Summary of 2025 Juvenile Fish Bypass Operations at Wells Hydroelectric Project
December 1, 2025

Douglas PUD operated the Wells bypass system in 2025 as guided by the Wells HCP Coordinating Committee-approved *2025 Bypass Operating Plan* (BOP). The plan was developed to provide non-turbine passage during 95 percent of the juvenile migrations of each Plan Species passing Wells Dam. Again for 2025, the BOP used an in-season estimator of passage timing for subyearling Chinook Salmon to determine when to end bypass operations. The approved method relied on Program RealTime (https://www.cbr.washington.edu/inseason/smolt_midcol_che) to estimate when the 95th percentile of the run-of-river subyearling Chinook Salmon migration passed Rