewatering structure receiving fish-laden flow). To ensure proper function of sampling systems, staff will pay particular attention to the following:

- i. Dewatering facilities, including screens, free of holes or gaps, and the screen cleaner brush system;
- ii. All valves and auxiliary water systems;
- iii. Flushing water valves and perforated plates;
- iv. All gates, including crest, tainter, switch, and rotating gates;
- v. Fish/debris separator, including perforated plates and adult passage chamber;
- vi. PIT-tag detectors;
- vii. All sampling building systems, including holding tanks, valves, and conduits;
- viii. During low to normal debris loads, the Primary Dewatering Screen (PDS) sweepers will be cycled twice per shift (six times per day). If higher debris loads, the frequency of screen sweeper cycling will be increased as determined by the Project Fisheries inspection.
- ix. The fish/debris separator will be visually inspected every 30 minutes to prevent injury and/or mortality to fish. During high debris loading periods (likely during spring runoff), additional personnel may be required to keep the separator free of any obstruction to fish passage. The Project Biologist will decide to assign a person to remove debris from the separator on a shift basis (possibly 24 hours/day presence) for as long as necessary to ensure the safety of passing fish.
- x. When river temperatures are  $\geq 70^{\circ}\text{F}$ , all fish handling to remove adult fish from the PDS area will be coordinated through FPOM.

#### **2.3.2.4. Temporary Spillway Weirs (TSWs).**

- i. John Day Dam has two temporary, or top, spillway weirs (TSWs) in spillbays 18 and 19 that provide surface passage routes for fish.
- ii. Opening and closing the TSWs requires a crew and gantry crane and must be done during daylight hours as weather allows.
- iii. When open, each TSW spills approximately 9.7 kcfs. Spill patterns with and without TSWs are in **Tables JDA-8** and **JDA-9**, respectively.
- iv. Both TSWs will be installed as early as possible on the first day of spring spill.
- v. During high flows, TSW removal is recommended before river flow exceeds 685 kcfs.



vi. Both TSWs will be closed on the last normal workday of summer spill (no later than August 31), as late in the day as possible. Spill for juvenile fish passage will be maintained through midnight on August 31 using the “No TSWs” patterns.

**2.3.2.5. Avian Predation Management.** Operate in accordance with the *Predation Monitoring and Deterrence Action Plans* for John Day Dam in **Appendix L** Table 2 and section 5. Avian monitoring at John Day Dam will occur daily during the adult and juvenile fish passage season and hazing will occur daily from April 10 through July 31.

## **2.4. Operating Criteria - Adult Fish Facilities**

### **2.4.1. Adult Fish Facilities - Winter Maintenance Period (December 1 – end of February)**

**2.4.1.1.** Operate according to criteria during adult fish passage season in **section 2.4.2** below, except facilities may be dewatered or operated out of criteria for maintenance or repair. Outage periods will be minimized to the extent practicable. Only one of the two adult fish passage facilities may be out of service at a time. The other facility must be operated within passage season criteria unless otherwise coordinated with FPOM. However, Unit 2 may be operated in place of Unit 1 without special coordination when the south fishway is in service.

**2.4.1.2.** Inspect and calibrate all staff gauges, water level sensors, and indicators. Repair and/or clean where necessary.

**2.4.1.3.** Dewater and inspect all ladders and other dewatered sections of fish facilities for projections, debris, or plugged orifices that could injure or delay fish. Repair as needed.

**2.4.1.4.** Inspect ladder exits for debris and clean when necessary.

**2.4.1.5.** At the end of the adult fish counting season (see **Table JDA-3**), pull picket leads at counting stations and adjust crowders so that the counting slots are fully opened (this should be done shortly after adult fish counting ends). Reinstall picket leads at counting stations prior to watering up ladders during maintenance.

**2.4.1.6.** Repair or, when necessary, upgrade netting and padding at the top of the north fish ladders to address the fish jumping problem in this area.

**2.4.1.7.** Maximum head on attraction water intakes and trash racks at all ladder exits is 0.5'. Remove debris when significant amounts accumulate.

### **2.4.2. Adult Fish Facilities – Adult Fish Passage Season (March 1 – November 30).**

**2.4.2.1.** Maintain staff gauges and water level indicators in readable condition at all water levels encountered during the fish passage season and check calibration weekly. When necessary, clean and/or recalibrate instruments as soon as practicable.

**2.4.2.2.** Maintain water depth over fish ladder weirs at 1.0'  $\pm$  0.1'. When the adult shad count at Bonneville Dam exceeds 5,000/day, increase water depth to 1.3'  $\pm$  0.1'.

**2.4.2.3.** Maintain main entrance weir depths at 8' or greater below tailwater. Maintain tailwater elevation above 158' msl to stay within criteria operating range for entrance weirs.

**2.4.2.4.** Maintain head on all entrances in the range of 1'–2' (1.5' optimum). When unable to achieve head criteria, refer to **section 3.2**.

**2.4.2.5.** Open floating orifice gates 1, 2, 18 and 19, and operate three fish pumps to maintain fishway criteria. The entrance gate should be submerged 8' deep or greater to be in criteria.

**2.4.2.6.** Maximum head on attraction water intakes and trashracks at all ladder exits is 0.5', with a maximum head on all picket leads of 0.3'. Remove significant debris build up.

**2.4.2.7.** Measure fishway channel water velocities at least three times per week (daily preferred) during adult fish passage season as part of the fishway inspection program. Floats will be timed through all fishway channels that are supplemented by auxiliary water and results reported in the project weekly fishway status report. Maintain water velocity in the range of 1.5–4.0 feet per second (fps), 2 fps optimum, in all channels and the lower ends of fish ladders that are below the tailwater.

**2.4.2.8. North Fishway.** Maintain netting and padding for the North fishway to address the adult salmonid jumping problem. All holes in the netting large enough to catch or allow escapement of an adult salmonid must be closed.

**2.4.2.9. South Fishway.** Operate entrance weir SE-1. Provide adult attraction flow from August 15 through November 30 by spilling from Bay 2 open one stop (1.5 kcfs) during daylight hours defined in **Table JDA-5**.

**2.4.2.10. Powerhouse.** Operate entrances NE-1 and NE-2. Operate four powerhouse floating orifices, 1, 2, 18, and 19, and open associated auxiliary water diffusers (see also **section 2.4.2.4**). From 0400–2000 hours, operate Unit 1 near 100 MW ( $\pm 10$ ) to provide best entrance conditions. If additional load is required by BPA, Unit 1 may be operated above 100 MW, but it should be the last unit brought up to full load when demand increases and the first unit to reduce when demand decreases (see **Appendix C - Load Shaping Guidelines**).

**2.4.2.11. Fishway Temperature Monitoring.**

**2.4.2.11.a.** Measure water temperatures at the count stations of each ladder and include the weekly means in the status report. When water temperature reaches 70°F, all fish handling activities will be coordinated through FPOM prior to any action to verify protocols that will be followed.

**2.4.2.11.b.** From June 1 through September 30, measure water temperature at adult fishway entrances and exits and submit data to the Fish Passage Center (FPC) weekly for posting online.<sup>4</sup> Ensure the location of the monitors meets the following criteria:

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<sup>4</sup> FPC ladder temperature data website: [www.fpc.org/smolt/smolt\\_queries/Q\\_ladderwatertempgraphv2.php](http://www.fpc.org/smolt/smolt_queries/Q_ladderwatertempgraphv2.php)

- i. Within 10 meters of all shore-oriented entrances and exits.
- ii. Entrance monitor within 1 meter above the ladder floor and at least 10 meters downstream of ladder diffusers, if possible, to allow for sufficient mixing with surface water.
- iii. Exit monitor within 1 meter above the ladder floor and above all diffusers to allow for sufficient mixing with surface water.
- iv. If an existing temperature monitoring location is proposed to be used for either the exit or entrance, verify that the site accurately reflects water temperature within 10 meters of the entrance or exit.

#### **2.4.2.12. Adult Fish Counting.**

- i. The current adult fish counting schedule is in **Table JDA-3**.
- ii. Crowder ranges are: JDA-North = 18”–28”; JDA-South = 18”–30”
- iii. When not counting, or if counting is temporarily discontinued due to unscheduled events, open the crowder to full count slot width. The crowder may remain in operating position during the counter’s hourly 10-minute break.
- iv. During counting, open the crowder as far as possible to allow accurate counting, at least 18”. Do not close to less than 18” inches while counting. This will usually occur during high turbidity conditions to maintain count accuracy. If passage is impaired by narrow count slot conditions, open the count slot until proper passage conditions are achieved, despite reduced count accuracy. Project biologists, FFU, and the fish count supervisor shall coordinate to achieve optimum count slot passage and/or count accuracy conditions.

### **2.5. Fish Facilities Monitoring & Reporting**

#### **2.5.1. Monitoring.**

- 2.5.1.1.** During fish passage season, inspect fish passage facilities at least twice per day, seven days a week to ensure operation according to established criteria.
- 2.5.1.2.** During the winter maintenance period, inspect fish facilities once per day, seven days a week. More frequent inspections of some facility components will occur pursuant to criteria in this document.
- 2.5.1.3.** Additional fishway inspections may be performed by FFU and fish agencies.
- 2.5.1.4.** Report results of all inspections and the readiness of the facilities for operation to FPOM at the meeting immediately prior to the fish passage season.
- 2.5.1.5.** Continue to implement the zebra mussel monitoring program. These organisms are a serious problem elsewhere in the country and may become introduced into the Columbia River basin. Inspections should also be made when dewatering project facilities.

### 2.5.2. Reporting.

**2.5.2.1. Weekly Reports.** Project biologists shall prepare weekly reports throughout the year summarizing project and fish facility operations for each week (Sunday through Saturday), along with an evaluation of resulting fish passage conditions. The reports will be e-mailed to CENWP-OD, CENWD-PDW-R (RCC), and other interested parties as soon as possible the following week. The weekly reports shall include:

- i. Out-of-criteria situations and subsequent corrective actions;
- ii. Equipment malfunctions, breakdowns, or damage, with a summary of resulting repairs;
- iii. Adult fishway control calibrations;
- iv. STS and VBS inspections;
- v. AWS closures (i.e. cleaning times);
- vi. Unusual activities at the project that may affect fish passage.

**2.5.2.2. In-Season.** Any adverse or negative impact to fish or fishways shall be reported in a *Memorandum for the Record* (MFR) prepared by Project biologists and sent to FPOM by the next working day, pursuant to the coordination process and template in **FPP Chapter 1 – Overview, section 2.3.2.**

**2.5.2.3. Annual Report.** Project biologists shall prepare an annual report by January 31 each year, summarizing fish facility operations for the previous year's winter maintenance period and fish passage season, December 1 through November 30. The annual report will also include all actions taken to discourage avian predation at the project, with an overview of the effectiveness of the actions. The annual report will be provided to CENWP-OD in time for distribution to FPOM members at the February meeting.

## 3. FISH FACILITIES MAINTENANCE

### 3.1. Fish Facilities Routine Maintenance

**3.1.1.** Routine maintenance of fish facilities will be conducted when fish passage has been documented to be at its lowest, to the extent practicable, to minimize fish impacts. Maintenance that occurs during juvenile or adult passage season that may affect fish passage will be included in the weekly reports, per **section 2.5.2.** If maintenance requires operating outside of FPP criteria, the work will be coordinated with FPOM per the procedures defined in **FPP Chapter 1– Overview, section 2.3.**

**3.1.2. Submersible Traveling Screens (STS).** The STS system may receive preventive maintenance or repair any time of the year as necessary. Most maintenance will occur during the winter maintenance period when all STSs may be removed from intakes. From April 1– December 15, a turbine unit cannot operate without a full complement of functioning STSs.

**3.1.3. Juvenile Bypass System (JBS).** The JBS facilities may receive preventive maintenance at any time of the year as necessary in coordination with FPOM. During the juvenile fish passage season, this will normally be out-of-water work (e.g., maintenance of automatic systems, air lines, electrical systems, and monitoring equipment). During the winter maintenance period, the system is dewatered and visually inspected in all accessible areas for damaged equipment and areas that may cause potential problems to juvenile fish. Identified problems will be repaired by project maintenance or the contractor as soon as possible. Extended repair projects will be coordinated through FPOM.

**3.1.4. Turbines & Spillbays.** Routine maintenance and repair of project turbines and spillbays is a regular and recurring process that requires extended outages (see **Turbine Maintenance section 4.3** and **Dewatering Plans section 5**). If maintenance requires operating outside of FPP criteria, the work will be coordinated with FPOM. Certain turbine and spillbay discharges are secondarily used to attract adult fish to fishway entrances, to keep predator fish from accumulating near juvenile release sites, and to move juveniles downstream away from the project. The maintenance schedules for these turbines and spillbays will reflect equal weight given to fish, power, and water management and will be coordinated with the appropriate fish agencies. Units 1, 2, and 5 should not be scheduled for maintenance during fish passage season.

**3.1.5. Fishway Auxiliary Water Systems.** John Day Dam has tailwater pump auxiliary water systems. Preventive maintenance and normal repair are carried out throughout the year. Trash racks for the AWS intakes will be raked when drawdown exceeds criteria. When practicable, rake trash racks during the time of day when fish passage is least affected. During the annual navigation lock maintenance outage, the north fish ladder auxiliary water is shut off for about half a day. This is required to allow divers to clean off the navigation lock discharge sill so that a bulkhead can be placed.

**3.1.6. Adult Fish Collection Systems.** Preventive maintenance and repair occurs throughout the year as needed. During the adult fish passage season, this maintenance will not result in failing to achieve fishway criteria unless coordinated with FPOM. During the winter maintenance period, an inspection will occur through dewatering or divers per discretion of the Project Biologists. One additional underwater diver/ROV will occur August 1-15. Timing of this inspection will be coordinated through FPOM. The Project Biologist or alternate Corps fish personnel will attend all dewatering and inspection activities potentially involving fish (**section 6**).

**3.1.7. Adult Ladders and Count Stations.** Adult fish ladders are dewatered once each year during the winter maintenance period. Unless specially coordinated, only one ladder will be dewatered at a time with the other ladder operating within criteria. During this time, the ladders are inspected for necessary maintenance needs and potential fish passage problems (e.g., blocked orifices, projections into the fishway that may injure fish, unstable weirs, damaged picket leads, exit gate problems, loose diffuser gratings, unreadable or damaged staff gauges, defective diffuser valves, and malfunctioning equipment at the counting stations). Potential problems identified throughout the passage year that do not impact fish passage, as well as those identified during the dewatered period, are repaired. Rake trash racks at ladder exits when criteria are exceeded. When practicable, rake trash racks during the time of day when fish passage would be least impacted. Clean fish count station windows, light panels, and crowder panels as needed to achieve accurate counts and, when practicable, during the time of day when fish passage is least

impacted. Inspect north netting on ladders daily to prevent fish leaping and maintain as necessary. Include inspection summaries in the weekly report.

### **3.2. Fish Facilities Non-Routine Maintenance**

**3.2.1.** Non-routine or unscheduled fish facility maintenance that may impact fish passage or operation of fish facilities (e.g., repair of diffuser gratings, etc.) shall be coordinated through FPOM on a case-by-case basis by Project and CENWP-OD biologists, per the coordination process described in **FPP Chapter 1–Overview, section 2.3**. The CENWP-OD biologists will be notified as soon as possible after it becomes apparent that non-routine maintenance or repairs are required. The Operations Project Manager has the authority to initiate work prior to notifying CENWP-OD when delay of work will result in unsafe situations for people, property, or fish.

**3.2.2.** Non-routine maintenance that affects fish passage will be included in the weekly reports.

#### **3.2.2. Juvenile Bypass System (JBS).**

**3.2.2.1.** The JBS is automatically controlled. If the automatic system fails, operate manually until automation is repaired.

**3.2.2.2.** If the orifices become plugged with debris, do not operate the turbine until it has been cleaned.

**3.2.2.3.** If an STS or VBS is found to be damaged or malfunctioning in an operating unit, the unit will be regarded as an unscreened unit. The screen will be repaired or replaced before returning the unit to service.

**3.2.2.4.** If the bypass system fails in the powerhouse conduit, tainter gate, or transportation outfall making the system unsafe for fish, a decision will be made in coordination with FPOM. During this emergency operating mode, minimize power generation to the extent practicable. If this operating mode is expected to last longer than four days, sequentially shut down all units required for generation, salvage fish from gatewells, remove STSs, and restart the unit. Close the orifice gates during this process.

#### **3.2.3. Turbines and Spillbays.**

**3.2.3.1.** Whenever Unit 1 is not operating, operate Unit 2 for adult attraction.

**3.2.3.2.** Between September 15 and the end of February, spillbay 2 may be closed for up to one workday for maintenance activities. During the outage, operate spillbay 3 for adult attraction flow.

**3.2.3.3.** If a spill gate becomes inoperable, the operators will make the necessary changes to accommodate spill and then immediately notify the operations supervisor and Project Biologist to determine the best spill pattern until repairs can be made. This interim operation shall be coordinated with the FPOM through the District biologist who will provide additional guidance to the project.

**3.2.4. Fishway Auxiliary Water Systems.** The fishway auxiliary water systems are mostly automated. If the automatic system fails, manually operate the system to maintain the fish facility within criteria until the automatic system is repaired. When this operation becomes necessary, project personnel will increase the surveillance of the adult system to ensure that criteria are being met. In the event of an AWS failure during adult passage season, coordinate with FPOM to determine the best operation.

**3.2.4.1. South Ladder:** Assuming all three auxiliary water turbines are being used to meet criteria, operate as follows in the event of a failure of one or more turbines:

**3.2.4.1.a.** If one turbine fails, increase the output of the two remaining turbines to meet adult fishway criteria.

**3.2.4.1.b.** If two turbine units fail, operate the adult fish facility as follows until a fishway head of 1' is achieved:

- i. Increase discharge of remaining unit to maximum capacity;
- ii. Close NE-1;
- iii. Leave NE-2 at a depth of 8';
- iv. Close remaining floating submerged orifice gate entrances starting at north end;
- v. Leave south powerhouse entrance weir (SE-1) at 8' depth below tailwater surface.
- vi. If criteria are still not achieved, reduce entrance weirs depth to 6', then to 4' if necessary, until more auxiliary water is available. Then reverse the above procedure.

**3.2.4.1.c.** If all three turbine units fail, operate as follows until repairs can be made:

- i. Open SE-1 with the weir crest 6' below the tailwater surface;
- ii. Close NE1 and NE2;
- iii. Place cross-channel bulkheads in powerhouse collection channel between Units 2 and 3;
- iv. Close floating orifice gate in front of Unit 2, leaving the floating orifice gate in front of Unit 1 open.

**3.2.4.2. North Ladder:** The six AWS pumps installed in 2011 are capable of achieving the optimal attraction criteria of 1.5' at all tailrace elevations. There is a built-in contingency as one of the six pumps is always spare and will be automatically started by PLC in case of another pump's failure.

**3.2.5. Powerhouse and Spillway Fish Collection Systems.** John Day Dam contains several types of fishway entrances. If failures occur, in most cases the entrance can be operated manually by project personnel until repaired. When this operation becomes necessary, project personnel will increase surveillance of the adult system to ensure criteria are being met. If the failure will not allow the entrance to be operated manually, the gate will be maintained in an operational position to the extent possible. If this is not possible, the entrance will be repaired expediently and the entrance will be returned to manual or automatic control at the earliest possible date.



**3.2.6. Adult Ladders and Count Stations.** Pickets with excessive spacing ( $>1''$ ), erosion of concrete around the picket leads, or missing pickets may allow fish into areas where they cannot escape. The north count station upstream picket leads have an exit hatch that can be opened to allow fish to escape. Repair will be required for picket lead failure at the south count station. In the instances of picket lead failure or concrete erosion, the timing and method of repair will depend upon the severity of the problem. The decision of whether or not to dewater the fishway for repairs will be made in coordination with FPOM.

**3.2.7. Diffuser Gratings.** Diffuser chambers for adding auxiliary water to ladders and collection channels are covered by gratings attached by several methods. Diffuser gratings are normally inspected during winter maintenance to ensure integrity. Inspections are done by either dewatering the fishway and/or collection channel, or by using video cameras and divers or other methods to inspect the gratings underwater. Diffuser gratings may come loose during fish passage season due to a variety of reasons. Daily inspections of the ladders and collection systems should include looking for flow changes that may indicate problems with diffuser gratings. If a diffuser grating is known to or suspected of having moved, creating an opening into a diffuser chamber, efforts must immediately be taken to correct the situation and minimize impacts on adult fish in the fishway. If possible, a video inspection should be made as soon as possible to determine the extent of the problem. If diffusers gratings are found to be missing or displaced, close the associated diffuser and develop a method of repair as coordinated with FPOM. Repair as quickly as possible unless coordinated differently.

#### **4. TURBINE UNIT OPERATION & MAINTENANCE**

##### **4.1. Turbine Unit Priority Order**

**4.1.1.** Turbine units will be operated in the order of priority defined in **Table JDA-6**, including time during synchronous condensing. If a unit is out of service for maintenance or repair, the next unit in the priority order shall be operated. Unit priority order may be coordinated differently for fish research, construction, or project maintenance.

**Table JDA-6. John Day Dam Turbine Unit Priority Order.**

Season	Unit Priority Order*
March 1 – November 30 Fish Passage Season	With TSWs = 5, 1, 3, 16, 14, 12, 10, 8, 15, 2, 11, 7, 4, 13, 9, 6 No TSWs = 1–4 any order, then 5–16 any order
December 1 – end of February Winter Maintenance Period	Any Order

\*When a main unit is not available, the paired adjacent unit will be used to comply with requested priority.

##### **4.2. Turbine Unit Operating Range**

**4.2.1.** Turbine unit flow and power output at the lower and upper limits of the  $\pm 1\%$  peak efficiency range, and at the operating limit, are defined in **Table JDA-7**, except units with locked runner blades (non-adjustable) are in **Table JDA-7-A**. **Turbine units will be operated within these ranges according to BPA's Load Shaping Guidelines (Appendix C), as summarized below.**

**4.2.2. In-Season: April 10–August 31 (Spring/Summer Spill for Juvenile Fish Passage).**

Turbine units will be operated within  $\pm 1\%$  of peak turbine efficiency (1% range), except under limited conditions and durations when turbines may be operated above the 1% range for the use of reserves or for TDG management during high flows (refer to **Appendix C** for more information). All required fish passage spill operations will be met prior to operating turbines above the 1% range.

At John Day Dam, if in-season operation outside the 1% range is necessary, units will be operated in order from north to south since juvenile passage through turbines decreases from south to north, making inefficient operation of Unit 16 least likely to impact fish. However, allowance will also be given to special project requirements for stable voltage control that requires load distribution between transformer banks. In-season operation outside the 1% range shall be recorded by Project personnel and provided to BPA on a weekly basis according to the *Guidelines*. Operation outside the 1% range may be necessary to:

- i. Meet BPA load requests made pursuant to BPA's policy, statutory requirements, and *Load Shaping Guidelines* (**Appendix C**).
- ii. If the draft tube is to be dewatered (**section 4.3.2**), the unit will be operated at full load  $> 1\%$  (or at speed-no-load  $< 1\%$  if not possible to load) for a minimum of 15 minutes prior to installing tail logs in order to flush fish from the unit.
- iii. Operate a turbine unit solely to provide station service.
- iv. Comply with other coordinated fish measures.

**4.2.3. Off-Season: September 1–April 9.** While not required to do so in the off-season, turbines will normally run within the 1% range since it is the optimum point for maximizing energy output of a given unit of water over time. Operation outside the 1% range is allowed if needed for power generation or other needs.

**4.3. Turbine Unit Maintenance**

**4.3.1.** Turbine unit maintenance schedules will be reviewed by Project and District biologists for fish impacts. If maintenance requires operating outside of FPP criteria, the work will be coordinated with FPOM per the procedures defined in **FPP Chapter 1–Overview, section 2.3**.

**4.3.2.** If the draft tube is to be dewatered (see **section 6.5**), the unit will be operated at full load above the 1% range (or at speed-no-load below the 1% range if not possible to load) for a minimum of 15 minutes prior to installing tail logs to flush fish from the unit.

**4.3.3. Operational Testing.** Some types of turbine maintenance require testing turbine operation throughout its full range before and after maintenance. Operational testing of a unit under maintenance is in addition to a unit in run status required for power plant reliability. Operational testing may deviate from FPP priority order and may require water that would otherwise be used for spill if the project is operating at minimum generation requirements. Water for operational testing will be used from powerhouse allocation when possible and diverted from spill only to the extent necessary to maintain generation system reliability.

i. Pre-Maintenance: Units may be operationally tested for up to 30 minutes by running at speed-no-load and various loads within the 1% range for pre-maintenance measurements and testing, and to allow all fish to move through the unit as defined in **section 6.5.2**.

ii. Post-Maintenance: After maintenance or repair, units may be operationally tested while in maintenance or forced outage status for up to a cumulative time of 30 minutes (within 1% range) before returning to operational status.

**4.3.4.** Wicket gate opening for functional testing of a watered-up unit will be less than 15 minutes total open time.

**Table JDA-7. John Day Dam Turbine Unit Power (MW) and Flow (cfs) at  $\pm 1\%$  of Peak Turbine Efficiency (Lower and Upper Limits of 1% Range) and Operating Limits. <sup>a</sup>**

Project Head (feet)	JDA Units 1–16 With STS <sup>b</sup>						JDA Units 1–16 No STS <sup>b</sup>					
	1% Lower Limit		1% Upper Limit		Operating Limit <sup>c</sup>		1% Lower Limit		1% Upper Limit		Operating Limit <sup>c</sup>	
	MW	cfs	MW	cfs	MW	cfs	MW	cfs	MW	cfs	MW	cfs
80	65.4	11,338	118.0	20,472	129.9	23,194	71.7	12,305	122.8	21,074	129.9	22,684
81	66.7	11,416	120.8	20,671	132.1	23,228	73.2	12,391	125.7	21,290	132.1	22,697
82	68.1	11,492	123.6	20,864	134.3	23,261	74.7	12,473	128.7	21,500	134.3	22,710
83	69.4	11,566	126.4	21,052	136.5	23,292	76.1	12,554	131.6	21,703	136.5	22,720
84	70.8	11,638	129.1	21,234	138.7	23,321	77.6	12,631	134.6	21,901	138.7	22,730
85	72.1	11,707	131.9	21,411	140.9	23,349	79.1	12,707	137.5	22,093	140.9	22,738
86	72.9	11,692	134.7	21,593	142.7	23,282	80.0	12,690	140.1	22,223	142.7	22,722
87	73.7	11,676	137.5	21,770	144.5	23,214	80.9	12,674	142.6	22,349	144.5	22,704
88	74.5	11,661	140.2	21,942	146.2	23,145	81.7	12,657	145.1	22,471	146.2	22,684
89	75.3	11,646	143.0	22,110	148.0	23,074	82.6	12,641	147.6	22,591	148.0	22,662
90	76.1	11,632	145.8	22,274	149.7	23,001	83.5	12,625	150.2	22,707	149.7	22,638
91	77.0	11,622	146.9	22,164	151.1	22,917	84.5	12,616	151.7	22,656	151.1	22,562
92	77.9	11,613	148.0	22,057	152.5	22,831	85.5	12,606	153.2	22,606	152.5	22,484
93	78.8	11,604	149.1	21,951	153.8	22,743	86.4	12,596	154.8	22,556	153.8	22,403
94	79.7	11,595	150.2	21,848	155.1	22,652	87.4	12,586	156.3	22,507	155.1	22,321
95	80.6	11,585	151.3	21,746	155.2	22,383	88.4	12,576	157.8	22,459	155.2	22,062
96	81.7	11,604	151.6	21,532	155.2	22,115	89.6	12,597	158.2	22,243	155.2	21,797
97	82.8	11,623	151.8	21,323	155.2	21,852	90.8	12,617	158.5	22,032	155.2	21,538
98	83.8	11,640	152.1	21,118	155.2	21,595	92.0	12,636	158.8	21,826	155.2	21,284
99	84.9	11,657	152.4	20,917	155.2	21,343	93.1	12,655	159.2	21,623	155.2	21,035
100	86.0	11,674	152.7	20,720	155.2	21,096	94.3	12,673	159.5	21,425	155.2	20,792
101	86.9	11,675	154.9	20,800	155.2	20,852	95.3	12,675	161.8	21,507	155.2	20,554
102	87.9	11,677	157.1	20,877	155.2	20,613	96.4	12,676	164.1	21,587	155.2	20,321
103	88.8	11,678	159.3	20,953	155.2	20,378	97.4	12,678	166.4	21,666	155.2	20,092
104	89.7	11,679	161.5	21,027	155.2	20,149	98.4	12,679	168.7	21,742	155.2	19,868
105	90.6	11,680	163.7	21,100	155.2	19,923	99.4	12,680	171.0	21,817	155.2	19,649
106	91.4	11,658	165.2	21,084	155.2	19,711	100.2	12,656	172.6	21,801	155.2	19,442
107	92.1	11,637	166.7	21,068	155.2	19,503	101.0	12,633	174.2	21,785	155.2	19,239
108	92.8	11,615	168.3	21,052	155.2	19,299	101.8	12,610	175.8	21,768	155.2	19,040
109	93.6	11,594	169.8	21,036	155.2	19,098	102.6	12,587	177.4	21,752	155.2	18,845
110	94.3	11,574	171.3	21,021	155.2	18,901	103.5	12,565	179.0	21,736	155.2	18,653

- a. Values provided by HDC (Nov 2002). Flow (cfs) was calculated based on turbine efficiency, project head, and power output (MW).
- b. Units 3, 4, 8, 9, 10, 11, and 14 have locked blades and a restricted operating range of approximately 17-19 kcfs. See Table JDA-7-A below for operating ranges of each locked-blade unit.
- c. "Operating Limit" (added Feb 2018) is the maximum safe operating point based on cavitation or generator limit. JDA units have a generator limit that restricts turbine output at higher heads. Values shaded in gray indicate the Operating Limit is below the 1% Upper Limit.

**Table JDA-7-A. Operating Range Values for John Day Turbine Units 3, 4, 8, 9, 10, 11, and 14 with Locked Runner Blades (Non-Adjustable).<sup>a</sup>**

Project Head (feet)	Units 3 and 10 w/ Blades Hydraulically Locked at 29.1° (Dec 2020)								Unit 4 w/ Blades Welded at 29.1° (May 2016)							
	With STS				No STS				With STS				No STS			
	Lower Limit		Upper Limit		Lower Limit		Upper Limit		Lower Limit		Upper Limit		Lower Limit		Upper Limit	
	MW	cfs	MW	cfs	MW	cfs	MW	cfs	MW	cfs	MW	cfs	MW	cfs	MW	cfs
80	104.8	18,339	109.3	19,139	105.2	18,204	109.8	18,995	103.1	18,040	108.0	18,909	103.5	17,912	108.5	18,771
81	106.2	18,317	110.6	19,087	106.6	18,183	111.1	18,944	104.4	18,019	109.3	18,857	104.9	17,892	109.7	18,720
82	107.5	18,296	111.9	19,036	108.0	18,162	112.3	18,893	105.8	17,998	110.5	18,806	106.3	17,871	111.0	18,670
83	108.9	18,274	113.2	18,985	109.4	18,141	113.6	18,843	107.1	17,977	111.8	18,756	107.6	17,850	112.3	18,621
84	110.3	18,252	114.4	18,934	110.8	18,119	114.9	18,793	108.5	17,955	113.0	18,706	109.0	17,829	113.5	18,572
85	111.7	18,230	115.7	18,885	112.1	18,097	116.2	18,744	109.9	17,933	114.3	18,657	110.4	17,808	114.8	18,523
86	113.4	18,279	117.2	18,902	113.8	18,134	117.7	18,749	111.5	17,969	115.8	18,662	112.0	17,843	116.3	18,528
87	115.1	18,326	118.8	18,920	115.6	18,169	119.3	18,754	113.2	18,003	117.5	18,687	113.7	17,877	118.0	18,554
88	116.8	18,372	120.4	18,936	117.3	18,202	120.8	18,758	114.9	18,036	119.2	18,711	115.4	17,910	119.7	18,578
89	118.5	18,417	121.9	18,952	119.0	18,234	122.4	18,761	116.5	18,067	120.8	18,734	117.1	17,942	121.4	18,601
90	120.2	18,397	123.5	18,902	120.7	18,264	124.0	18,763	118.2	18,097	122.0	18,674	118.7	17,972	122.5	18,542
91	121.6	18,395	125.2	18,931	122.1	18,263	125.7	18,792	119.6	18,096	123.7	18,703	120.2	17,971	124.2	18,571
92	123.1	18,393	126.9	18,959	123.6	18,262	127.4	18,820	121.1	18,094	125.3	18,731	121.6	17,969	125.9	18,598
93	124.6	18,391	128.6	18,986	125.1	18,260	129.1	18,848	122.5	18,092	127.0	18,757	123.1	17,967	127.6	18,625
94	126.0	18,389	130.3	19,012	126.5	18,257	130.8	18,873	124.0	18,089	128.7	18,783	124.5	17,965	129.3	18,651
95	127.5	18,386	132.0	19,037	128.0	18,255	132.5	18,898	125.4	18,086	130.4	18,807	126.0	17,962	131.0	18,675
96	129.0	18,400	133.6	19,051	129.5	18,269	134.1	18,912	126.9	18,100	132.0	18,821	127.5	17,976	132.5	18,689
97	130.5	18,413	135.2	19,064	131.1	18,283	135.7	18,925	128.4	18,114	133.5	18,834	129.0	17,990	134.1	18,702
98	132.1	18,426	136.7	19,076	132.6	18,296	137.3	18,938	129.9	18,127	135.1	18,846	130.5	18,003	135.7	18,714
99	133.6	18,439	138.3	19,088	134.2	18,308	138.9	18,949	131.4	18,139	136.6	18,858	132.0	18,015	137.2	18,726
100	135.1	18,451	139.9	19,099	135.7	18,320	140.4	18,961	132.9	18,151	138.2	18,869	133.5	18,027	138.8	18,737
101	136.4	18,428	141.4	19,099	137.0	18,297	141.9	18,960	134.2	18,128	139.7	18,868	134.8	18,004	140.3	18,737
102	137.7	18,404	142.9	19,098	138.2	18,274	143.4	18,960	135.4	18,105	141.1	18,868	136.0	17,982	141.7	18,736
103	138.9	18,381	144.3	19,097	139.5	18,252	144.9	18,959	136.7	18,082	142.6	18,866	137.3	17,959	143.2	18,735
104	140.2	18,359	145.8	19,095	140.8	18,229	146.4	18,958	137.9	18,060	144.1	18,865	138.5	17,937	144.7	18,734
105	141.5	18,336	147.3	19,094	142.1	18,207	147.9	18,956	139.2	18,038	145.6	18,864	139.8	17,915	146.2	18,732
106	142.3	18,262	148.7	19,076	142.9	18,133	149.3	18,938	140.0	17,965	146.9	18,846	140.7	17,843	147.5	18,715
107	143.2	18,189	150.1	19,058	143.8	18,061	150.7	18,920	140.9	17,893	148.2	18,828	141.5	17,772	148.9	18,697
108	144.1	18,117	151.4	19,040	144.7	17,990	152.0	18,903	141.7	17,822	149.6	18,810	142.4	17,702	150.2	18,680
109	144.9	18,047	152.8	19,022	145.5	17,920	153.4	18,885	142.6	17,753	150.9	18,792	143.2	17,633	151.6	18,662
110	145.8	17,978	154.1	19,004	146.4	17,852	154.8	18,868	143.4	17,685	152.3	18,775	144.1	17,566	152.9	18,645

Project Head (feet)	Unit 8 w/ Blades Welded at 29.4° (March 2017)								Unit 9 w/ Blades Welded at 29.0° (Sep 2015)							
	With STS				No STS				With STS				No STS			
	Lower Limit		Upper Limit		Lower Limit		Upper Limit		Lower Limit		Upper Limit		Lower Limit		Upper Limit	
	MW	cfs	MW	cfs	MW	cfs	MW	cfs	MW	cfs	MW	cfs	MW	cfs	MW	cfs
80	105.7	18,499	109.4	19,157	106.1	18,366	109.9	19,017	102.4	17,813	107.3	18,665	102.8	17,688	107.7	18,531
81	107.1	18,478	110.7	19,105	107.5	18,345	111.2	18,966	103.7	17,792	108.5	18,615	104.2	17,668	109.0	18,481
82	108.5	18,456	112.0	19,054	108.9	18,323	112.5	18,915	105.1	17,771	109.7	18,564	105.5	17,648	110.2	18,432
83	109.9	18,434	113.3	19,003	110.3	18,302	113.7	18,865	106.4	17,750	111.0	18,515	106.9	17,627	111.5	18,383
84	111.3	18,412	114.5	18,952	111.7	18,280	115.0	18,815	107.8	17,729	112.2	18,466	108.2	17,607	112.7	18,335
85	112.7	18,389	115.8	18,902	113.1	18,259	116.3	18,766	109.1	17,708	113.5	18,418	109.6	17,586	114.0	18,287
86	114.4	18,426	117.4	18,907	114.9	18,295	117.9	18,771	110.8	17,743	115.0	18,423	111.3	17,621	115.5	18,293
87	116.1	18,461	119.1	18,936	116.6	18,330	119.6	18,800	112.4	17,777	116.7	18,448	112.9	17,655	117.2	18,318
88	117.8	18,494	120.8	18,964	118.3	18,364	121.3	18,828	114.1	17,810	118.3	18,472	114.6	17,688	118.8	18,342
89	119.5	18,527	122.5	18,990	120.0	18,396	123.0	18,854	115.7	17,841	120.0	18,494	116.3	17,719	120.5	18,365
90	121.2	18,557	123.6	18,920	121.7	18,427	124.1	18,785	117.4	17,871	121.1	18,435	117.9	17,749	121.6	18,306
91	122.7	18,556	125.3	18,949	123.2	18,426	125.8	18,814	118.8	17,869	122.8	18,464	119.4	17,748	123.3	18,335
92	124.2	18,554	127.0	18,977	124.7	18,424	127.5	18,842	120.3	17,868	124.5	18,491	120.8	17,746	125.0	18,363
93	125.6	18,552	128.7	19,004	126.2	18,422	129.2	18,869	121.7	17,866	126.1	18,518	122.2	17,744	126.7	18,389
94	127.1	18,549	130.4	19,030	127.7	18,420	131.0	18,895	123.1	17,863	127.8	18,543	123.7	17,742	128.4	18,415
95	128.6	18,546	132.1	19,055	129.2	18,417	132.7	18,920	124.5	17,861	129.5	18,568	125.1	17,740	130.0	18,439
96	130.1	18,561	133.7	19,069	130.7	18,432	134.3	18,934	126.0	17,874	131.0	18,581	126.6	17,754	131.6	18,452
97	131.7	18,574	135.3	19,082	132.3	18,445	135.8	18,947	127.5	17,888	132.6	18,594	128.1	17,767	133.1	18,465
98	133.2	18,588	136.9	19,094	133.8	18,459	137.4	18,959	129.0	17,900	134.1	18,606	129.6	17,780	134.7	18,477
99	134.8	18,600	138.4	19,106	135.4	18,471	139.0	18,971	130.5	17,913	135.7	18,618	131.1	17,792	136.2	18,489
100	136.3	18,612	140.0	19,117	136.9	18,483	140.6	18,983	132.0	17,924	137.2	18,629	132.6	17,804	137.8	18,500
101	137.6	18,589	141.5	19,117	138.2	18,460	142.1	18,982	133.3	17,902	138.7	18,628	133.9	17,781	139.3	18,500
102	138.9	18,565	143.0	19,116	139.5	18,437	143.6	18,982	134.5	17,879	140.1	18,627	135.1	17,759	140.7	18,499
103	140.2	18,542	144.5	19,115	140.8	18,414	145.1	18,981	135.7	17,857	141.6	18,626	136.3	17,737	142.2	18,498
104	141.4	18,519	146.0	19,113	142.0	18,391	146.6	18,979	137.0	17,835	143.1	18,625	137.6	17,716	143.7	18,497
105	142.7	18,496	147.5	19,112	143.3	18,369	148.1	18,978	138.2	17,813	144.5	18,624	138.8	17,694	145.1	18,496
106	143.6	18,422	148.8	19,094	144.2	18,295	149.5	18,960	139.1	17,741	145.8	18,606	139.7	17,623	146.5	18,479
107	144.5	18,348	150.2	19,076	145.1	18,222	150.8	18,942	139.9	17,670	147.2	18,588	140.5	17,552	147.8	18,461
108	145.3	18,276	151.6	19,058	146.0	18,150	152.2	18,925	140.8	17,601	148.5	18,571	141.4	17,484	149.2	18,444
109	146.2	18,205	152.9	19,040	146.8	18,080	153.6	18,907	141.6	17,532	149.9	18,554	142.2	17,416	150.5	18,427
110	147.1	18,135	154.3	19,022	147.7	18,010	154.9	18,889	142.5	17,465	151.2	18,536	143.1	17,349	151.8	18,410

Project Head (feet)	Unit 11 w/ Blades Welded at 29.9° (April 2012)								Unit 14 w/ Blades Welded at 29.6° (Aug 2019)							
	With STS				No STS				With STS				No STS			
	Lower Limit		Upper Limit		Lower Limit		Upper Limit		Lower Limit		Upper Limit		Lower Limit		Upper Limit	
	MW	MW	MW	MW	MW	MW	MW	MW	MW	cfs	MW	cfs	MW	cfs	MW	cfs
80	106.1	18,487	111.2	19,368	106.6	18,354	111.6	19,226	106.5	18,639	110.6	19,356	106.9	18,501	111.0	19,210
81	107.4	18,451	112.4	19,307	107.9	18,319	112.9	19,166	107.9	18,617	111.9	19,304	108.3	18,479	112.3	19,158
82	108.7	18,416	113.6	19,246	109.2	18,285	114.1	19,106	109.3	18,596	113.2	19,252	109.7	18,458	113.6	19,107
83	110.1	18,381	114.9	19,187	110.5	18,251	115.4	19,047	110.7	18,573	114.4	19,200	111.2	18,436	114.9	19,056
84	111.4	18,346	116.1	19,128	111.9	18,216	116.6	18,990	112.1	18,551	115.7	19,149	112.6	18,415	116.2	19,006
85	112.7	18,312	117.4	19,070	113.2	18,182	117.9	18,932	113.5	18,528	117.0	19,099	114.0	18,393	117.5	18,956
86	114.4	18,348	118.9	19,071	114.9	18,219	119.4	18,933	115.2	18,565	118.6	19,104	115.7	18,430	119.0	18,961
87	116.1	18,383	120.6	19,096	116.6	18,253	121.1	18,959	117.0	18,601	120.3	19,132	117.4	18,465	120.8	18,990
88	117.8	18,416	122.3	19,120	118.3	18,287	122.8	18,983	118.7	18,634	122.0	19,159	119.2	18,499	122.5	19,017
89	119.5	18,448	124.0	19,143	120.1	18,319	124.6	19,006	120.4	18,667	123.7	19,185	120.9	18,531	124.2	19,043
90	121.2	18,478	125.1	19,067	121.8	18,349	125.6	18,931	122.1	18,698	124.9	19,116	122.6	18,562	125.4	18,975
91	122.7	18,479	126.8	19,097	123.3	18,350	127.4	18,961	123.6	18,697	126.6	19,146	124.1	18,561	127.1	19,005
92	124.2	18,479	128.6	19,125	124.8	18,350	129.1	18,989	125.1	18,695	128.3	19,174	125.6	18,560	128.8	19,033
93	125.7	18,479	130.3	19,153	126.3	18,350	130.8	19,017	126.6	18,692	130.0	19,202	127.1	18,558	130.6	19,060
94	127.2	18,478	132.0	19,179	127.8	18,350	132.6	19,043	128.1	18,690	131.8	19,228	128.6	18,555	132.3	19,087
95	128.7	18,477	133.8	19,205	129.3	18,349	134.3	19,069	129.6	18,687	133.5	19,253	130.1	18,553	134.0	19,112
96	130.3	18,485	135.4	19,211	130.8	18,358	135.9	19,075	131.1	18,701	135.1	19,267	131.7	18,567	135.6	19,126
97	131.8	18,493	137.0	19,217	132.4	18,365	137.5	19,081	132.7	18,715	136.7	19,280	133.2	18,581	137.2	19,139
98	133.4	18,500	138.6	19,222	134.0	18,373	139.2	19,087	134.2	18,728	138.3	19,292	134.8	18,594	138.8	19,151
99	134.9	18,506	140.2	19,227	135.5	18,379	140.8	19,092	135.8	18,741	139.9	19,304	136.3	18,607	140.4	19,164
100	136.5	18,512	141.8	19,231	137.1	18,385	142.4	19,096	137.3	18,753	141.5	19,316	137.9	18,619	142.0	19,175
101	137.8	18,490	143.4	19,246	138.4	18,364	144.0	19,111	138.6	18,729	143.0	19,315	139.2	18,596	143.5	19,175
102	139.0	18,469	145.0	19,260	139.6	18,342	145.6	19,125	139.9	18,706	144.5	19,314	140.5	18,572	145.1	19,174
103	140.3	18,447	146.6	19,273	140.9	18,321	147.2	19,138	141.2	18,682	146.0	19,313	141.8	18,549	146.6	19,173
104	141.6	18,426	148.2	19,287	142.2	18,300	148.8	19,152	142.5	18,659	147.5	19,312	143.1	18,526	148.1	19,172
105	142.8	18,405	149.8	19,299	143.4	18,279	150.4	19,164	143.8	18,636	149.0	19,310	144.4	18,504	149.6	19,170
106	143.6	18,327	151.1	19,283	144.2	18,201	151.7	19,148	144.7	18,561	150.3	19,277	145.3	18,429	150.7	19,122
107	144.4	18,249	152.5	19,267	145.1	18,125	153.1	19,132	145.6	18,487	151.5	19,244	146.2	18,356	151.9	19,074
108	145.2	18,173	153.9	19,251	145.9	18,049	154.5	19,116	146.4	18,414	152.8	19,211	147.0	18,284	153.0	19,027
109	146.1	18,099	155.2	19,235	146.7	17,975	155.3	19,032	147.3	18,343	154.0	19,179	147.9	18,213	154.2	18,980
110	146.9	18,025	155.3	19,061	147.5	17,903	155.3	18,850	148.2	18,272	155.3	19,147	148.8	18,143	155.3	18,934

a. Units 3, 4, 8, 9, 10, 11, and 14 have runner blades that are locked at a fixed angle (non-adjustable) and a restricted operating range until the unit is repaired.



## 5. DEWATERING PLANS

### 5.1. General

**5.1.1.** *Guidelines for Dewatering and Fish Handling (Appendix F)* and project *Dewatering Plans*<sup>5</sup> have been developed by the projects and approved by FPOM and are followed for most project facility dewaterings. The appropriate plans are reviewed by participants before each salvage operation. The plans include consideration for fish safety and are consistent with the following general guidance.

**5.1.2.** The Project biologist and/or alternate Corps fish personnel will attend all project activities involving fish handling. Personnel shall remain present onsite during pumping operations to ensure stranding does not occur or a water level sensor that deactivates the dewatering process will be used. During the pumping or draining operation to dewater a portion or all, the water level will not be allowed to drop so low it strands fish. The fish agencies and tribes will be encouraged to participate in all ladder dewaterings.

### 5.2. Dewatering – Adult Fish Ladders

**5.2.1.** When possible prior to dewatering, operate ladders to be dewatered at orifice flow, with the AWS off, for at least 24 hours but not more than 96 hours. For non-routine or unscheduled maintenance, discontinue auxiliary water and operate ladder at reduced flow as long as possible for up to 72 hours prior to dewatering and follow guidance in **section 6.4**.

**5.2.2.** Project personnel will install head gates<sup>6</sup> to shut down ladder flow. Where possible, a flushing flow of 1”–2” will be maintained in the ladder until fish are rescued.

**5.2.3.** A Project biologist will ensure availability of fish rescue equipment and adequate numbers of personnel necessary to move fish out of the dewatered ladder. The Project Biologist or alternate Corps fish personnel will oversee fish rescue when the ladders are dewatered. The Project Biologist will invite fish agency and/or tribal biologists to participate in the dewatering activities. Juvenile fish will be transported and released in the tailrace and adults released in the forebay (except identifiable steelhead kelts should be released into the tailrace).

**5.2.4.** Orifice blocking devices, which are placed in the lower-most weirs to prevent fish from re-ascending the dewatered portion of the adult fishway, shall have ropes attached to them by project operations and be tied off to fishway railings. The blocking devices shall be removed just before the fishway is returned to service. These devices will be noted on the pre-water-up checklist maintained by Project fish biologists. This will prevent the orifice blocks from being unintentionally left in place following fishway water-up.

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<sup>5</sup> Dewatering Plans: [pweb.crohms.org/tmt/documents/FPOM/2010/](http://pweb.crohms.org/tmt/documents/FPOM/2010/)

<sup>6</sup> Head gates may also be referred to as “operating” gates at some projects. The terms are interchangeable.

### **5.3. Dewatering – Powerhouse Fish Collection System**

**5.3.1.** During the pumping or draining operation to dewater a portion or the entire collection channel, the water will not be allowed to drop to a level which strands fish. Personnel shall remain present onsite during pumping operations to ensure that stranding does not occur. The Project Biologist will assure that all necessary rescue equipment is available. The Project Biologist or alternate Corps fish personnel will provide technical guidance on fish safety and will assist directly in rescue operations.

### **5.4. Dewatering – Juvenile Bypass System (JBS)**

**5.4.1.** When draining the juvenile bypass channel, it is typical to flush the channel with only Unit 16 bypass orifices open. Unit 16 gatewells will be dipped in advance to minimize the number of fish contained in this flushing water during fish passage season.

### **5.5. Dewatering – Turbine Units**

**5.5.1. Gatewell Dipping:** Remove juvenile fish from gatewell(s) that will be drained by use of a special dipping basket. During fish passage season, April 1–December 15, gatewell dipping is mandatory whether or not fish screens are installed. Dipping is not required during winter maintenance, December 16–March 31, when fish screens have been removed. To minimize the number of fish contained in the gatewell:

- i. Shut down the turbine the previous evening/night and leave idle with all orifices open overnight if power demand allows;
- ii. Keep orifices open during the removal of screens/STSSs, during turbine spinning, and while gatewell dipping is performed;
- iii. Close orifices only after gatewell dipping/fish removal has been completed and immediately before installing the bulkhead;
- iv. It is strongly preferred that, if possible, two roller gates and one bulkhead are deployed to isolate a turbine for dewatering.

**5.5.2.** If the turbine draft tube is dewatered, operate unit at full load for a minimum of 15 minutes immediately prior to installing tail logs. If not possible to load, run unit at speed-no-load for a minimum of 15 minutes. Install the bottom two tail logs side-by-side prior to stacking the remainder to minimize risk of sturgeon entering the draft tube before dewatering. This is necessary for both scheduled and unscheduled outages.

**5.5.3.** If a turbine unit is idle and partially dewatered, and tail logs are to be put into place, an adequate safety pool may be maintained for up to 4 days to accommodate fish trapped in the draft tube. If longer timeframes are needed for the safety pool, project fisheries will coordinate with FPOM on a case-by-case basis. Adequate inspections will need to be conducted to ensure that the safety pool is maintained and fish are in good condition. Water levels in the draft tube will not be allowed to drop to a level that strands fish.

**5.5.4.** Fish rescue personnel will inspect dewatered turbine draft tubes, scroll cases, and intakes as soon as they can gain access and the water levels reach a depth permitting visual inspection.

The Project Biologist or alternate fish personnel will provide technical guidance on fish safety and will directly participate in fish salvage. The Project Biologist will ensure that all necessary rescue equipment is available.

## **5.6. Dewatering – Navigation Lock**

**5.6.1.** The navigation lock is frequently dewatered for routine maintenance in late February/early March, in conjunction with navigation lock outages at The Dalles and Bonneville dams. The area between the upstream bulkhead and the upstream gate is surveyed for fish as water levels allow. The lateral and pool areas on the floor of the lock are surveyed for fish from above. Most of these areas remain full of water, precluding the ability to implement successful fish salvage operations. Areas where water levels slowly decrease are accessed via crane when pool levels reach a depth of approximately 3 feet. The fill conduits are accessed and checked for fish only if needed and can be done safely. All salvaged fish are removed, transported via bag or tank and released to the river.

## **6. FOREBAY DEBRIS REMOVAL**

Debris at projects can impact fish passage conditions by plugging or blocking trash racks, VBSs, gatewell orifices, dewatering screens, separators, and facility piping resulting in impingement, injuries, and descaling of fish. Removing debris at its source in the forebay is sometimes necessary to maintain safe and efficient fish passage conditions, navigation, and other project activities. In this case, the only viable alternative is to spill to pass the debris. Special spill operations that don't follow the normal spill schedule or volume limits will be coordinated prior to their execution. Normally, the project shall contact CENWP-OD at least two workdays prior to the day the special operation is required. Using information provided by the project, CENWP-OD will coordinate with FPOM and with RCC, as necessary. Once the coordination is complete, RCC will issue a teletype detailing the special operations.

## **7. RESPONSE TO HAZARDOUS MATERIALS SPILLS**

John Day Project's guidance for responding to hazardous substance spills is contained in its *Emergency Spill Response Plan*. This guidance will be followed in case of a spill. In the event of a hazardous materials spill, the Project Biologist has the authority to make fishway adjustments outside of operating criteria as necessary to prevent contamination of the ladder until unified command is formed and consultation is established with FPOM. NOAA Fisheries will be notified within 24 hours of a ladder closure.

Project Fisheries will be contacted as soon as possible after a hazardous material release and prior to any modification to fishway operations. Project Fisheries will then contact the CENWP-OD biologist and FPOM. Attempts should be made to first contact the Project Biologist on duty. During fish passage season there is a Project Biologist on duty 7 days/week. If a Project Biologist cannot be reached by radio or in the office, attempts to contact Project Fisheries will occur in the following order (contact info available in the Control Room): Eric Grosvenor; Michael Lotspeich; Tammy Mackey.

**Table JDA-8. [pg 1 of 11] John Day Dam Spill Patterns with TSWs in Bays 18-19.**

JDA Spill Patterns with TSWs in Bays 18, 19 - # Gate Stops per Spillbay																				Total Stops (#)	Spill <sup>a</sup> (kcfs)
1 <sup>b</sup>	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18 <sup>c</sup>	19 <sup>c</sup>	20 <sup>b</sup>		
																	TSW	TSW		0	19.4
																	TSW	TSW	1	1	21
																	TSW	TSW	1.5	1.5	21.8
	1																TSW	TSW	1.5	2.5	23.4
	1	1															TSW	TSW	1.5	3.5	25
	1	1														1	TSW	TSW	1.5	4.5	26.6
	1	1													1	1	TSW	TSW	1.5	5.5	28.2
	1	1												1	1	1	TSW	TSW	1.5	6.5	29.8
	1	1											1	1	1	1	TSW	TSW	1.5	7.5	31.4
	1	1										1	1	1	1	1	TSW	TSW	1.5	8.5	33
	1	1									1	1	1	1	1	1	TSW	TSW	1.5	9.5	34.6
	1	1								1	1	1	1	1	1	1	TSW	TSW	1.5	10.5	36.2
	1	1							1	1	1	1	1	1	1	1	TSW	TSW	1.5	11.5	37.8
	1	1						1	1	1	1	1	1	1	1	1	TSW	TSW	1.5	12.5	39.4
	1	1					1	1	1	1	1	1	1	1	1	1	TSW	TSW	1.5	13.5	41
	1	1				1	1	1	1	1	1	1	1	1	1	1	TSW	TSW	1.5	14.5	42.6
	1	1	1			1	1	1	1	1	1	1	1	1	1	1	TSW	TSW	1.5	15.5	44.2
	1	1	1			1	1	1	1	1	1	1	1	1	1	1.5	TSW	TSW	1.5	16	45
	2	1	1			1	1	1	1	1	1	1	1	1	1	1.5	TSW	TSW	1.5	16.5	45.8
	2	1.5	1			1	1	1	1	1	1	1	1	1	1	1.5	TSW	TSW	1.5	17	46.6
	2	1.5	1	1		1	1	1	1	1	1	1	1	1	1	1.5	TSW	TSW	1.5	18	48.2
	2	1.5	1	1		1	1	1	1	1	1	1	1	1	1.5	1.5	TSW	TSW	1.5	18.5	49
	2	1.5	1.5	1		1	1	1	1	1	1	1	1	1	1.5	1.5	TSW	TSW	1.5	19	49.8
	2	1.5	1.5	1		1	1	1	1	1	1	1	1	1	1.5	1.5	TSW	TSW	2	19.5	50.6
	2	1.5	1.5	1		1	1	1	1	1	1	1	1	1	1.5	2	TSW	TSW	2	20	51.4
	2	1.5	1.5	1	1	1	1	1	1	1	1	1	1	1	1.5	2	TSW	TSW	2	21	53
	2	1.5	1.5	1.5	1	1	1	1	1	1	1	1	1	1	1.5	2	TSW	TSW	2	21.5	53.8
	2	1.5	1	1.5	1	1	1	1.5	1	1	1	1	1	1	1.5	2	TSW	TSW	2	22	54.6
	2	1.5	1	1.5	1	1.5	1	1.5	1	1	1	1	1	1	1.5	2	TSW	TSW	2	22.5	55.4
	2	1.5	1	1.5	1	1.5	1	1.5	1	1	1	1	1	1.5	1.5	2	TSW	TSW	2	23	56.2
	2	1.5	1	1.5	1	1.5	1	1.5	1	1	1	1	1	1.5	2	2	TSW	TSW	2	23.5	57
	3	1.5	1	1.5	1	1.5	1	1.5	1	1	1	1	1	1.5	2	2	TSW	TSW	2	24	57.8
	3	1.5	1	1.5	1	1.5	1	1.5	1.5	1	1	1	1	1.5	2	2	TSW	TSW	2	24.5	58.6
	3	1.5	1	1.5	1	1.5	1.5	1.5	1.5	1	1	1	1	1.5	2	2	TSW	TSW	2	25	59.4
	3	1.5	1	1.5	1	1.5	1.5	1.5	1.5	1	1	1	1.5	1.5	2	2	TSW	TSW	2	25.5	60.2
	3	1.5	1	1.5	1	1.5	1.5	2	1.5	1	1	1	1.5	1.5	2	2	TSW	TSW	2	26	61
	3	1.5	1	1.5	1.5	1.5	1.5	2	1.5	1	1	1	1.5	1.5	2	2	TSW	TSW	2	26.5	61.8
	3	1.5	1	1.5	1.5	1.5	1.5	2	1.5	1	1	1.5	1.5	1.5	2	2	TSW	TSW	2	27	62.6
	3	1.5	1	1.5	1.5	1.5	1.5	2	1.5	1	1.5	1.5	1.5	1.5	2	2	TSW	TSW	2	27.5	63.4
	3	1.5	1	1.5	1.5	2	1.5	2	1.5	1	1.5	1.5	1.5	1.5	2	2	TSW	TSW	2	28	64.2
	3	1.5	1	1.5	1.5	2	1.5	2	1.5	1	1.5	1.5	1.5	1.5	2	2.5	TSW	TSW	2	28.5	65
	3	1.5	1	1.5	1.5	2	1.5	2	1.5	1	1.5	1.5	1.5	1.5	2	2.5	TSW	TSW	2	29	65.8

<sup>a</sup> Spill (kcfs) is calculated as a function of total stops + TSW spill. At Spill > 305 kcfs, transition from pattern for juvenile fish to flood.

<sup>b</sup> Gates 1 & 20 blocked at 11 stops (10.3 ft opening).

<sup>c</sup> TSWs in Bays 18-19 = fixed spill of ~19.4 kcfs (~9.7 kcfs/bay). TSW removal recommended for flow > 685 kcfs. TSW does not affect spillway flood capacity until flow ≥ 1,492 kcfs.

JDA Spill Patterns with TSWs in Bays 18, 19 - # Gate Stops per Spillbay																				Total Stops (#)	Spill a (kcfs)
1 <sup>b</sup>	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18 <sup>c</sup>	19 <sup>c</sup>	20 <sup>b</sup>		
	3	1.5	1	1.5	1.5	2	1.5	2	1.5	1.5	1.5	1.5	1.5	2	2	2.5	TSW	TSW	2	29.5	66.6
	3	1.5	1.5	1.5	1.5	2	1.5	2	1.5	1.5	1.5	1.5	1.5	2	2	2.5	TSW	TSW	2	30	67.4
	3	1.5	1.5	1.5	1.5	2	2	2	1.5	1.5	1.5	1.5	1.5	2	2	2.5	TSW	TSW	2	30.5	68.2
	3	1.5	1.5	1.5	1.5	2	2	2	1.5	1.5	1.5	1.5	2	2	2	2.5	TSW	TSW	2	31	69
	3	1.5	1.5	1.5	1.5	2	2	2	1.5	1.5	1.5	1.5	2	2	2.5	2.5	TSW	TSW	2	31.5	69.8
	3	2	1.5	1.5	1.5	2	2	2	1.5	1.5	1.5	1.5	2	2	2.5	2.5	TSW	TSW	2	32	70.6
	3	2	1.5	1.5	1.5	2	2	2	1.5	1.5	1.5	1.5	2	2	2.5	2.5	TSW	TSW	2.5	32.5	71.4
	3	2	1.5	1.5	1.5	2	2	2	1.5	1.5	1.5	2	2	2	2.5	2.5	TSW	TSW	2.5	33	72.2
	3	2	1.5	1.5	1.5	2	2	2	1.5	1.5	1.5	2	2	2	2.5	2.5	TSW	TSW	2.5	33.5	73
	3	2	1.5	2	1.5	2	2	2	1.5	1.5	1.5	2	2	2	2.5	2.5	TSW	TSW	2.5	34	73.8
	3	2	1.5	2	1.5	2	2	2	1.5	1.5	2	2	2	2	2.5	2.5	TSW	TSW	2.5	34.5	74.6
	3	2	1.5	2	1.5	2	2	2	2	1.5	2	2	2	2	2.5	2.5	TSW	TSW	2.5	35	75.4
	3	2	1.5	2	1.5	2	2	2	2	2	2	2	2	2	2.5	2.5	TSW	TSW	2.5	35.5	76.2
	3	2	1.5	2	2	2	2	2	2	2	2	2	2	2	2.5	2.5	TSW	TSW	2.5	36	77
	3	2	1.5	2	2	2.5	2	2	2	2	2	2	2	2	2.5	2.5	TSW	TSW	2.5	36.5	77.8
	3	2	2	2	2	2.5	2	2	2	2	2	2	2	2	2.5	2.5	TSW	TSW	2.5	37	78.6
	3	2.5	2	2	2	2.5	2	2	2	2	2	2	2	2	2.5	2.5	TSW	TSW	2.5	37.5	79.4
	3	2.5	2	2	2.5	2.5	2	2	2	2	2	2	2	2	2.5	2.5	TSW	TSW	2.5	38	80.2
	4	2.5	2	2	2.5	2.5	2	2	2	2	2	2	2	2	2.5	2.5	TSW	TSW	2.5	38.5	81
	4	2.5	2	2	2.5	2.5	2	2	2	2	2	2	2	2.5	2.5	2.5	TSW	TSW	2.5	39	81.8
	4	2.5	2	2	2.5	2.5	2.5	2	2	2	2	2	2	2.5	2.5	2.5	TSW	TSW	2.5	39.5	82.6
	4	2.5	2	2	2.5	2.5	2.5	2	2	2	2	2	2.5	2.5	2.5	2.5	TSW	TSW	2.5	40	83.4
	4	2.5	1.5	2	2.5	2.5	2.5	2.5	2	2	2	2.5	2.5	2.5	2.5	2.5	TSW	TSW	2.5	40.5	84.2
	4	2.5	1.5	2	2.5	2.5	2.5	2.5	2.5	2	2	2.5	2.5	2.5	2.5	2.5	TSW	TSW	2.5	41	85
	4	2.5	1.5	2	2.5	2.5	2.5	2.5	2.5	2	2	2.5	2.5	2.5	3	2.5	TSW	TSW	2.5	41.5	85.8
	4	2.5	1.5	2	2.5	2.5	2.5	2.5	2.5	2	2	2.5	2.5	3	3	2.5	TSW	TSW	2.5	42	86.6
	4	2.5	1.5	2	2.5	2.5	2.5	2.5	2.5	2	2.5	2.5	2.5	3	3	2.5	TSW	TSW	2.5	42.5	87.4
	4	3	1.5	2	2.5	2.5	2.5	2.5	2.5	2	2.5	2.5	2.5	3	3	2.5	TSW	TSW	2.5	43	88.2
	4	3	1.5	2	2.5	2.5	2.5	2.5	2.5	2	2.5	2.5	3	3	3	2.5	TSW	TSW	2.5	43.5	89
	4	3	1.5	2	2.5	3	2.5	2.5	2.5	2	2.5	2.5	3	3	3	2.5	TSW	TSW	2.5	44	89.8
	4	3	1.5	2	2.5	3	2.5	2.5	2.5	2.5	2.5	2.5	3	3	3	2.5	TSW	TSW	2.5	44.5	90.6
	4	3	2	2	2.5	3	2.5	2.5	2.5	2.5	2.5	2.5	3	3	3	2.5	TSW	TSW	2.5	45	91.4
	4	3	2	2	2.5	3	2.5	2.5	2.5	2.5	2.5	2.5	3	3	3	3	TSW	TSW	2.5	45.5	92.2
	4	3	2	2.5	2.5	3	2.5	2.5	2.5	2.5	2.5	2.5	3	3	3	3	TSW	TSW	2.5	46	93
	4	3	2	2.5	2.5	3	2.5	2.5	2.5	2.5	2.5	2.5	3	3	3.5	3	TSW	TSW	2.5	46.5	93.8
	4	3.5	2	2.5	2.5	3	2.5	2.5	2.5	2.5	2.5	2.5	3	3	3.5	3	TSW	TSW	2.5	47	94.6
	4	3.5	2	2.5	2.5	3	3	2.5	2.5	2.5	2.5	2.5	3	3	3.5	3	TSW	TSW	2.5	47.5	95.4
	4	3.5	2	2.5	2.5	3	3	2.5	2.5	2.5	2.5	2.5	3	3	3.5	3.5	TSW	TSW	2.5	48	96.2
	4	3.5	2	3	2.5	3	3	2.5	2.5	2.5	2.5	2.5	3	3	3.5	3.5	TSW	TSW	2.5	48.5	97
	4	3.5	2.5	3	2.5	3	3	2.5	2.5	2.5	2.5	2.5	3	3	3.5	3.5	TSW	TSW	2.5	49	97.8
	4	3.5	2.5	3	2.5	3	3	2.5	2.5	2.5	3	2.5	3	3	3.5	3.5	TSW	TSW	2.5	49.5	98.6
	4	3.5	2.5	3	2.5	3	3	3	2.5	2.5	3	2.5	3	3	3.5	3.5	TSW	TSW	2.5	50	99.4
	4	3.5	2.5	3	2.5	3	3	3	3	2.5	3	2.5	3	3	3.5	3.5	TSW	TSW	2.5	50.5	100.2
	4	3.5	2.5	3	2.5	3	3	3	3	2.5	3	3	3	3	3.5	3.5	TSW	TSW	2.5	51	101
	4	3.5	2.5	3.5	2.5	3	3	3	3	2.5	3	3	3	3	3.5	3.5	TSW	TSW	2.5	51.5	101.8
	4	3.5	3	3.5	2.5	3	3	3	3	2.5	3	3	3	3	3.5	3.5	TSW	TSW	2.5	52	102.6
	4	3.5	3	3.5	2.5	3	3	3	3	2.5	3	3	3	3	3.5	4	TSW	TSW	2.5	52.5	103.4
	4	3.5	3	3.5	2.5	3	3	3	3	2.5	3	3	3	3.5	3.5	4	TSW	TSW	2.5	53	104.2
	4	3.5	3	3.5	2.5	3	3	3	3	2.5	3	3	3	3.5	3.5	4	TSW	TSW	2.5	53.5	105

JDA Spill Patterns with TSWs in Bays 18, 19 - # Gate Stops per Spillbay																				Total	Spill a	
1 <sup>b</sup>	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18 <sup>c</sup>	19 <sup>c</sup>	20 <sup>b</sup>	Stops (#)	(kcfs)	
	4	3.5	3	3.5	2.5	3	3	3	3	3	3	3	3	3.5	3.5	4	TSW	TSW	2.5	54	105.8	
	4	3.5	3	3.5	3	3	3	3	3	3	3	3	3	3.5	3.5	4	TSW	TSW	2.5	54.5	106.6	
	4	3.5	3	3.5	3	3	3	3	3	3	3	3	3	3.5	4	4	TSW	TSW	2.5	55	107.4	
	4	3.5	3	3.5	3	3	3	3	3	3	3	3	3.5	3.5	4	4	TSW	TSW	2.5	55.5	108.2	
	4	4	3	3.5	3	3	3	3	3	3	3	3	3.5	3.5	4	4	TSW	TSW	2.5	56	109	
	4	4	3	3.5	3	3	3	3	3	3	3.5	3	3.5	3.5	4	4	TSW	TSW	2.5	56.5	109.8	
	4	4	3	3.5	3	3.5	3	3	3	3	3.5	3	3.5	3.5	4	4	TSW	TSW	2.5	57	110.6	
	4	4	3	3.5	3	3.5	3	3	3	3.5	3.5	3	3.5	3.5	4	4	TSW	TSW	2.5	57.5	111.4	
	4	4	3	3.5	3	3.5	3	3	3	3.5	3.5	3.5	3.5	3.5	4	4	TSW	TSW	2.5	58	112.2	
	4	4	3	3.5	3.5	3.5	3	3	3	3.5	3.5	3.5	3.5	3.5	4	4	TSW	TSW	2.5	58.5	113	
	4	4	3	3.5	3.5	3.5	3	3.5	3	3.5	3.5	3.5	3.5	3.5	4	4	TSW	TSW	2.5	59	113.8	
	4	4	3	3.5	3.5	3.5	3	3.5	3	3.5	3.5	3.5	3.5	3.5	4	4.5	TSW	TSW	2.5	59.5	114.6	
	4	4	3	3.5	3.5	3.5	3	3.5	3	3.5	3.5	3.5	3.5	3.5	4	4.5	TSW	TSW	3	60	115.4	
	4	4	3	3.5	3.5	3.5	3	3.5	3	3.5	3.5	3.5	3.5	4	4	4.5	TSW	TSW	3	60.5	116.2	
	4	4	3.5	3.5	3.5	3.5	3	3.5	3	3.5	3.5	3.5	3.5	4	4	4.5	TSW	TSW	3	61	117	
	4	4	3.5	3.5	3.5	3.5	3.5	3.5	3	3.5	3.5	3.5	3.5	4	4	4.5	TSW	TSW	3	61.5	117.8	
	4	4	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	4	4	4.5	TSW	TSW	3	62	118.6	
	4	4	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	4	4.5	4.5	TSW	TSW	3	62.5	119.4	
	4	4	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	4	4	4.5	4.5	TSW	TSW	3	63	120.2	
	4	4.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	4	4	4.5	4.5	TSW	TSW	3	63.5	121	
	4	4.5	3.5	4	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	4	4	4.5	4.5	TSW	TSW	3	64	121.8	
	4	4.5	3.5	4	3.5	3.5	3.5	3.5	3.5	3.5	4	3.5	4	4	4.5	4.5	TSW	TSW	3	64.5	122.6	
	4	4.5	3.5	4	3.5	4	3.5	3.5	3.5	3.5	4	3.5	4	4	4.5	4.5	TSW	TSW	3	65	123.4	
	4	4.5	3.5	4	3.5	4	3.5	3.5	3.5	4	4	3.5	4	4	4.5	4.5	TSW	TSW	3	65.5	124.2	
	4	4.5	3.5	4	3.5	4	3.5	3.5	3.5	4	4	4	4	4	4.5	4.5	TSW	TSW	3	66	125	
	4	4.5	3.5	4	4	4	3.5	3.5	3.5	4	4	4	4	4	4.5	4.5	TSW	TSW	3	66.5	125.8	
	4	4.5	3.5	4	4	4	3.5	4	3.5	4	4	4	4	4	4.5	4.5	TSW	TSW	3	67	126.6	
	4	4.5	3.5	4	4	4	3.5	4	3.5	4	4	4	4	4	4.5	5	TSW	TSW	3	67.5	127.4	
	4	4.5	3.5	4	4	4	3.5	4	3.5	4	4	4	4	4	4.5	5	TSW	TSW	3.5	68	128.2	
	4	4.5	3.5	4	4	4	3.5	4	3.5	4	4	4	4	4.5	4.5	5	TSW	TSW	3.5	68.5	129	
	4	4.5	4	4	4	4	3.5	4	3.5	4	4	4	4	4.5	4.5	5	TSW	TSW	3.5	69	129.8	
	4	4.5	4	4	4	4	4	4	3.5	4	4	4	4	4.5	4.5	5	TSW	TSW	3.5	69.5	130.6	
	4	4.5	4	4	4	4	4	4	4	4	4	4	4	4.5	4.5	5	TSW	TSW	3.5	70	131.4	
	4	4.5	4	4	4	4	4	4	4	4	4	4	4	4.5	5	5	TSW	TSW	3.5	70.5	132.2	
	4	4.5	4	4	4	4	4	4	4	4	4	4	4	4.5	4.5	5	5	TSW	TSW	3.5	71	133
	4	5	4	4	4	4	4	4	4	4	4	4	4	4.5	4.5	5	5	TSW	TSW	3.5	71.5	133.8
	4	5	4	4.5	4	4	4	4	4	4	4	4	4	4.5	4.5	5	5	TSW	TSW	3.5	72	134.6
	4	5	4	4.5	4	4	4	4	4	4	4	4	4.5	4.5	5	5	TSW	TSW	3.5	72.5	135.4	
	4	5	4	4.5	4	4.5	4	4	4	4	4	4	4.5	4.5	5	5	TSW	TSW	3.5	73	136.2	
	4	5	4	4.5	4	4.5	4	4	4	4	4.5	4.5	4	4.5	4.5	5	5	TSW	TSW	3.5	73.5	137
	4	5	4	4.5	4	4.5	4	4	4	4	4.5	4.5	4.5	4.5	5	5	TSW	TSW	3.5	74	137.8	
	4	5	4	4.5	4.5	4.5	4	4	4	4	4.5	4.5	4.5	4.5	5	5	TSW	TSW	3.5	74.5	138.6	
	4	5	4	4.5	4.5	4.5	4	4.5	4	4	4.5	4.5	4.5	4.5	5	5	TSW	TSW	3.5	75	139.4	
	4	5	4	4.5	4.5	4.5	4	4.5	4	4	4.5	4.5	4.5	4.5	5	5.5	TSW	TSW	3.5	75.5	140.2	
	4	5	4	4.5	4.5	4.5	4	4.5	4	4	4.5	4.5	4.5	4.5	5	5.5	TSW	TSW	4	76	141	
	4	5	4	4.5	4.5	4.5	4	4.5	4	4	4.5	4.5	4.5	5	5	5.5	TSW	TSW	4	76.5	141.8	
	4	5	4.5	4.5	4.5	4.5	4	4.5	4	4	4.5	4.5	4.5	5	5	5.5	TSW	TSW	4	77	142.6	
	4	5	4.5	4.5	4.5	4.5	4.5	4.5	4	4	4.5	4.5	4.5	5	5	5.5	TSW	TSW	4	77.5	143.4	
	4	5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	5	5	5.5	TSW	TSW	4	78	144.2	

JDA Spill Patterns with TSWs in Bays 18, 19 - # Gate Stops per Spillbay																				Total	Spill a	
1 <sup>b</sup>	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18 <sup>c</sup>	19 <sup>c</sup>	20 <sup>b</sup>	Stops (#)	(kcfs)	
	4	5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	5	5.5	5.5	TSW	TSW	4	78.5	145	
	4	5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	5	5	5.5	5.5	TSW	TSW	4	79	145.8	
	4	5.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	5	5	5.5	5.5	TSW	TSW	4	79.5	146.6	
	4	5.5	4.5	5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	5	5	5.5	5.5	TSW	TSW	4	80	147.4	
	4	5.5	4.5	5	4.5	4.5	4.5	4.5	4.5	4.5	5	4.5	5	5	5.5	5.5	TSW	TSW	4	80.5	148.2	
	4	5.5	4.5	5	4.5	5	4.5	4.5	4.5	4.5	5	4.5	5	5	5.5	5.5	TSW	TSW	4	81	149	
	4	5.5	4.5	5	4.5	5	4.5	4.5	4.5	5	5	4.5	5	5	5.5	5.5	TSW	TSW	4	81.5	149.8	
	4	5.5	4.5	5	4.5	5	4.5	4.5	4.5	5	5	5	5	5	5.5	5.5	TSW	TSW	4	82	150.6	
	4	5.5	4.5	5	5	5	4.5	4.5	4.5	5	5	5	5	5	5.5	5.5	TSW	TSW	4	82.5	151.4	
	4	5.5	4.5	5	5	5	4.5	5	4.5	5	5	5	5	5	5.5	5.5	TSW	TSW	4	83	152.2	
	4	5.5	4.5	5	5	5	4.5	5	4.5	5	5	5	5	5	5.5	6	TSW	TSW	4	83.5	153	
	4	5.5	4.5	5	5	5	4.5	5	4.5	5	5	5	5	5	5.5	6	TSW	TSW	4.5	84	153.8	
	4	5.5	4.5	5	5	5	4.5	5	4.5	5	5	5	5	5.5	5.5	6	TSW	TSW	4.5	84.5	154.6	
	4	5.5	5	5	5	5	4.5	5	4.5	5	5	5	5	5.5	5.5	6	TSW	TSW	4.5	85	155.4	
	4	5.5	5	5	5	5	5	5	4.5	5	5	5	5	5.5	5.5	6	TSW	TSW	4.5	85.5	156.2	
	4	5.5	5	5	5	5	5	5	5	5	5	5	5	5.5	5.5	6	TSW	TSW	4.5	86	157	
	4	5.5	5	5	5	5	5	5	5	5	5	5	5	5.5	6	6	TSW	TSW	4.5	86.5	157.8	
	4	5.5	5	5	5	5	5	5	5	5	5	5	5.5	5.5	6	6	TSW	TSW	4.5	87	158.6	
	4	6	5	5	5	5	5	5	5	5	5	5	5.5	5.5	6	6	TSW	TSW	4.5	87.5	159.4	
	4	6	5	5.5	5	5	5	5	5	5	5	5	5.5	5.5	6	6	TSW	TSW	4.5	88	160.2	
	4	6	5	5.5	5	5	5	5	5	5	5.5	5	5.5	5.5	6	6	TSW	TSW	4.5	88.5	161	
	4	6	5	5.5	5	5.5	5	5	5	5	5.5	5	5.5	5.5	6	6	TSW	TSW	4.5	89	161.8	
	4	6	5	5.5	5	5.5	5	5	5	5	5.5	5.5	5	5.5	5.5	6	6	TSW	TSW	4.5	89.5	162.6
	4	6	5	5.5	5	5.5	5	5	5	5	5.5	5.5	5.5	5.5	6	6	TSW	TSW	4.5	90	163.4	
	4	6	5	5.5	5.5	5.5	5	5	5	5	5.5	5.5	5.5	5.5	6	6	TSW	TSW	4.5	90.5	164.2	
	4	6	5	5.5	5.5	5.5	5	5.5	5	5.5	5.5	5.5	5.5	5.5	6	6	TSW	TSW	4.5	91	165	
	4	6	5	5.5	5.5	5.5	5	5.5	5	5.5	5.5	5.5	5.5	5.5	6	6.5	TSW	TSW	4.5	91.5	165.8	
	4	6	5	5.5	5.5	5.5	5	5.5	5	5.5	5.5	5.5	5.5	5.5	6	6.5	TSW	TSW	5	92	166.6	
	4	6	5	5.5	5.5	5.5	5	5.5	5	5.5	5.5	5.5	5.5	6	6	6.5	TSW	TSW	5	92.5	167.4	
	4	6	5.5	5.5	5.5	5.5	5	5.5	5	5.5	5.5	5.5	5.5	6	6	6.5	TSW	TSW	5	93	168.2	
	4	6	5.5	5.5	5.5	5.5	5.5	5.5	5	5.5	5.5	5.5	5.5	6	6	6.5	TSW	TSW	5	93.5	169	
	4	6	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	6	6	6.5	TSW	TSW	5	94	169.8	
	4	6	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	6	6.5	6.5	TSW	TSW	5	94.5	170.6	
	4	6	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	6	6	6.5	6.5	TSW	TSW	5	95	171.4	
	4	6	5.5	6	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	6	6	6.5	6.5	TSW	TSW	5	95.5	172.2	
	4	6	5.5	6	5.5	5.5	5.5	5.5	5.5	5.5	6	5.5	6	6	6.5	6.5	TSW	TSW	5	96	173	
	4	6	5.5	6	5.5	6	5.5	5.5	5.5	5.5	6	5.5	6	6	6.5	6.5	TSW	TSW	5	96.5	173.8	
	4	6	5.5	6	5.5	6	5.5	5.5	5.5	6	6	5.5	6	6	6.5	6.5	TSW	TSW	5	97	174.6	
	4	6	5.5	6	5.5	6	5.5	5.5	5.5	6	6	6	6	6	6.5	6.5	TSW	TSW	5	97.5	175.4	
	4	6	5.5	6	6	6	5.5	5.5	5.5	6	6	6	6	6	6.5	6.5	TSW	TSW	5	98	176.2	
	4	6	5.5	6	6	6	5.5	6	5.5	6	6	6	6	6	6.5	6.5	TSW	TSW	5	98.5	177	
	4	6	5.5	6	6	6	5.5	6	5.5	6	6	6	6	6	6.5	7	TSW	TSW	5	99	177.8	
	4	6	5.5	6	6	6	5.5	6	5.5	6	6	6	6	6	6.5	7	TSW	TSW	5.5	99.5	178.6	
	4	6	5.5	6	6	6	5.5	6	5.5	6	6	6	6	6.5	6.5	7	TSW	TSW	5.5	100	179.4	
	4	6	6	6	6	6	5.5	6	5.5	6	6	6	6	6.5	6.5	7	TSW	TSW	5.5	100.5	180.2	
	4	6	6	6	6	6	6	6	5.5	6	6	6	6	6.5	6.5	7	TSW	TSW	5.5	101	181	
	4	6	6	6	6	6	6	6	6	6	6	6	6	6.5	6.5	7	TSW	TSW	5.5	101.5	181.8	
	4	6	6	6	6	6	6	6	6	6	6	6	6	6.5	7	7	TSW	TSW	5.5	102	182.6	
	4	6	6	6	6	6	6	6	6	6	6	6	6.5	6.5	7	7	TSW	TSW	5.5	102.5	183.4	



JDA Spill Patterns with TSWs in Bays 18, 19 - # Gate Stops per Spillbay																				Total	Spill a
1 <sup>b</sup>	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18 <sup>c</sup>	19 <sup>c</sup>	20 <sup>b</sup>	Stops (#)	(kcfs)
	4	6	6	6.5	6	6	6	6	6	6	6	6	6.5	6.5	7	7	TSW	TSW	5.5	103	184.2
	4	6	6	6.5	6	6	6	6	6	6	6.5	6	6.5	6.5	7	7	TSW	TSW	5.5	103.5	185
	4	6	6	6.5	6	6.5	6	6	6	6	6.5	6	6.5	6.5	7	7	TSW	TSW	5.5	104	185.8
	4	6	6	6.5	6	6.5	6	6	6	6.5	6.5	6	6.5	6.5	7	7	TSW	TSW	5.5	104.5	186.6
	4	6	6	6.5	6	6.5	6	6	6	6.5	6.5	6.5	6.5	6.5	7	7	TSW	TSW	5.5	105	187.4
	4	6	6	6.5	6.5	6.5	6	6	6	6.5	6.5	6.5	6.5	6.5	7	7	TSW	TSW	5.5	105.5	188.2
	4	6	6	6.5	6.5	6.5	6	6.5	6	6.5	6.5	6.5	6.5	6.5	7	7	TSW	TSW	5.5	106	189
	4	6	6	6.5	6.5	6.5	6	6.5	6	6.5	6.5	6.5	6.5	6.5	7	7.5	TSW	TSW	5.5	106.5	189.8
	4	6	6	6.5	6.5	6.5	6	6.5	6	6.5	6.5	6.5	6.5	6.5	7	7.5	TSW	TSW	6	107	190.6
	4	6	6	6.5	6.5	6.5	6	6.5	6	6.5	6.5	6.5	6.5	7	7	7.5	TSW	TSW	6	107.5	191.4
	4	6	6.5	6.5	6.5	6.5	6	6.5	6	6.5	6.5	6.5	6.5	7	7	7.5	TSW	TSW	6	108	192.2
	4	6	6.5	6.5	6.5	6.5	6.5	6.5	6	6.5	6.5	6.5	6.5	7	7	7.5	TSW	TSW	6	108.5	193
	4	6	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	7	7	7.5	TSW	TSW	6	109	193.8
	4	6	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	7	7.5	7.5	TSW	TSW	6	109.5	194.6
	4	6	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	7	7	7.5	7.5	TSW	TSW	6	110	195.4
	4	6	6.5	7	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	7	7	7.5	7.5	TSW	TSW	6	110.5	196.2
	4	6	6.5	7	6.5	6.5	6.5	6.5	6.5	6.5	7	6.5	7	7	7.5	7.5	TSW	TSW	6	111	197
	4	6	6.5	7	6.5	7	6.5	6.5	6.5	6.5	7	6.5	7	7	7.5	7.5	TSW	TSW	6	111.5	197.8
	4	6	6.5	7	6.5	7	6.5	6.5	6.5	7	7	6.5	7	7	7.5	7.5	TSW	TSW	6	112	198.6
	4	6	6.5	7	6.5	7	6.5	6.5	6.5	7	7	7	7	7	7.5	7.5	TSW	TSW	6	112.5	199.4
	4	6	6.5	7	7	7	6.5	6.5	6.5	7	7	7	7	7	7.5	7.5	TSW	TSW	6	113	200.2
	4	6	6.5	7	7	7	6.5	7	6.5	7	7	7	7	7	7.5	7.5	TSW	TSW	6	113.5	201
	4	6	6.5	7	7	7	6.5	7	6.5	7	7	7	7	7	7.5	8	TSW	TSW	6	114	201.8
	4	6	6.5	7	7	7	6.5	7	6.5	7	7	7	7	7	7.5	8	TSW	TSW	6.5	114.5	202.6
	4	6	6.5	7	7	7	6.5	7	6.5	7	7	7	7	7.5	7.5	8	TSW	TSW	6.5	115	203.4
	4	6	7	7	7	7	6.5	7	6.5	7	7	7	7	7.5	7.5	8	TSW	TSW	6.5	115.5	204.2
	4	6	7	7	7	7	7	7	6.5	7	7	7	7	7.5	7.5	8	TSW	TSW	6.5	116	205
	4	6	7	7	7	7	7	7	7	7	7	7	7	7.5	7.5	8	TSW	TSW	6.5	116.5	205.8
	4	6	7	7	7	7	7	7	7	7	7	7	7	7.5	8	8	TSW	TSW	6.5	117	206.6
	4	6	7	7	7	7	7	7	7	7	7	7	7.5	7.5	8	8	TSW	TSW	6.5	117.5	207.4
	4	6	7	7.5	7	7	7	7	7	7	7	7	7.5	7.5	8	8	TSW	TSW	6.5	118	208.2
	4	6	7	7.5	7	7	7	7	7	7	7.5	7	7.5	7.5	8	8	TSW	TSW	6.5	118.5	209
	4	6	7	7.5	7	7.5	7	7	7	7	7.5	7	7.5	7.5	8	8	TSW	TSW	6.5	119	209.8
	4	6	7	7.5	7	7.5	7	7	7	7.5	7.5	7	7.5	7.5	8	8	TSW	TSW	6.5	119.5	210.6
	4	6	7	7.5	7	7.5	7	7	7	7.5	7.5	7.5	7.5	7.5	8	8	TSW	TSW	6.5	120	211.4
	4	6	7	7.5	7.5	7.5	7	7	7	7.5	7.5	7.5	7.5	7.5	8	8	TSW	TSW	6.5	120.5	212.2
	4	6	7	7.5	7.5	7.5	7	7.5	7	7.5	7.5	7.5	7.5	7.5	8	8	TSW	TSW	6.5	121	213
	4	6	7	7.5	7.5	7.5	7	7.5	7	7.5	7.5	7.5	7.5	7.5	8	8.5	TSW	TSW	6.5	121.5	213.8
	4	6	7	7.5	7.5	7.5	7	7.5	7	7.5	7.5	7.5	7.5	7.5	8	8.5	TSW	TSW	7	122	214.6
	4	6	7	7.5	7.5	7.5	7	7.5	7	7.5	7.5	7.5	7.5	8	8	8.5	TSW	TSW	7	122.5	215.4
	4	6	7.5	7.5	7.5	7.5	7	7.5	7	7.5	7.5	7.5	7.5	8	8	8.5	TSW	TSW	7	123	216.2
	4	6	7.5	7.5	7.5	7.5	7.5	7.5	7	7.5	7.5	7.5	7.5	8	8	8.5	TSW	TSW	7	123.5	217
	4	6	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	8	8	8.5	TSW	TSW	7	124	217.8
	4	6	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	8	8.5	8.5	TSW	TSW	7	124.5	218.6
	4	6	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	8	8	8.5	8.5	TSW	TSW	7	125	219.4
	4	6	7.5	8	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	8	8	8.5	8.5	TSW	TSW	7	125.5	220.2
	4	6	7.5	8	7.5	7.5	7.5	7.5	7.5	7.5	8	7.5	8	8	8.5	8.5	TSW	TSW	7	126	221
	4	6	7.5	8	7.5	8	7.5	7.5	7.5	7.5	8	7.5	8	8	8.5	8.5	TSW	TSW	7	126.5	221.8
	4	6	7.5	8	7.5	8	7.5	7.5	7.5	8	8	7.5	8	8	8.5	8.5	TSW	TSW	7	127	222.6

JDA Spill Patterns with TSWs in Bays 18, 19 - # Gate Stops per Spillbay																				Total	Spill
1 <sup>b</sup>	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18 <sup>c</sup>	19 <sup>c</sup>	20 <sup>b</sup>	Stops (#)	(kcfs)
	4	6	7.5	8	7.5	8	7.5	7.5	7.5	8	8	8	8	8	8.5	8.5	TSW	TSW	7	127.5	223.4
	4	6	7.5	8	8	8	7.5	7.5	7.5	8	8	8	8	8	8.5	8.5	TSW	TSW	7	128	224.2
	4	6	7.5	8	8	8	7.5	8	7.5	8	8	8	8	8	8.5	8.5	TSW	TSW	7	128.5	225
	4	6	7.5	8	8	8	7.5	8	7.5	8	8	8	8	8	8.5	9	TSW	TSW	7	129	225.8
	4	6	7.5	8	8	8	7.5	8	7.5	8	8	8	8	8	8.5	9	TSW	TSW	7.5	129.5	226.6
	4	6	7.5	8	8	8	7.5	8	7.5	8	8	8	8	8.5	8.5	9	TSW	TSW	7.5	130	227.4
	4	6	8	8	8	8	7.5	8	7.5	8	8	8	8	8.5	8.5	9	TSW	TSW	7.5	130.5	228.2
	4	6	8	8	8	8	8	8	7.5	8	8	8	8	8.5	8.5	9	TSW	TSW	7.5	131	229
	4	6	8	8	8	8	8	8	8	8	8	8	8	8.5	8.5	9	TSW	TSW	7.5	131.5	229.8
	4	6	8	8	8	8	8	8	8	8	8	8	8	8.5	9	9	TSW	TSW	7.5	132	230.6
	4	6	8	8	8	8	8	8	8	8	8	8	8.5	8.5	9	9	TSW	TSW	7.5	132.5	231.4
	4	6	8	8.5	8	8	8	8	8	8	8	8	8.5	8.5	9	9	TSW	TSW	7.5	133	232.2
	4	6	8	8.5	8	8	8	8	8	8	8.5	8	8.5	8.5	9	9	TSW	TSW	7.5	133.5	233
	4	6	8	8.5	8	8.5	8	8	8	8	8.5	8	8.5	8.5	9	9	TSW	TSW	7.5	134	233.8
	4	6	8	8.5	8	8.5	8	8	8	8.5	8.5	8	8.5	8.5	9	9	TSW	TSW	7.5	134.5	234.6
	4	6	8	8.5	8	8.5	8	8	8	8.5	8.5	8.5	8.5	8.5	9	9	TSW	TSW	7.5	135	235.4
	4	6	8	8.5	8.5	8.5	8	8	8	8.5	8.5	8.5	8.5	8.5	9	9	TSW	TSW	7.5	135.5	236.2
	4	6	8	8.5	8.5	8.5	8	8.5	8	8.5	8.5	8.5	8.5	8.5	9	9	TSW	TSW	7.5	136	237
	4	6	8	8.5	8.5	8.5	8	8.5	8	8.5	8.5	8.5	8.5	8.5	9	9.5	TSW	TSW	7.5	136.5	237.8
	4	6	8	8.5	8.5	8.5	8	8.5	8	8.5	8.5	8.5	8.5	8.5	9	9.5	TSW	TSW	8	137	238.6
	4	6	8	8.5	8.5	8.5	8	8.5	8	8.5	8.5	8.5	8.5	9	9	9.5	TSW	TSW	8	137.5	239.4
	4	6	8	8.5	8.5	8.5	8.5	8.5	8	8.5	8.5	8.5	8.5	9	9	9.5	TSW	TSW	8	138	240.2
	4	6	8	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	9	9	9.5	TSW	TSW	8	138.5	241
	4	6	8	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	9	9.5	9.5	TSW	TSW	8	139	241.8
	4	6	8	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	9	9	9.5	9.5	TSW	TSW	8	139.5	242.6
	4	6	8	9	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	9	9	9.5	9.5	TSW	TSW	8	140	243.4
	4	6	8	9	8.5	8.5	8.5	8.5	8.5	8.5	9	8.5	9	9	9.5	9.5	TSW	TSW	8	140.5	244.2
	4	6	8	9	8.5	9	8.5	8.5	8.5	8.5	9	8.5	9	9	9.5	9.5	TSW	TSW	8	141	245
	4	6	8	9	8.5	9	8.5	8.5	8.5	9	9	8.5	9	9	9.5	9.5	TSW	TSW	8	141.5	245.8
	4	6	8	9	8.5	9	8.5	8.5	8.5	9	9	9	9	9	9.5	9.5	TSW	TSW	8	142	246.6
	4	6	8	9	9	9	8.5	8.5	8.5	9	9	9	9	9	9.5	9.5	TSW	TSW	8	142.5	247.4
	4	6	8	9	9	9	8.5	9	8.5	9	9	9	9	9	9.5	9.5	TSW	TSW	8	143	248.2
	4	6	8	9	9	9	8.5	9	8.5	9	9	9	9	9	9.5	10	TSW	TSW	8	143.5	249
	4	6	8	9	9	9	8.5	9	8.5	9	9	9	9	9	9.5	10	TSW	TSW	8.5	144	249.8
	4	6	8	9	9	9	8.5	9	8.5	9	9	9	9	9.5	9.5	10	TSW	TSW	8.5	144.5	250.6
	4	6	8	9	9	9	9	9	8.5	9	9	9	9	9.5	9.5	10	TSW	TSW	8.5	145	251.4
	4	6	8	9	9	9	9	9	9	9	9	9	9	9.5	9.5	10	TSW	TSW	8.5	145.5	252.2
	4	6	8	9	9	9	9	9	9	9	9	9	9	9.5	10	10	TSW	TSW	8.5	146	253
	4	6	8	9	9	9	9	9	9	9	9	9	9.5	9.5	10	10	TSW	TSW	8.5	146.5	253.8
	4	6	8	9.5	9	9	9	9	9	9	9	9	9.5	9.5	10	10	TSW	TSW	8.5	147	254.6
	4	6	8	9.5	9	9	9	9	9	9	9.5	9	9.5	9.5	10	10	TSW	TSW	8.5	147.5	255.4
	4	6	8	9.5	9	9.5	9	9	9	9	9.5	9	9.5	9.5	10	10	TSW	TSW	8.5	148	256.2
	4	6	8	9.5	9	9.5	9	9	9	9.5	9.5	9	9.5	9.5	10	10	TSW	TSW	8.5	148.5	257
	4	6	8	9.5	9	9.5	9	9	9	9.5	9.5	9.5	9.5	9.5	10	10	TSW	TSW	8.5	149	257.8
	4	6	8	9.5	9.5	9.5	9	9	9	9.5	9.5	9.5	9.5	9.5	10	10	TSW	TSW	8.5	149.5	258.6
	4	6	8	9.5	9.5	9.5	9	9.5	9	9.5	9.5	9.5	9.5	9.5	10	10	TSW	TSW	8.5	150	259.4
	4	6	8	9.5	9.5	9.5	9	9.5	9	9.5	9.5	9.5	9.5	9.5	10	11	TSW	TSW	8.5	151	260.2
	4	6	8	9.5	9.5	9.5	9	9.5	9	9.5	9.5	9.5	9.5	9.5	10	11	TSW	TSW	9	151.5	261
	4	6	8	9.5	9.5	9.5	9	9.5	9	9.5	9.5	9.5	9.5	10	10	11	TSW	TSW	9	152	261.8

JDA Spill Patterns with TSWs in Bays 18, 19 - # Gate Stops per Spillbay																				Total Stops (#)	Spill a (kcfs)
1 <sup>b</sup>	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18 <sup>c</sup>	19 <sup>c</sup>	20 <sup>b</sup>		
	4	6	8	9.5	9.5	9.5	9.5	9.5	9	9.5	9.5	9.5	9.5	10	10	11	TSW	TSW	9	152.5	262.6
	4	6	8	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5	10	10	11	TSW	TSW	9	153	263.4
	4	6	8	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5	10	11	11	TSW	TSW	9	154	264.2
	4	6	8	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5	10	10	11	11	TSW	TSW	9	154.5	265
	4	6	8	10	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5	10	10	11	11	TSW	TSW	9	155	265.8
	4	6	8	10	9.5	9.5	9.5	9.5	9.5	9.5	10	9.5	10	10	11	11	TSW	TSW	9	155.5	266.6
	4	6	8	10	9.5	10	9.5	9.5	9.5	9.5	10	9.5	10	10	11	11	TSW	TSW	9	156	267.4
	4	6	8	10	9.5	10	9.5	9.5	9.5	10	10	9.5	10	10	11	11	TSW	TSW	9	156.5	268.2
	4	6	8	10	9.5	10	9.5	9.5	9.5	10	10	10	10	10	11	11	TSW	TSW	9	157	269
	4	6	8	10	10	10	9.5	9.5	9.5	10	10	10	10	10	11	11	TSW	TSW	9	157.5	269.8
	4	6	8	10	10	10	9.5	10	9.5	10	10	10	10	10	11	11	TSW	TSW	9	158	270.6
	4	6	8	10	10	10	9.5	10	9.5	10	10	10	10	10	11	11	TSW	TSW	9	158	271.4
	4	6	8	10	10	10	9.5	10	9.5	10	10	10	10	10	11	11	TSW	TSW	9.5	158.5	272.2
	4	6	8	10	10	10	9.5	10	9.5	10	10	10	10	11	11	11	TSW	TSW	9.5	159.5	273
	4	6	8	10	10	10	10	10	9.5	10	10	10	10	11	11	11	TSW	TSW	9.5	160	273.8
	4	6	8	10	10	10	10	10	10	10	10	10	10	11	11	11	TSW	TSW	9.5	160.5	274.6
	4	6	8	10	10	10	10	10	10	10	10	10	10	11	11	11	TSW	TSW	9.5	160.5	275.4
	4	6	8	10	10	10	10	10	10	10	10	10	11	11	11	11	TSW	TSW	9.5	161.5	276.2
	4	6	8	11	10	10	10	10	10	10	10	10	11	11	11	11	TSW	TSW	9.5	162.5	277
	4	6	8	11	10	10	10	10	10	10	11	10	11	11	11	11	TSW	TSW	9.5	163.5	277.8
	4	6	8	11	10	11	10	10	10	10	11	10	11	11	11	11	TSW	TSW	9.5	164.5	278.6
	4	6	8	11	10	11	10	10	10	11	11	10	11	11	11	11	TSW	TSW	9.5	165.5	279.4
	4	6	8	11	10	11	10	10	10	11	11	11	11	11	11	11	TSW	TSW	9.5	166.5	280.2
	4	6	8	11	11	11	10	10	10	11	11	11	11	11	11	11	TSW	TSW	9.5	167.5	281
	4	6	8	11	11	11	10	11	10	11	11	11	11	11	11	11	TSW	TSW	9.5	168.5	281.8
	4	6	8	11	11	11	10	11	10	11	11	11	11	11	11	12	TSW	TSW	9.5	169.5	282.6
	4	6	8	11	11	11	10	11	10	11	11	11	11	11	11	12	TSW	TSW	10	170	283.4
	4	6	8	11	11	11	10	11	10	11	11	11	11	11	11	12	TSW	TSW	10	170	284.2
	4	6	8	11	11	11	11	11	10	11	11	11	11	11	11	12	TSW	TSW	10	171	285
	4	6	8	11	11	11	11	11	11	11	11	11	11	11	11	12	TSW	TSW	10	172	285.8
	4	6	8	11	11	11	11	11	11	11	11	11	11	11	12	12	TSW	TSW	10	173	286.6
	4	6	8	11	11	11	11	11	11	11	11	11	11	11	12	12	TSW	TSW	10	173	287.4
	4	6	8	11	11	11	11	11	11	11	11	11	11	11	12	12	TSW	TSW	10	173	288.2
	4	6	8	11	11	11	11	11	11	11	11	11	11	11	12	12	TSW	TSW	10	173	289
	4	6	8	11	11	11	11	11	11	11	11	11	11	11	12	12	TSW	TSW	10	173	289.8
	4	6	8	11	11	11	11	11	11	11	11	11	11	11	12	12	TSW	TSW	10	173	290.6
	4	6	8	11	11	11	11	11	11	11	11	11	11	11	12	12	TSW	TSW	10	173	291.4
	4	6	8	11	11	11	11	11	11	11	11	11	11	11	12	12	TSW	TSW	10	173	292.2
	4	6	8	11	11	11	11	11	11	11	11	11	11	11	12	12	TSW	TSW	10	173	293
	4	6	8	11	11	11	11	11	11	11	11	11	11	11	12	12	TSW	TSW	10	173	293.8
	4	6	8	11	11	11	11	11	11	11	11	11	11	11	12	12	TSW	TSW	10.5	173.5	294.6
	4	6	8	11	11	11	11	11	11	11	11	11	11	12	12	12	TSW	TSW	10.5	174.5	295.4
	4	6	8	11	11	11	11	11	11	11	11	11	11	12	12	12	TSW	TSW	10.5	174.5	296.2
	4	6	8	11	11	11	11	11	11	11	11	11	11	12	12	12	TSW	TSW	10.5	174.5	297
	4	6	8	11	11	11	11	11	11	11	11	11	11	12	12	12	TSW	TSW	10.5	174.5	297.8
	4	6	8	11	11	11	11	11	11	11	11	11	12	12	12	12	TSW	TSW	10.5	175.5	298.6
	4	6	8	12	11	11	11	11	11	11	11	11	12	12	12	12	TSW	TSW	10.5	176.5	299.4
	4	6	8	12	11	11	11	11	11	11	11	12	11	12	12	12	TSW	TSW	10.5	177.5	300.2
	4	6	8	12	11	12	11	11	11	11	11	12	11	12	12	12	TSW	TSW	10.5	178.5	301

JDA Spill Patterns with TSWs in Bays 18, 19 - # Gate Stops per Spillbay																				Total Stops (#)	Spill a (kcfs)
1 <sup>b</sup>	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18 <sup>c</sup>	19 <sup>c</sup>	20 <sup>b</sup>		
	4	6	8	12	11	12	11	11	11	12	12	11	12	12	12	12	TSW	TSW	10.5	179.5	301.8
	4	6	8	12	11	12	11	11	11	12	12	12	12	12	12	12	TSW	TSW	10.5	180.5	302.6
	4	6	8	12	12	12	11	11	11	12	12	12	12	12	12	12	TSW	TSW	10.5	181.5	303.4
	4	6	8	12	12	12	11	12	11	12	12	12	12	12	12	12	TSW	TSW	10.5	182.5	304.2
	4	6	8	12	12	12	11	12	11	12	12	12	12	12	12	12	TSW	TSW	11	183	305
	4	6	8	12	12	12	12	12	11	12	12	12	12	12	12	12	TSW	TSW	11	184	305.8
	4	6	8	12	12	12	12	12	11	12	12	12	12	12	12	12	TSW	TSW	11	184	306.6
	4	6	8	12	12	12	12	12	11	12	12	12	12	12	12	12	TSW	TSW	11	184	307.4
	4	6	8	12	12	12	12	12	12	12	12	12	12	12	12	12	TSW	TSW	11	185	308.2
	4	6	8	12	12	12	12	12	12	12	12	12	12	12	12	12	TSW	TSW	11	185	309
	4	6	8	12	12	12	12	12	12	12	12	12	12	12	12	12	TSW	TSW	11	185	309.8
	4	6	8	12	12	12	12	12	12	12	12	12	12	12	12	12	TSW	TSW	11	185	310.6
	4	6	8	12	12	12	12	12	12	12	12	12	12	12	12	12	TSW	TSW	11	185	311.4
	4	6	8	12	12	12	12	12	12	12	12	12	12	12	12	12	TSW	TSW	11	185	312.2
	4	6	8	12	12	12	12	12	12	12	12	12	12	12	12	12	TSW	TSW	11	185	313
	4	6	8	12	12	12	12	12	12	12	12	12	12	12	12	12	TSW	TSW	11	185	313.8
	4	6	8	12	12	12	12	12	12	12	12	12	12	12	12	12	TSW	TSW	11	185	314.6
	4	6	8	12	12	12	12	12	12	12	12	12	12	12	12	12	TSW	TSW	11	185	315.4
1	4	6	8	12	12	12	12	12	12	12	12	12	12	12	12	12	TSW	TSW	11	186	317
2	4	6	8	12	12	12	12	12	12	12	12	12	12	12	12	12	TSW	TSW	11	187	318.6
3	4	6	8	12	12	12	12	12	12	12	12	12	12	12	12	12	TSW	TSW	11	188	320.2
3	4	6	9	12	12	12	12	12	12	12	12	12	12	12	12	12	TSW	TSW	11	189	321.8
4	4	6	9	12	12	12	12	12	12	12	12	12	12	12	12	12	TSW	TSW	11	190	323.4
4	5	6	9	12	12	12	12	12	12	12	12	12	12	12	12	12	TSW	TSW	11	191	325
4	5	7	9	12	12	12	12	12	12	12	12	12	12	12	12	12	TSW	TSW	11	192	326.6
4	5	7	10	12	12	12	12	12	12	12	12	12	12	12	12	12	TSW	TSW	11	193	328.2
5	5	7	10	12	12	12	12	12	12	12	12	12	12	12	12	12	TSW	TSW	11	194	329.8
5	6	7	10	12	12	12	12	12	12	12	12	12	12	12	12	12	TSW	TSW	11	195	331.4
5	6	8	10	12	12	12	12	12	12	12	12	12	12	12	12	12	TSW	TSW	11	196	333
5	6	8	11	12	12	12	12	12	12	12	12	12	12	12	12	12	TSW	TSW	11	197	334.6
6	6	8	11	12	12	12	12	12	12	12	12	12	12	12	12	12	TSW	TSW	11	198	336.2
6	7	8	11	12	12	12	12	12	12	12	12	12	12	12	12	12	TSW	TSW	11	199	337.8
6	7	9	11	12	12	12	12	12	12	12	12	12	12	12	12	12	TSW	TSW	11	200	339.4
6	7	9	12	12	12	12	12	12	12	12	12	12	12	12	12	12	TSW	TSW	11	201	341
7	7	9	12	12	12	12	12	12	12	12	12	12	12	12	12	12	TSW	TSW	11	202	342.6
7	8	9	12	12	12	12	12	12	12	12	12	12	12	12	12	12	TSW	TSW	11	203	344.2
7	8	10	12	12	12	12	12	12	12	12	12	12	12	12	12	12	TSW	TSW	11	204	345.8
8	8	10	12	12	12	12	12	12	12	12	12	12	12	12	12	12	TSW	TSW	11	205	347.4
8	9	10	12	12	12	12	12	12	12	12	12	12	12	12	12	12	TSW	TSW	11	206	349
8	9	11	12	12	12	12	12	12	12	12	12	12	12	12	12	12	TSW	TSW	11	207	350.6
9	9	11	12	12	12	12	12	12	12	12	12	12	12	12	12	12	TSW	TSW	11	208	352.2
9	10	11	12	12	12	12	12	12	12	12	12	12	12	12	12	12	TSW	TSW	11	209	353.8
10	10	11	12	12	12	12	12	12	12	12	12	12	12	12	12	12	TSW	TSW	11	210	355.4
10	11	11	12	12	12	12	12	12	12	12	12	12	12	12	12	12	TSW	TSW	11	211	357
10	11	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	TSW	TSW	11	212	358.6
11	11	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	TSW	TSW	11	213	360.2
11	11	13	12	12	12	12	12	12	12	12	12	12	12	12	12	12	TSW	TSW	11	214	361.8
11	11	13	12	12	12	12	12	12	12	12	12	12	12	12	12	13	TSW	TSW	11	215	363.4
11	11	13	13	12	12	12	12	12	12	12	12	12	12	12	12	13	TSW	TSW	11	216	365

JDA Spill Patterns with TSWs in Bays 18, 19 - # Gate Stops per Spillbay																				Total Stops (#)	Spill a (kcfs)
1 <sup>b</sup>	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18 <sup>c</sup>	19 <sup>c</sup>	20 <sup>b</sup>		
11	11	13	13	12	12	12	12	12	12	12	12	12	12	13	12	13	TSW	TSW	11	217	366.6
11	11	13	13	13	12	12	12	12	12	12	12	12	12	13	12	13	TSW	TSW	11	218	368.2
11	11	13	13	13	12	12	13	12	12	12	12	12	12	13	12	13	TSW	TSW	11	219	369.8
11	11	13	13	13	12	12	13	12	13	12	12	12	12	13	12	13	TSW	TSW	11	220	371.4
11	11	13	13	13	12	12	13	12	13	12	13	12	12	13	12	13	TSW	TSW	11	221	373
11	11	13	13	13	13	12	13	12	13	12	13	12	12	13	12	13	TSW	TSW	11	222	374.6
11	11	13	13	13	13	12	13	12	13	12	13	12	12	13	13	13	TSW	TSW	11	223	376.2
11	11	13	13	13	13	13	13	12	13	12	13	12	12	13	13	13	TSW	TSW	11	224	377.8
11	11	13	13	13	13	13	13	12	13	12	13	12	13	13	13	13	TSW	TSW	11	225	379.4
11	11	13	13	13	13	13	13	13	13	12	13	12	13	13	13	13	TSW	TSW	11	226	381
11	11	13	13	13	13	13	13	13	13	13	13	12	13	13	13	13	TSW	TSW	11	227	382.6
11	11	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	TSW	TSW	11	228	384.2
11	11	14	13	13	13	13	13	13	13	13	13	13	13	13	13	13	TSW	TSW	11	229	385.8
11	11	14	13	13	13	13	13	13	13	13	13	13	13	13	13	14	TSW	TSW	11	230	387.4
11	11	14	14	13	13	13	13	13	13	13	13	13	13	13	13	14	TSW	TSW	11	231	389
11	11	14	14	13	13	13	13	13	13	13	13	13	13	14	13	14	TSW	TSW	11	232	390.6
11	11	14	14	14	13	13	13	13	13	13	13	13	13	14	13	14	TSW	TSW	11	233	392.2
11	11	14	14	14	13	13	14	13	13	13	13	13	13	14	13	14	TSW	TSW	11	234	393.8
11	11	14	14	14	13	13	14	13	14	13	13	13	13	14	13	14	TSW	TSW	11	235	395.4
11	11	14	14	14	13	13	14	13	14	13	14	13	13	14	13	14	TSW	TSW	11	236	397
11	11	14	14	14	14	13	14	13	14	13	14	13	13	14	13	14	TSW	TSW	11	237	398.6
11	11	14	14	14	14	13	14	13	14	13	14	13	13	14	14	14	TSW	TSW	11	238	400.2
11	11	14	14	14	14	14	14	13	14	13	14	13	13	14	14	14	TSW	TSW	11	239	401.8
11	11	14	14	14	14	14	14	13	14	13	14	13	14	14	14	14	TSW	TSW	11	240	403.4
11	11	14	14	14	14	14	14	14	14	13	14	13	14	14	14	14	TSW	TSW	11	241	405
11	11	14	14	14	14	14	14	14	14	14	14	13	14	14	14	14	TSW	TSW	11	242	406.6
11	11	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	TSW	TSW	11	243	408.2
11	11	15	14	14	14	14	14	14	14	14	14	14	14	14	14	14	TSW	TSW	11	244	409.8
11	11	15	14	14	14	14	14	14	14	14	14	14	14	14	14	15	TSW	TSW	11	245	411.4
11	11	15	15	14	14	14	14	14	14	14	14	14	14	14	14	15	TSW	TSW	11	246	413
11	11	15	15	14	14	14	14	14	14	14	14	14	14	15	14	15	TSW	TSW	11	247	414.6
11	11	15	15	15	14	14	14	14	14	14	14	14	14	15	14	15	TSW	TSW	11	248	416.2
11	11	15	15	15	14	14	15	14	14	14	14	14	14	15	14	15	TSW	TSW	11	249	417.8
11	11	15	15	15	14	14	15	14	15	14	14	14	14	15	14	15	TSW	TSW	11	250	419.4
11	11	15	15	15	14	14	15	14	15	14	15	14	14	15	14	15	TSW	TSW	11	251	421
11	11	15	15	15	15	14	15	14	15	14	15	14	14	15	14	15	TSW	TSW	11	252	422.6
11	11	15	15	15	15	14	15	14	15	14	15	14	14	15	15	15	TSW	TSW	11	253	424.2
11	11	15	15	15	15	15	15	14	15	14	15	14	14	15	15	15	TSW	TSW	11	254	425.8
11	11	15	15	15	15	15	15	15	14	15	14	15	15	15	15	15	TSW	TSW	11	255	427.4
11	11	15	15	15	15	15	15	15	15	15	14	15	15	15	15	15	TSW	TSW	11	256	429
11	11	15	15	15	15	15	15	15	15	15	15	14	15	15	15	15	TSW	TSW	11	257	430.6
11	11	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	TSW	TSW	11	258	432.2
11	11	16	15	15	15	15	15	15	15	15	15	15	15	15	15	15	TSW	TSW	11	259	433.8
11	11	16	15	15	15	15	15	15	15	15	15	15	15	15	15	16	TSW	TSW	11	260	435.4
11	11	16	16	15	15	15	15	15	15	15	15	15	15	15	15	16	TSW	TSW	11	261	437
11	11	16	16	15	15	15	15	15	15	15	15	15	15	16	15	16	TSW	TSW	11	262	438.6
11	11	16	16	16	15	15	15	15	15	15	15	15	15	16	15	16	TSW	TSW	11	263	440.2
11	11	16	16	16	15	15	16	15	15	15	15	15	15	16	15	16	TSW	TSW	11	264	441.8
11	11	16	16	16	15	15	16	15	16	15	15	15	15	16	15	16	TSW	TSW	11	265	443.4

JDA Spill Patterns with TSWs in Bays 18, 19 - # Gate Stops per Spillbay																				Total Stops (#)	Spill a (kcfs)
1 <sup>b</sup>	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18 <sup>c</sup>	19 <sup>c</sup>	20 <sup>b</sup>		
11	11	16	16	16	15	15	16	15	16	15	16	15	15	16	15	16	TSW	TSW	11	266	445
11	11	16	16	16	16	15	16	15	16	15	16	15	15	16	15	16	TSW	TSW	11	267	446.6
11	11	16	16	16	16	15	16	15	16	15	16	15	15	16	16	16	TSW	TSW	11	268	448.2
11	11	16	16	16	16	16	16	15	16	15	16	15	15	16	16	16	TSW	TSW	11	269	449.8
11	11	16	16	16	16	16	16	15	16	15	16	15	16	16	16	16	TSW	TSW	11	270	451.4
11	11	16	16	16	16	16	16	16	16	15	16	15	16	16	16	16	TSW	TSW	11	271	453
11	11	16	16	16	16	16	16	16	16	16	16	15	16	16	16	16	TSW	TSW	11	272	454.6
11	11	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	TSW	TSW	11	273	456.2
11	11	17	16	16	16	16	16	16	16	16	16	16	16	16	16	16	TSW	TSW	11	274	457.8
11	11	17	16	16	16	16	16	16	16	16	16	16	16	16	16	17	TSW	TSW	11	275	459.4
11	11	17	17	16	16	16	16	16	16	16	16	16	16	16	16	17	TSW	TSW	11	276	461
11	11	17	17	16	16	16	16	16	16	16	16	16	16	17	16	17	TSW	TSW	11	277	462.6
11	11	17	17	17	16	16	16	16	16	16	16	16	16	17	16	17	TSW	TSW	11	278	464.2
11	11	17	17	17	16	16	17	16	16	16	16	16	16	17	16	17	TSW	TSW	11	279	465.8
11	11	17	17	17	16	16	17	16	17	16	16	16	16	17	16	17	TSW	TSW	11	280	467.4
11	11	17	17	17	16	16	17	16	17	16	17	16	16	17	16	17	TSW	TSW	11	281	469
11	11	17	17	17	17	16	17	16	17	16	17	16	16	17	16	17	TSW	TSW	11	282	470.6
11	11	17	17	17	17	16	17	16	17	16	17	16	16	17	17	17	TSW	TSW	11	283	472.2
11	11	17	17	17	17	17	17	16	17	16	17	16	16	17	17	17	TSW	TSW	11	284	473.8
11	11	17	17	17	17	17	17	16	17	16	17	16	17	17	17	17	TSW	TSW	11	285	475.4
11	11	17	17	17	17	17	17	17	17	16	17	16	17	17	17	17	TSW	TSW	11	286	477
11	11	17	17	17	17	17	17	17	17	17	17	16	17	17	17	17	TSW	TSW	11	287	478.6
11	11	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	TSW	TSW	11	288	480.2
11	11	18	17	17	17	17	17	17	17	17	17	17	17	17	17	17	TSW	TSW	11	289	481.8
11	11	18	17	17	17	17	17	17	17	17	17	17	17	17	17	18	TSW	TSW	11	290	483.4
11	11	18	18	17	17	17	17	17	17	17	17	17	17	17	17	18	TSW	TSW	11	291	485
11	11	18	18	17	17	17	17	17	17	17	17	17	17	18	17	18	TSW	TSW	11	292	486.6
11	11	18	18	18	17	17	17	17	17	17	17	17	17	18	17	18	TSW	TSW	11	293	488.2
11	11	18	18	18	17	17	18	17	17	17	17	17	17	18	17	18	TSW	TSW	11	294	489.8
11	11	18	18	18	17	17	18	17	18	17	17	17	17	18	17	18	TSW	TSW	11	295	491.4
11	11	18	18	18	18	17	18	17	18	17	18	17	17	18	17	18	TSW	TSW	11	296	493
11	11	18	18	18	18	17	18	17	18	17	18	17	17	18	18	18	TSW	TSW	11	297	494.6
11	11	18	18	18	18	18	18	17	18	17	18	17	17	18	18	18	TSW	TSW	11	298	496.2
11	11	18	18	18	18	18	18	18	17	18	17	17	17	18	18	18	TSW	TSW	11	299	497.8
11	11	18	18	18	18	18	18	18	17	18	17	18	18	18	18	18	TSW	TSW	11	300	499.4
11	11	18	18	18	18	18	18	18	18	18	18	17	18	18	18	18	TSW	TSW	11	301	501
11	11	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	TSW	TSW	11	302	502.6
11	11	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	TSW	TSW	11	303	504.2
11	11	19	18	18	18	18	18	18	18	18	18	18	18	18	18	18	TSW	TSW	11	304	505.8
11	11	19	18	18	18	18	18	18	18	18	18	18	18	18	18	19	TSW	TSW	11	305	507.4
11	11	19	19	18	18	18	18	18	18	18	18	18	18	18	18	19	TSW	TSW	11	306	509
11	11	19	19	18	18	18	18	18	18	18	18	18	18	19	18	19	TSW	TSW	11	307	510.6
11	11	19	19	19	18	18	18	18	18	18	18	18	18	19	18	19	TSW	TSW	11	308	512.2
11	11	19	19	19	18	18	19	18	18	18	18	18	18	19	18	19	TSW	TSW	11	309	513.8
11	11	19	19	19	18	18	19	18	19	18	18	18	18	19	18	19	TSW	TSW	11	310	515.4
11	11	19	19	19	18	18	19	18	19	18	19	18	18	19	18	19	TSW	TSW	11	311	517
11	11	19	19	19	19	18	19	18	19	18	19	18	18	19	18	19	TSW	TSW	11	312	518.6
11	11	19	19	19	19	18	19	18	19	18	19	18	18	19	19	19	TSW	TSW	11	313	520.2
11	11	19	19	19	19	19	19	18	19	18	19	18	18	19	19	19	TSW	TSW	11	314	521.8

JDA Spill Patterns with TSWs in Bays 18, 19 - # Gate Stops per Spillbay																				Total	Spill
1 <sup>b</sup>	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18 <sup>c</sup>	19 <sup>c</sup>	20 <sup>b</sup>	Stops (#)	(kcfs)
11	11	19	19	19	19	19	19	18	19	18	19	18	19	19	19	19	TSW	TSW	11	315	523.4
11	11	19	19	19	19	19	19	19	19	18	19	18	19	19	19	19	TSW	TSW	11	316	525
11	11	19	19	19	19	19	19	19	19	19	19	18	19	19	19	19	TSW	TSW	11	317	526.6
11	11	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	TSW	TSW	11	318	528.2
11	11	20	19	19	19	19	19	19	19	19	19	19	19	19	19	19	TSW	TSW	11	319	529.8
11	11	20	19	19	19	19	19	19	19	19	19	19	19	19	19	20	TSW	TSW	11	320	531.4
11	11	20	20	19	19	19	19	19	19	19	19	19	19	19	19	20	TSW	TSW	11	321	533
11	11	20	20	19	19	19	19	19	19	19	19	19	19	20	19	20	TSW	TSW	11	322	534.6
11	11	20	20	20	19	19	19	19	19	19	19	19	19	20	19	20	TSW	TSW	11	323	536.2
11	11	20	20	20	19	19	20	19	19	19	19	19	19	20	19	20	TSW	TSW	11	324	537.8
11	11	20	20	20	19	19	20	19	20	19	19	19	19	20	19	20	TSW	TSW	11	325	539.4
11	11	20	20	20	19	19	20	19	20	19	20	19	19	20	19	20	TSW	TSW	11	326	541
11	11	20	20	20	20	19	20	19	20	19	20	19	19	20	19	20	TSW	TSW	11	327	542.6
11	11	20	20	20	20	19	20	19	20	19	20	19	19	20	20	20	TSW	TSW	11	328	544.2
11	11	20	20	20	20	20	20	19	20	19	20	19	19	20	20	20	TSW	TSW	11	329	545.8
11	11	20	20	20	20	20	20	19	20	19	20	19	20	20	20	20	TSW	TSW	11	330	547.4
11	11	20	20	20	20	20	20	20	20	19	20	19	20	20	20	20	TSW	TSW	11	331	549
11	11	20	20	20	20	20	20	20	20	20	20	19	20	20	20	20	TSW	TSW	11	332	550.6
11	11	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	TSW	TSW	11	333	552.2
11	11	21	20	20	20	20	20	20	20	20	20	20	20	20	20	20	TSW	TSW	11	334	553.8
11	11	21	20	20	20	20	20	20	20	20	20	20	20	20	20	21	TSW	TSW	11	335	555.4
11	11	21	21	20	20	20	20	20	20	20	20	20	20	20	20	21	TSW	TSW	11	336	557
11	11	21	21	20	20	20	20	20	20	20	20	20	20	21	20	21	TSW	TSW	11	337	558.6
11	11	21	21	21	20	20	20	20	20	20	20	20	20	21	20	21	TSW	TSW	11	338	560.2
11	11	21	21	21	20	20	21	20	20	20	20	20	20	21	20	21	TSW	TSW	11	339	561.8
11	11	21	21	21	20	20	21	20	21	20	20	20	20	21	20	21	TSW	TSW	11	340	563.4
11	11	21	21	21	20	20	21	20	21	20	21	20	20	21	20	21	TSW	TSW	11	341	565
11	11	21	21	21	21	20	21	20	21	20	21	20	20	21	20	21	TSW	TSW	11	342	566.6
11	11	21	21	21	21	20	21	20	21	20	21	20	20	21	21	21	TSW	TSW	11	343	568.2
11	11	21	21	21	21	21	21	20	21	20	21	20	20	21	21	21	TSW	TSW	11	344	569.8
11	11	21	21	21	21	21	21	21	21	20	21	20	21	21	21	21	TSW	TSW	11	345	571.4
11	11	21	21	21	21	21	21	21	21	21	20	21	21	21	21	21	TSW	TSW	11	346	573
11	11	21	21	21	21	21	21	21	21	21	21	20	21	21	21	21	TSW	TSW	11	347	574.6
11	11	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	TSW	TSW	11	348	576.2
11	11	22	21	21	21	21	21	21	21	21	21	21	21	21	21	21	TSW	TSW	11	349	577.8
11	11	22	21	21	21	21	21	21	21	21	21	21	21	21	21	22	TSW	TSW	11	350	579.4
11	11	22	22	21	21	21	21	21	21	21	21	21	21	21	21	22	TSW	TSW	11	351	581
11	11	22	22	21	21	21	21	21	21	21	21	21	21	22	21	22	TSW	TSW	11	352	582.6
11	11	22	22	22	21	21	21	21	21	21	21	21	21	22	21	22	TSW	TSW	11	353	584.2
11	11	22	22	22	21	21	22	21	21	21	21	21	21	22	21	22	TSW	TSW	11	354	585.8
11	11	22	22	22	21	21	22	21	22	21	21	21	21	22	21	22	TSW	TSW	11	355	587.4
11	11	22	22	22	21	21	22	21	22	21	22	21	21	22	21	22	TSW	TSW	11	356	589
11	11	22	22	22	22	21	22	21	22	21	22	21	21	22	21	22	TSW	TSW	11	357	590.6
11	11	22	22	22	22	21	22	21	22	21	22	21	21	22	22	22	TSW	TSW	11	358	592.2
11	11	22	22	22	22	22	22	21	22	21	22	21	21	22	22	22	TSW	TSW	11	359	593.8
11	11	22	22	22	22	22	22	22	22	21	22	21	22	22	22	22	TSW	TSW	11	360	595.4
11	11	22	22	22	22	22	22	22	22	22	22	21	22	22	22	22	TSW	TSW	11	361	597
11	11	22	22	22	22	22	22	22	22	22	22	21	22	22	22	22	TSW	TSW	11	362	598.6
11	11	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	TSW	TSW	11	363	600.2



**Table JDA-9. [pg 1 of 8] John Day Dam Spill Pattern with No TSWs (Bays 18-19 Closed).**

JDA Spill Patterns with No TSWs - # Gate Stops per Spillbay																				Total Stops (#)	Spill <sup>a</sup> (kcfs)
1 <sup>b</sup>	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20		
	3	2	1														CLOSE	CLOSE		6	9.6
	3	2	2														CLOSE	CLOSE		7	11.2
	3	3	2														CLOSE	CLOSE		8	12.8
	3	3	2	1													CLOSE	CLOSE		9	14.4
	3	3	2	2													CLOSE	CLOSE		10	16.0
	3	3	2	2	1												CLOSE	CLOSE		11	17.6
	3	3	2	2	2												CLOSE	CLOSE		12	19.2
	3	3	2	2	2	1											CLOSE	CLOSE		13	20.8
	3	3	2	2	2	2											CLOSE	CLOSE		14	22.4
	3	3	2	2	2	2	1										CLOSE	CLOSE		15	24.0
	3	3	3	2	2	2	1										CLOSE	CLOSE		16	25.6
	3	3	3	2	2	2	2										CLOSE	CLOSE		17	27.2
	3	3	3	2	2	2	2	1									CLOSE	CLOSE		18	28.8
	3	3	3	3	2	2	2	1									CLOSE	CLOSE		19	30.4
	3	3	3	3	3	2	2	1									CLOSE	CLOSE		20	32.0
	3	3	3	3	3	2	2	2									CLOSE	CLOSE		21	33.6
	3	3	3	3	3	2	2	2	1								CLOSE	CLOSE		22	35.2
	3	3	3	3	3	2	2	2	2								CLOSE	CLOSE		23	36.8
	3	3	3	3	3	2	2	2	2	1							CLOSE	CLOSE		24	38.4
	3	3	3	3	3	2	2	2	2	2							CLOSE	CLOSE		25	40.0
	3	3	3	3	3	2	2	2	2	2	1						CLOSE	CLOSE		26	41.6
	3	3	3	3	3	2	2	2	2	2	2						CLOSE	CLOSE		27	43.2
	3	3	3	3	3	3	2	2	2	2	2						CLOSE	CLOSE		28	44.8
	3	3	3	3	3	3	2	2	2	2	2	1					CLOSE	CLOSE		29	46.4
	3	3	3	3	3	3	2	2	2	2	2	2					CLOSE	CLOSE		30	48.0
	3	3	3	3	3	3	2	2	2	2	2	2	1				CLOSE	CLOSE		31	49.6
	3	3	3	3	3	3	3	2	2	2	2	2	2				CLOSE	CLOSE		32	51.2
	3	3	3	3	3	3	3	2	2	2	2	2	2				CLOSE	CLOSE		33	52.8
	3	3	3	3	3	3	3	2	2	2	2	2	2	1			CLOSE	CLOSE		34	54.4
	3	3	3	3	3	3	3	2	2	2	2	2	2	2			CLOSE	CLOSE		35	56.0
	3	3	3	3	3	3	3	2	2	2	2	2	2	2	1		CLOSE	CLOSE		36	57.6
	3	3	3	3	3	3	3	2	2	2	2	2	2	2	2		CLOSE	CLOSE		37	59.2
	3	3	3	3	3	3	3	2	2	2	2	2	2	2	2	1	CLOSE	CLOSE		38	60.8
	4	3	3	3	3	3	3	2	2	2	2	2	2	2	2	1	CLOSE	CLOSE		39	62.4
	4	4	3	3	3	3	3	2	2	2	2	2	2	2	2	1	CLOSE	CLOSE		40	64.0
	4	4	4	3	3	3	3	2	2	2	2	2	2	2	2	1	CLOSE	CLOSE		41	65.6
	4	4	4	4	3	3	3	2	2	2	2	2	2	2	2	1	CLOSE	CLOSE		42	67.2
	4	4	4	4	3	3	3	3	2	2	2	2	2	2	2	1	CLOSE	CLOSE		43	68.8
	4	4	4	4	3	3	3	3	2	2	2	2	2	2	2	1	CLOSE	CLOSE		44	70.4
	4	4	4	4	4	3	3	3	3	2	2	2	2	2	2	1	CLOSE	CLOSE		45	72.0
	4	5	4	4	4	3	3	3	3	2	2	2	2	2	2	1	CLOSE	CLOSE		46	73.6
	4	5	4	4	4	3	3	3	3	2	2	2	2	2	2	2	CLOSE	CLOSE		47	75.2
	4	5	4	4	4	3	3	3	3	3	2	2	2	2	2	2	CLOSE	CLOSE		48	76.8
	4	5	4	4	4	3	3	3	3	3	3	2	2	2	2	2	CLOSE	CLOSE		49	78.4

<sup>a</sup> Spill (kcfs) is calculated as a function of total stops + TSW spill. At Spill >305 kcfs, transition from pattern for juvenile fish to flood.

<sup>b</sup> Gates 1 & 20 blocked at 11 stops (10.3 ft opening).

JDA Spill Patterns with No TSWs - # Gate Stops per Spillbay																				Total Stops (#)	Spill a (kcfs)
1 <sup>b</sup>	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20		
	4	5	5	4	4	3	3	3	3	3	3	2	2	2	2	2	CLOSE	CLOSE		50	80.0
	4	5	5	4	4	4	3	3	3	3	3	2	2	2	2	2	CLOSE	CLOSE		51	81.6
	4	5	5	4	4	4	3	3	3	3	3	3	2	2	2	2	CLOSE	CLOSE		52	83.2
	4	5	5	4	4	4	3	3	3	3	3	3	3	2	2	2	CLOSE	CLOSE		53	84.8
	4	5	5	4	4	4	3	3	3	3	3	3	3	3	2	2	CLOSE	CLOSE		54	86.4
	4	5	5	4	4	4	3	3	3	3	3	3	3	3	3	2	CLOSE	CLOSE		55	88.0
	4	5	5	4	4	4	4	3	3	3	3	3	3	3	3	2	CLOSE	CLOSE		56	89.6
	4	5	5	4	4	4	4	4	3	3	3	3	3	3	3	2	CLOSE	CLOSE		57	91.2
	4	5	5	5	4	4	4	4	3	3	3	3	3	3	3	2	CLOSE	CLOSE		58	92.8
	4	5	5	5	4	4	4	4	4	3	3	3	3	3	3	2	CLOSE	CLOSE		59	94.4
	4	5	5	5	4	4	4	4	4	4	3	3	3	3	3	2	CLOSE	CLOSE		60	96.0
	4	5	5	5	4	4	4	4	4	4	3	3	3	3	3	3	CLOSE	CLOSE		61	97.6
	4	5	5	5	4	4	4	4	4	4	4	3	3	3	3	3	CLOSE	CLOSE		62	99.2
	4	4	4	4	4	4	4	4	4	4	4	3	4	4	4	4	CLOSE	CLOSE		63	100.8
	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	CLOSE	CLOSE		64	102.4
	4	5	4	4	4	4	4	4	4	4	4	4	4	4	4	4	CLOSE	CLOSE		65	104.0
	4	5	5	4	4	4	4	4	4	4	4	4	4	4	4	4	CLOSE	CLOSE		66	105.6
	4	5	5	4	4	4	4	4	4	4	4	4	4	4	4	5	CLOSE	CLOSE		67	107.2
	4	5	5	4	4	4	4	4	4	4	4	4	4	5	4	5	CLOSE	CLOSE		68	108.8
	4	5	5	5	4	4	4	4	4	4	4	4	4	5	4	5	CLOSE	CLOSE		69	110.4
	4	5	5	5	4	4	5	4	4	4	4	4	4	5	4	5	CLOSE	CLOSE		70	112.0
	4	5	5	5	4	4	5	4	5	4	4	4	4	5	4	5	CLOSE	CLOSE		71	113.6
	4	5	5	5	4	4	5	4	5	4	5	4	4	5	4	5	CLOSE	CLOSE		72	115.2
	4	5	5	5	5	4	5	4	5	4	5	4	4	5	4	5	CLOSE	CLOSE		73	116.8
	4	5	5	5	5	4	5	4	5	4	5	4	4	5	5	5	CLOSE	CLOSE		74	118.4
	4	5	5	5	5	5	5	4	5	4	5	4	4	5	5	5	CLOSE	CLOSE		75	120.0
	4	5	5	5	5	5	5	4	5	4	5	4	5	5	5	5	CLOSE	CLOSE		76	121.6
	4	5	5	5	5	5	5	5	5	4	5	4	5	5	5	5	CLOSE	CLOSE		77	123.2
	4	5	5	5	5	5	5	5	5	5	5	4	5	5	5	5	CLOSE	CLOSE		78	124.8
	4	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	CLOSE	CLOSE		79	126.4
	4	6	5	5	5	5	5	5	5	5	5	5	5	5	5	5	CLOSE	CLOSE		80	128.0
	4	6	6	5	5	5	5	5	5	5	5	5	5	5	5	5	CLOSE	CLOSE		81	129.6
	4	6	6	5	5	5	5	5	5	5	5	5	5	5	5	6	CLOSE	CLOSE		82	131.2
	4	6	6	5	5	5	5	5	5	5	5	5	5	6	5	6	CLOSE	CLOSE		83	132.8
	4	6	6	6	5	5	5	5	5	5	5	5	5	6	5	6	CLOSE	CLOSE		84	134.4
	4	6	6	6	5	5	6	5	5	5	5	5	5	6	5	6	CLOSE	CLOSE		85	136.0
	4	6	6	6	5	5	6	5	6	5	5	5	5	6	5	6	CLOSE	CLOSE		86	137.6
	4	6	6	6	5	5	6	5	6	5	6	5	5	6	5	6	CLOSE	CLOSE		87	139.2
	4	6	6	6	6	5	6	5	6	5	6	5	5	6	5	6	CLOSE	CLOSE		88	140.8
	4	6	6	6	6	5	6	5	6	5	6	5	5	6	6	6	CLOSE	CLOSE		89	142.4
	4	6	6	6	6	6	6	5	6	5	6	5	5	6	6	6	CLOSE	CLOSE		90	144.0
	4	6	6	6	6	6	6	5	6	5	6	5	6	6	6	6	CLOSE	CLOSE		91	145.6
	4	6	6	6	6	6	6	6	6	5	6	5	6	6	6	6	CLOSE	CLOSE		92	147.2
	4	6	6	6	6	6	6	6	6	6	6	5	6	6	6	6	CLOSE	CLOSE		93	148.8
	4	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	CLOSE	CLOSE		94	150.4
	4	6	7	6	6	6	6	6	6	6	6	6	6	6	6	6	CLOSE	CLOSE		95	152.0
	4	6	7	6	6	6	6	6	6	6	6	6	6	6	6	7	CLOSE	CLOSE		96	153.6
	4	6	7	6	6	6	6	6	6	6	6	6	6	7	6	7	CLOSE	CLOSE		97	155.2
	4	6	7	7	6	6	6	6	6	6	6	6	6	7	6	7	CLOSE	CLOSE		98	156.8

JDA Spill Patterns with No TSWs - # Gate Stops per Spillbay																				Total Stops (#)	Spill a (kcfs)
1 <sup>b</sup>	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20		
	4	6	7	7	6	6	7	6	6	6	6	6	6	7	6	7	CLOSE	CLOSE		99	158.4
	4	6	7	7	6	6	7	6	7	6	6	6	6	7	6	7	CLOSE	CLOSE		100	160.0
	4	6	7	7	6	6	7	6	7	6	7	6	6	7	6	7	CLOSE	CLOSE		101	161.6
	4	6	7	7	7	6	7	6	7	6	7	6	6	7	6	7	CLOSE	CLOSE		102	163.2
	4	6	7	7	7	6	7	6	7	6	7	6	6	7	7	7	CLOSE	CLOSE		103	164.8
	4	6	7	7	7	7	7	6	7	6	7	6	6	7	7	7	CLOSE	CLOSE		104	166.4
	4	6	7	7	7	7	7	6	7	6	7	6	7	7	7	7	CLOSE	CLOSE		105	168.0
	4	6	7	7	7	7	7	7	7	6	7	6	7	7	7	7	CLOSE	CLOSE		106	169.6
	4	6	7	7	7	7	7	7	7	7	7	6	7	7	7	7	CLOSE	CLOSE		107	171.2
	4	6	7	7	7	7	7	7	7	7	7	7	7	7	7	7	CLOSE	CLOSE		108	172.8
	4	6	8	7	7	7	7	7	7	7	7	7	7	7	7	7	CLOSE	CLOSE		109	174.4
	4	6	8	7	7	7	7	7	7	7	7	7	7	7	7	8	CLOSE	CLOSE		110	176.0
	4	6	8	7	7	7	7	7	7	7	7	7	7	8	7	8	CLOSE	CLOSE		111	177.6
	4	6	8	8	7	7	7	7	7	7	7	7	7	8	7	8	CLOSE	CLOSE		112	179.2
	4	6	8	8	7	7	8	7	7	7	7	7	7	8	7	8	CLOSE	CLOSE		113	180.8
	4	6	8	8	7	7	8	7	8	7	7	7	7	8	7	8	CLOSE	CLOSE		114	182.4
	4	6	8	8	7	7	8	7	8	7	8	7	7	8	7	8	CLOSE	CLOSE		115	184.0
	4	6	8	8	8	7	8	7	8	7	8	7	7	8	7	8	CLOSE	CLOSE		116	185.6
	4	6	8	8	8	7	8	7	8	7	8	7	7	8	8	8	CLOSE	CLOSE		117	187.2
	4	6	8	8	8	8	8	7	8	7	8	7	7	8	8	8	CLOSE	CLOSE		118	188.8
	4	6	8	8	8	8	8	8	7	8	7	8	7	8	8	8	CLOSE	CLOSE		119	190.4
	4	6	8	8	8	8	8	8	8	7	8	7	8	8	8	8	CLOSE	CLOSE		120	192.0
	4	6	8	8	8	8	8	8	8	8	8	7	8	8	8	8	CLOSE	CLOSE		121	193.6
	4	6	8	8	8	8	8	8	8	8	8	8	8	8	8	8	CLOSE	CLOSE		122	195.2
	4	6	8	8	8	8	8	8	8	8	8	8	8	8	8	9	CLOSE	CLOSE		123	196.8
	4	6	8	8	8	8	8	8	8	8	8	8	8	9	8	9	CLOSE	CLOSE		124	198.4
	4	6	8	9	8	8	8	8	8	8	8	8	8	9	8	9	CLOSE	CLOSE		125	200.0
	4	6	8	9	8	8	9	8	8	8	8	8	8	9	8	9	CLOSE	CLOSE		126	201.6
	4	6	8	9	8	8	9	8	9	8	8	8	8	9	8	9	CLOSE	CLOSE		127	203.2
	4	6	8	9	8	8	9	8	9	8	9	8	8	9	8	9	CLOSE	CLOSE		128	204.8
	4	6	8	9	9	8	9	8	9	8	9	8	8	9	8	9	CLOSE	CLOSE		129	206.4
	4	6	8	9	9	8	9	8	9	8	9	8	8	9	9	9	CLOSE	CLOSE		130	208.0
	4	6	8	9	9	9	9	8	9	8	9	8	8	9	9	9	CLOSE	CLOSE		131	209.6
	4	6	8	9	9	9	9	9	9	9	9	8	9	9	9	9	CLOSE	CLOSE		132	211.2
	4	6	8	9	9	9	9	9	9	9	9	9	9	9	9	9	CLOSE	CLOSE		133	212.8
	4	6	8	9	9	9	9	9	9	9	9	9	9	9	9	9	CLOSE	CLOSE		134	214.4
	4	6	8	9	9	9	9	9	9	9	9	9	9	9	9	9	CLOSE	CLOSE		135	216.0
	4	6	8	9	9	9	9	9	9	9	9	9	9	9	9	10	CLOSE	CLOSE		136	217.6
	4	6	8	9	9	9	9	9	9	9	9	9	9	10	9	10	CLOSE	CLOSE		137	219.2
	4	6	8	10	9	9	9	9	9	9	9	9	9	10	9	10	CLOSE	CLOSE		138	220.8
	4	6	8	10	9	9	10	9	9	9	9	9	9	10	9	10	CLOSE	CLOSE		139	222.4
	4	6	8	10	9	9	10	9	10	9	9	9	9	10	9	10	CLOSE	CLOSE		140	224.0
	4	6	8	10	9	9	10	9	10	9	10	9	9	10	9	10	CLOSE	CLOSE		141	225.6
	4	6	8	10	10	9	10	9	10	9	10	9	9	10	9	10	CLOSE	CLOSE		142	227.2
	4	6	8	10	10	9	10	9	10	9	10	9	9	10	10	10	CLOSE	CLOSE		143	228.8
	4	6	8	10	10	10	10	9	10	9	10	9	9	10	10	10	CLOSE	CLOSE		144	230.4
	4	6	8	10	10	10	10	10	10	9	10	9	10	10	10	10	CLOSE	CLOSE		145	232.0
	4	6	8	10	10	10	10	10	10	10	10	9	10	10	10	10	CLOSE	CLOSE		146	233.6
	4	6	8	10	10	10	10	10	10	10	10	9	10	10	10	10	CLOSE	CLOSE		147	235.2

JDA Spill Patterns with No TSWs - # Gate Stops per Spillbay																				Total	Spill	
1 <sup>b</sup>	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Stops (#)	(kcfs)	
	4	6	8	10	10	10	10	10	10	10	10	10	10	10	10	10	CLOSE	CLOSE		148	236.8	
	4	6	8	10	10	10	10	10	10	10	10	10	10	10	10	11	CLOSE	CLOSE		149	238.4	
	4	6	8	10	10	10	10	10	10	10	10	10	10	11	10	11	CLOSE	CLOSE		150	240.0	
	4	6	8	10	10	10	11	10	10	10	10	10	10	11	10	11	CLOSE	CLOSE		151	241.6	
	4	6	8	10	10	10	11	10	11	10	10	10	10	11	10	11	CLOSE	CLOSE		152	243.2	
	4	6	8	10	10	10	11	10	11	10	11	10	10	11	10	11	CLOSE	CLOSE		153	244.8	
	4	6	8	10	11	10	11	10	11	10	11	10	10	11	10	11	CLOSE	CLOSE		154	246.4	
	4	6	8	10	11	10	11	10	11	10	11	10	10	11	11	11	CLOSE	CLOSE		155	248.0	
	4	6	8	10	11	11	11	10	11	10	11	10	10	11	11	11	CLOSE	CLOSE		156	249.6	
	4	6	8	10	11	11	11	10	11	10	11	10	11	11	11	11	CLOSE	CLOSE		157	251.2	
	4	6	8	10	11	11	11	11	11	10	11	10	11	11	11	11	CLOSE	CLOSE		158	252.8	
	4	6	8	10	11	11	11	11	11	11	11	10	11	11	11	11	CLOSE	CLOSE		159	254.4	
	4	6	8	10	11	11	11	11	11	11	11	11	11	11	11	11	CLOSE	CLOSE		160	256.0	
	4	6	8	10	11	11	11	11	11	11	11	11	11	11	12	11	11	CLOSE	CLOSE		161	257.6
	4	6	8	10	11	11	12	11	11	11	11	11	11	11	12	11	11	CLOSE	CLOSE		162	259.2
	4	6	8	10	11	11	12	11	12	11	11	11	11	11	12	11	11	CLOSE	CLOSE		163	260.8
	4	6	8	10	11	11	12	11	12	11	12	11	11	11	12	11	11	CLOSE	CLOSE		164	262.4
	4	6	8	10	12	11	12	11	12	11	12	11	11	11	12	11	11	CLOSE	CLOSE		165	264.0
	4	6	8	10	12	11	12	11	12	11	12	11	11	11	12	12	11	CLOSE	CLOSE		166	265.6
	4	6	8	10	12	12	12	11	12	11	12	11	11	11	12	12	11	CLOSE	CLOSE		167	267.2
	4	6	8	10	12	12	12	11	12	11	12	11	12	12	12	12	11	CLOSE	CLOSE		168	268.8
	4	6	8	10	12	12	12	12	12	11	12	11	12	12	12	12	11	CLOSE	CLOSE		169	270.4
	4	6	8	10	12	12	12	12	12	12	12	12	11	12	12	12	11	CLOSE	CLOSE		170	272.0
	4	6	8	10	12	12	12	12	12	12	12	12	12	12	12	12	11	CLOSE	CLOSE		171	273.6
	4	6	8	10	12	12	12	12	12	12	12	12	12	12	12	12	11	CLOSE	CLOSE		172	275.2
	4	6	8	10	12	12	13	12	12	12	12	12	12	12	13	12	11	CLOSE	CLOSE		173	276.8
	4	6	8	10	12	12	13	12	13	12	12	12	12	12	13	12	11	CLOSE	CLOSE		174	278.4
	4	6	8	10	12	12	13	12	13	12	13	12	12	12	13	12	11	CLOSE	CLOSE		175	280.0
	4	6	8	10	12	12	13	12	13	12	13	12	12	12	13	13	11	CLOSE	CLOSE		176	281.6
	4	6	8	10	12	13	13	12	13	12	13	12	12	12	13	13	11	CLOSE	CLOSE		177	283.2
	4	6	8	10	12	13	13	12	13	12	13	12	13	13	13	13	11	CLOSE	CLOSE		178	284.8
	4	6	8	10	12	13	13	13	13	12	13	12	13	13	13	13	11	CLOSE	CLOSE		179	286.4
	4	6	8	10	12	13	13	13	13	13	13	12	13	13	13	13	11	CLOSE	CLOSE		180	288.0
	4	6	8	10	12	13	13	13	13	13	13	13	13	13	13	13	11	CLOSE	CLOSE		181	289.6
	4	6	8	10	12	13	13	13	13	13	13	13	13	13	14	13	11	CLOSE	CLOSE		182	291.2
	4	6	8	10	12	13	14	13	13	13	13	13	13	13	14	13	11	CLOSE	CLOSE		183	292.8
	4	6	8	10	12	13	14	13	14	13	13	13	13	13	14	13	11	CLOSE	CLOSE		184	294.4
	4	6	8	10	12	13	14	13	14	13	14	13	13	13	14	13	11	CLOSE	CLOSE		185	296.0
	4	6	8	10	12	13	14	13	14	13	14	13	13	13	14	14	11	CLOSE	CLOSE		186	297.6
	4	6	8	10	12	14	14	13	14	13	14	13	13	13	14	14	11	CLOSE	CLOSE		187	299.2
	4	6	8	10	12	14	14	13	14	13	14	13	14	14	14	14	11	CLOSE	CLOSE		188	300.8
	4	6	8	10	12	14	14	14	14	13	14	13	14	14	14	14	11	CLOSE	CLOSE		189	302.4
	4	6	8	10	12	14	14	14	14	14	14	13	14	14	14	14	11	CLOSE	CLOSE		190	304.0
	4	6	8	10	12	14	14	14	14	14	14	14	14	14	14	14	11	CLOSE	CLOSE		191	305.6
	4	6	8	10	12	14	14	14	14	14	14	14	14	14	15	14	11	CLOSE	CLOSE		192	307.2
	4	6	8	10	12	14	15	14	14	14	14	14	14	14	15	14	11	CLOSE	CLOSE		193	308.8
	4	6	8	10	12	14	15	14	15	14	14	14	14	14	15	14	11	CLOSE	CLOSE		194	310.4
	4	6	8	10	12	14	15	14	15	14	15	14	14	14	15	14	11	CLOSE	CLOSE		195	312.0
	4	6	8	10	12	14	15	14	15	14	15	14	14	14	15	15	11	CLOSE	CLOSE		196	313.6

JDA Spill Patterns with No TSWs - # Gate Stops per Spillbay																				Total Stops (#)	Spill a (kcfs)
1 <sup>b</sup>	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20		
	4	6	8	10	12	14	15	14	15	14	15	14	15	15	15	11	CLOSE	CLOSE		197	315.2
	4	6	8	10	12	14	15	15	15	14	15	14	15	15	15	11	CLOSE	CLOSE		198	316.8
	4	6	8	10	12	14	15	15	15	15	15	14	15	15	15	11	CLOSE	CLOSE		199	318.4
	4	6	8	10	12	14	15	15	15	15	15	15	15	15	15	11	CLOSE	CLOSE		200	320.0
	4	6	8	10	12	14	15	15	15	15	15	15	15	16	15	11	CLOSE	CLOSE		201	321.6
	4	6	8	10	12	14	16	15	15	15	15	15	15	16	15	11	CLOSE	CLOSE		202	323.2
	4	6	8	10	12	14	16	15	16	15	15	15	15	16	15	11	CLOSE	CLOSE		203	324.8
	4	6	8	10	12	14	16	15	16	15	16	15	15	16	15	11	CLOSE	CLOSE		204	326.4
	4	6	8	10	12	14	16	15	16	15	16	15	15	16	16	11	CLOSE	CLOSE		205	328.0
	4	6	8	10	12	14	16	15	16	15	16	15	16	16	16	11	CLOSE	CLOSE		206	329.6
	4	6	8	10	12	14	16	16	16	15	16	15	16	16	16	11	CLOSE	CLOSE		207	331.2
	4	6	8	10	12	14	16	16	16	16	16	15	16	16	16	11	CLOSE	CLOSE		208	332.8
	4	6	8	10	12	14	16	16	16	16	16	16	16	16	16	11	CLOSE	CLOSE		209	334.4
	4	6	8	10	12	15	16	16	16	16	16	16	16	16	16	11	CLOSE	CLOSE		210	336.0
	4	6	8	10	13	15	16	16	16	16	16	16	16	16	16	11	CLOSE	CLOSE		211	337.6
	4	6	8	11	13	15	16	16	16	16	16	16	16	16	16	11	CLOSE	CLOSE		212	339.2
	4	6	9	11	13	15	16	16	16	16	16	16	16	16	16	11	CLOSE	CLOSE		213	340.8
	4	7	9	11	13	15	16	16	16	16	16	16	16	16	16	11	CLOSE	CLOSE		214	342.4
	5	7	9	11	13	15	16	16	16	16	16	16	16	16	16	11	CLOSE	CLOSE		215	344.0
1	5	7	9	11	13	15	16	16	16	16	16	16	16	16	16	11	CLOSE	CLOSE		216	345.6
1	5	7	9	11	13	16	16	16	16	16	16	16	16	16	16	11	CLOSE	CLOSE		217	347.2
1	5	7	9	11	14	16	16	16	16	16	16	16	16	16	16	11	CLOSE	CLOSE		218	348.8
1	5	7	9	12	14	16	16	16	16	16	16	16	16	16	16	11	CLOSE	CLOSE		219	350.4
1	5	7	10	12	14	16	16	16	16	16	16	16	16	16	16	11	CLOSE	CLOSE		220	352.0
1	5	8	10	12	14	16	16	16	16	16	16	16	16	16	16	11	CLOSE	CLOSE		221	353.6
1	6	8	10	12	14	16	16	16	16	16	16	16	16	16	16	11	CLOSE	CLOSE		222	355.2
2	6	8	10	12	14	16	16	16	16	16	16	16	16	16	16	11	CLOSE	CLOSE		223	356.8
2	6	8	10	12	15	16	16	16	16	16	16	16	16	16	16	11	CLOSE	CLOSE		224	358.4
2	6	8	10	13	15	16	16	16	16	16	16	16	16	16	16	11	CLOSE	CLOSE		225	360.0
2	6	8	11	13	15	16	16	16	16	16	16	16	16	16	16	11	CLOSE	CLOSE		226	361.6
2	6	9	11	13	15	16	16	16	16	16	16	16	16	16	16	11	CLOSE	CLOSE		227	363.2
2	7	9	11	13	15	16	16	16	16	16	16	16	16	16	16	11	CLOSE	CLOSE		228	364.8
3	7	9	11	13	15	16	16	16	16	16	16	16	16	16	16	11	CLOSE	CLOSE		229	366.4
3	7	9	11	13	16	16	16	16	16	16	16	16	16	16	16	11	CLOSE	CLOSE		230	368.0
3	7	9	11	14	16	16	16	16	16	16	16	16	16	16	16	11	CLOSE	CLOSE		231	369.6
3	7	9	12	14	16	16	16	16	16	16	16	16	16	16	16	11	CLOSE	CLOSE		232	371.2
3	7	10	12	14	16	16	16	16	16	16	16	16	16	16	16	11	CLOSE	CLOSE		233	372.8
3	8	10	12	14	16	16	16	16	16	16	16	16	16	16	16	11	CLOSE	CLOSE		234	374.4
4	8	10	12	14	16	16	16	16	16	16	16	16	16	16	16	11	CLOSE	CLOSE		235	376.0
4	8	10	12	15	16	16	16	16	16	16	16	16	16	16	16	11	CLOSE	CLOSE		236	377.6
4	8	10	13	15	16	16	16	16	16	16	16	16	16	16	16	11	CLOSE	CLOSE		237	379.2
4	8	11	13	15	16	16	16	16	16	16	16	16	16	16	16	11	CLOSE	CLOSE		238	380.8
4	9	11	13	15	16	16	16	16	16	16	16	16	16	16	16	11	CLOSE	CLOSE		239	382.4
5	9	11	13	15	16	16	16	16	16	16	16	16	16	16	16	11	CLOSE	CLOSE		240	384.0
5	9	11	13	16	16	16	16	16	16	16	16	16	16	16	16	11	CLOSE	CLOSE		241	385.6
5	9	11	14	16	16	16	16	16	16	16	16	16	16	16	16	11	CLOSE	CLOSE		242	387.2
5	9	12	14	16	16	16	16	16	16	16	16	16	16	16	16	11	CLOSE	CLOSE		243	388.8
5	10	12	14	16	16	16	16	16	16	16	16	16	16	16	16	11	CLOSE	CLOSE		244	390.4
6	10	12	14	16	16	16	16	16	16	16	16	16	16	16	16	11	CLOSE	CLOSE		245	392.0

JDA Spill Patterns with No TSWs - # Gate Stops per Spillbay																				Total Stops (#)	Spill a (kcfs)
1 <sup>b</sup>	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20		
6	10	12	15	16	16	16	16	16	16	16	16	16	16	16	16	11	CLOSE	CLOSE		246	393.6
6	10	13	15	16	16	16	16	16	16	16	16	16	16	16	16	11	CLOSE	CLOSE		247	395.2
6	11	13	15	16	16	16	16	16	16	16	16	16	16	16	16	11	CLOSE	CLOSE		248	396.8
7	11	13	15	16	16	16	16	16	16	16	16	16	16	16	16	11	CLOSE	CLOSE		249	398.4
7	11	13	16	16	16	16	16	16	16	16	16	16	16	16	16	11	CLOSE	CLOSE		250	400.0
7	11	14	16	16	16	16	16	16	16	16	16	16	16	16	16	11	CLOSE	CLOSE		251	401.6
8	11	14	16	16	16	16	16	16	16	16	16	16	16	16	16	11	CLOSE	CLOSE		252	403.2
8	11	15	16	16	16	16	16	16	16	16	16	16	16	16	16	11	CLOSE	CLOSE		253	404.8
9	11	15	16	16	16	16	16	16	16	16	16	16	16	16	16	11	CLOSE	CLOSE		254	406.4
9	11	16	16	16	16	16	16	16	16	16	16	16	16	16	16	11	CLOSE	CLOSE		255	408.0
10	11	16	16	16	16	16	16	16	16	16	16	16	16	16	16	11	CLOSE	CLOSE		256	409.6
11	11	16	16	16	16	16	16	16	16	16	16	16	16	16	16	11	CLOSE	CLOSE		257	411.2
11	11	17	16	16	16	16	16	16	16	16	16	16	16	16	16	11	CLOSE	CLOSE		258	412.8
11	11	17	17	16	16	16	16	16	16	16	16	16	16	16	16	11	CLOSE	CLOSE		259	414.4
11	11	17	17	16	16	16	16	16	16	16	16	16	16	17	16	11	CLOSE	CLOSE		260	416.0
11	11	17	17	17	16	16	16	16	16	16	16	16	16	17	16	11	CLOSE	CLOSE		261	417.6
11	11	17	17	17	16	16	17	16	16	16	16	16	16	17	16	11	CLOSE	CLOSE		262	419.2
11	11	17	17	17	16	16	17	16	17	16	16	16	16	17	16	11	CLOSE	CLOSE		263	420.8
11	11	17	17	17	16	16	17	16	17	16	17	16	16	17	16	11	CLOSE	CLOSE		264	422.4
11	11	17	17	17	17	16	17	16	17	16	17	16	16	17	16	11	CLOSE	CLOSE		265	424.0
11	11	17	17	17	17	16	17	16	17	16	17	16	16	17	17	11	CLOSE	CLOSE		266	425.6
11	11	17	17	17	17	17	17	16	17	16	17	16	16	17	17	11	CLOSE	CLOSE		267	427.2
11	11	17	17	17	17	17	17	16	17	16	17	16	17	17	17	11	CLOSE	CLOSE		268	428.8
11	11	17	17	17	17	17	17	17	17	16	17	16	17	17	17	11	CLOSE	CLOSE		269	430.4
11	11	17	17	17	17	17	17	17	17	17	17	16	17	17	17	11	CLOSE	CLOSE		270	432.0
11	11	17	17	17	17	17	17	17	17	17	17	17	17	17	17	11	CLOSE	CLOSE		271	433.6
11	11	18	17	17	17	17	17	17	17	17	17	17	17	17	17	11	CLOSE	CLOSE		272	435.2
11	11	18	18	17	17	17	17	17	17	17	17	17	17	17	17	11	CLOSE	CLOSE		273	436.8
11	11	18	18	17	17	17	17	17	17	17	17	17	17	18	17	11	CLOSE	CLOSE		274	438.4
11	11	18	18	18	17	17	17	17	17	17	17	17	17	18	17	11	CLOSE	CLOSE		275	440.0
11	11	18	18	18	17	17	18	17	17	17	17	17	17	18	17	11	CLOSE	CLOSE		276	441.6
11	11	18	18	18	17	17	18	17	18	17	17	17	17	18	17	11	CLOSE	CLOSE		277	443.2
11	11	18	18	18	17	17	18	17	18	17	18	17	17	18	17	11	CLOSE	CLOSE		278	444.8
11	11	18	18	18	18	17	18	17	18	17	18	17	17	18	17	11	CLOSE	CLOSE		279	446.4
11	11	18	18	18	18	17	18	17	18	17	18	17	17	18	18	11	CLOSE	CLOSE		280	448.0
11	11	18	18	18	18	18	18	17	18	17	18	17	17	18	18	11	CLOSE	CLOSE		281	449.6
11	11	18	18	18	18	18	18	17	18	17	18	17	18	18	18	11	CLOSE	CLOSE		282	451.2
11	11	18	18	18	18	18	18	18	18	17	18	17	18	18	18	11	CLOSE	CLOSE		283	452.8
11	11	18	18	18	18	18	18	18	18	18	18	17	18	18	18	11	CLOSE	CLOSE		284	454.4
11	11	18	18	18	18	18	18	18	18	18	18	18	18	18	18	11	CLOSE	CLOSE		285	456.0
11	11	19	18	18	18	18	18	18	18	18	18	18	18	18	18	11	CLOSE	CLOSE		286	457.6
11	11	19	19	18	18	18	18	18	18	18	18	18	18	18	18	11	CLOSE	CLOSE		287	459.2
11	11	19	19	18	18	18	18	18	18	18	18	18	18	19	18	11	CLOSE	CLOSE		288	460.8
11	11	19	19	19	18	18	18	18	18	18	18	18	18	19	18	11	CLOSE	CLOSE		289	462.4
11	11	19	19	19	18	18	19	18	18	18	18	18	18	19	18	11	CLOSE	CLOSE		290	464.0
11	11	19	19	19	18	18	19	18	19	18	18	18	18	19	18	11	CLOSE	CLOSE		291	465.6
11	11	19	19	19	18	18	19	18	19	18	19	18	18	19	18	11	CLOSE	CLOSE		292	467.2
11	11	19	19	19	19	18	19	18	19	18	19	18	18	19	18	11	CLOSE	CLOSE		293	468.8
11	11	19	19	19	19	18	19	18	19	18	19	18	18	19	19	11	CLOSE	CLOSE		294	470.4

JDA Spill Patterns with No TSWs - # Gate Stops per Spillbay																				Total Stops (#)	Spill a (kcfs)
1 <sup>b</sup>	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20		
11	11	19	19	19	19	19	19	18	19	18	19	18	18	19	19	11	CLOSE	CLOSE		295	472.0
11	11	19	19	19	19	19	19	18	19	18	19	18	19	19	19	11	CLOSE	CLOSE		296	473.6
11	11	19	19	19	19	19	19	19	19	18	19	18	19	19	19	11	CLOSE	CLOSE		297	475.2
11	11	19	19	19	19	19	19	19	19	19	19	18	19	19	19	11	CLOSE	CLOSE		298	476.8
11	11	19	19	19	19	19	19	19	19	19	19	19	19	19	19	11	CLOSE	CLOSE		299	478.4
11	11	20	19	19	19	19	19	19	19	19	19	19	19	19	19	11	CLOSE	CLOSE		300	480.0
11	11	20	20	19	19	19	19	19	19	19	19	19	19	19	19	11	CLOSE	CLOSE		301	481.6
11	11	20	20	19	19	19	19	19	19	19	19	19	19	20	19	11	CLOSE	CLOSE		302	483.2
11	11	20	20	20	19	19	19	19	19	19	19	19	19	20	19	11	CLOSE	CLOSE		303	484.8
11	11	20	20	20	19	19	20	19	19	19	19	19	19	20	19	11	CLOSE	CLOSE		304	486.4
11	11	20	20	20	19	19	20	19	20	19	19	19	19	20	19	11	CLOSE	CLOSE		305	488.0
11	11	20	20	20	19	19	20	19	20	19	20	19	19	20	19	11	CLOSE	CLOSE		306	489.6
11	11	20	20	20	20	19	20	19	20	19	20	19	19	20	19	11	CLOSE	CLOSE		307	491.2
11	11	20	20	20	20	19	20	19	20	19	20	19	19	20	20	11	CLOSE	CLOSE		308	492.8
11	11	20	20	20	20	20	20	19	20	19	20	19	19	20	20	11	CLOSE	CLOSE		309	494.4
11	11	20	20	20	20	20	20	19	20	19	20	19	20	20	20	11	CLOSE	CLOSE		310	496.0
11	11	20	20	20	20	20	20	20	20	19	20	19	20	20	20	11	CLOSE	CLOSE		311	497.6
11	11	20	20	20	20	20	20	20	20	20	20	19	20	20	20	11	CLOSE	CLOSE		312	499.2
11	11	20	20	20	20	20	20	20	20	20	20	20	20	20	20	11	CLOSE	CLOSE		313	500.8
11	11	21	20	20	20	20	20	20	20	20	20	20	20	20	20	11	CLOSE	CLOSE		314	502.4
11	11	21	21	20	20	20	20	20	20	20	20	20	20	20	20	11	CLOSE	CLOSE		315	504.0
11	11	21	21	20	20	20	20	20	20	20	20	20	20	21	20	11	CLOSE	CLOSE		316	505.6
11	11	21	21	21	20	20	20	20	20	20	20	20	20	21	20	11	CLOSE	CLOSE		317	507.2
11	11	21	21	21	20	20	21	20	20	20	20	20	20	21	20	11	CLOSE	CLOSE		318	508.8
11	11	21	21	21	20	20	21	20	21	20	20	20	20	21	20	11	CLOSE	CLOSE		319	510.4
11	11	21	21	21	20	20	21	20	21	20	21	20	20	21	20	11	CLOSE	CLOSE		320	512.0
11	11	21	21	21	21	20	21	20	21	20	21	20	20	21	20	11	CLOSE	CLOSE		321	513.6
11	11	21	21	21	21	20	21	20	21	20	21	20	20	21	21	11	CLOSE	CLOSE		322	515.2
11	11	21	21	21	21	21	21	20	21	20	21	20	20	21	21	11	CLOSE	CLOSE		323	516.8
11	11	21	21	21	21	21	21	20	21	20	21	20	21	21	21	11	CLOSE	CLOSE		324	518.4
11	11	21	21	21	21	21	21	21	21	20	21	20	21	21	21	11	CLOSE	CLOSE		325	520.0
11	11	21	21	21	21	21	21	21	21	21	21	20	21	21	21	11	CLOSE	CLOSE		326	521.6
11	11	21	21	21	21	21	21	21	21	21	21	21	21	21	21	11	CLOSE	CLOSE		327	523.2
11	11	22	21	21	21	21	21	21	21	21	21	21	21	21	21	11	CLOSE	CLOSE		328	524.8
11	11	22	22	21	21	21	21	21	21	21	21	21	21	21	21	11	CLOSE	CLOSE		329	526.4
11	11	22	22	21	21	21	21	21	21	21	21	21	21	22	21	11	CLOSE	CLOSE		330	528.0
11	11	22	22	22	21	21	21	21	21	21	21	21	21	22	21	11	CLOSE	CLOSE		331	529.6
11	11	22	22	22	21	21	22	21	21	21	21	21	21	22	21	11	CLOSE	CLOSE		332	531.2
11	11	22	22	22	21	21	22	21	22	21	21	21	21	22	21	11	CLOSE	CLOSE		333	532.8
11	11	22	22	22	21	21	22	21	22	21	22	21	21	22	21	11	CLOSE	CLOSE		334	534.4
11	11	22	22	22	22	21	22	21	22	21	22	21	21	22	21	11	CLOSE	CLOSE		335	536.0
11	11	22	22	22	22	21	22	21	22	21	22	21	21	22	22	11	CLOSE	CLOSE		336	537.6
11	11	22	22	22	22	22	22	21	22	21	22	21	21	22	22	11	CLOSE	CLOSE		337	539.2
11	11	22	22	22	22	22	22	21	22	21	22	21	22	22	22	11	CLOSE	CLOSE		338	540.8
11	11	22	22	22	22	22	22	22	22	21	22	21	22	22	22	11	CLOSE	CLOSE		339	542.4
11	11	22	22	22	22	22	22	22	22	22	22	21	22	22	22	11	CLOSE	CLOSE		340	544.0
11	11	22	22	22	22	22	22	22	22	22	22	22	22	22	22	11	CLOSE	CLOSE		341	545.6
11	11	23	22	22	22	22	22	22	22	22	22	22	22	22	22	11	CLOSE	CLOSE		342	547.2
11	11	23	23	22	22	22	22	22	22	22	22	22	22	22	22	11	CLOSE	CLOSE		343	548.8



JDA Spill Patterns with No TSWs - # Gate Stops per Spillbay																				Total Stops (#)	Spill <sup>a</sup> (kcfs)
1 <sup>b</sup>	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20		
11	11	23	23	22	22	22	22	22	22	22	22	22	23	22	11	CLOSE	CLOSE			344	550.4
11	11	23	23	23	22	22	22	22	22	22	22	22	23	22	11	CLOSE	CLOSE			345	552.0
11	11	23	23	23	22	22	23	22	22	22	22	22	23	22	11	CLOSE	CLOSE			346	553.6
11	11	23	23	23	22	22	23	22	23	22	22	22	23	22	11	CLOSE	CLOSE			347	555.2
11	11	23	23	23	22	22	23	22	23	22	23	22	23	22	11	CLOSE	CLOSE			348	556.8
11	11	23	23	23	23	22	23	22	23	22	23	22	23	22	11	CLOSE	CLOSE			349	558.4
11	11	23	23	23	23	22	23	22	23	22	23	22	23	23	11	CLOSE	CLOSE			350	560.0
11	11	23	23	23	23	23	23	22	23	22	23	22	23	23	11	CLOSE	CLOSE			351	561.6
11	11	23	23	23	23	23	23	22	23	22	23	22	23	23	11	CLOSE	CLOSE			352	563.2
11	11	23	23	23	23	23	23	23	23	22	23	22	23	23	11	CLOSE	CLOSE			353	564.8
11	11	23	23	23	23	23	23	23	23	23	23	22	23	23	11	CLOSE	CLOSE			354	566.4
11	11	23	23	23	23	23	23	23	23	23	23	23	23	23	11	CLOSE	CLOSE			355	568.0
11	11	24	23	23	23	23	23	23	23	23	23	23	23	23	11	CLOSE	CLOSE			356	569.6
11	11	24	24	23	23	23	23	23	23	23	23	23	23	23	11	CLOSE	CLOSE			357	571.2
11	11	24	24	23	23	23	23	23	23	23	23	23	24	23	11	CLOSE	CLOSE			358	572.8
11	11	24	24	24	23	23	23	23	23	23	23	23	24	23	11	CLOSE	CLOSE			359	574.4
11	11	24	24	24	23	23	24	23	23	23	23	23	24	23	11	CLOSE	CLOSE			360	576.0
11	11	24	24	24	23	23	24	23	24	23	23	23	24	23	11	CLOSE	CLOSE			361	577.6
11	11	24	24	24	23	23	24	23	24	23	24	23	24	23	11	CLOSE	CLOSE			362	579.2
11	11	24	24	24	24	23	24	23	24	23	24	23	24	23	11	CLOSE	CLOSE			363	580.8
11	11	24	24	24	24	23	24	23	24	23	24	23	24	24	11	CLOSE	CLOSE			364	582.4
11	11	24	24	24	24	24	24	23	24	23	24	23	24	24	11	CLOSE	CLOSE			365	584.0
11	11	24	24	24	24	24	24	23	24	23	24	23	24	24	11	CLOSE	CLOSE			366	585.6
11	11	24	24	24	24	24	24	24	24	23	24	23	24	24	11	CLOSE	CLOSE			367	587.2
11	11	24	24	24	24	24	24	24	24	24	24	23	24	24	11	CLOSE	CLOSE			368	588.8
11	11	24	24	24	24	24	24	24	24	24	24	24	24	24	11	CLOSE	CLOSE			369	590.4
11	11	25	24	24	24	24	24	24	24	24	24	24	24	24	11	CLOSE	CLOSE			370	592.0
11	11	25	25	24	24	24	24	24	24	24	24	24	24	24	11	CLOSE	CLOSE			371	593.6
11	11	25	25	24	24	24	24	24	24	24	24	24	24	25	11	CLOSE	CLOSE			372	595.2
11	11	25	25	25	24	24	24	24	24	24	24	24	24	25	11	CLOSE	CLOSE			373	596.8
11	11	25	25	25	24	24	25	24	24	24	24	24	24	25	11	CLOSE	CLOSE			374	598.4
11	11	25	25	25	24	24	25	24	25	24	24	24	24	25	11	CLOSE	CLOSE			375	600.0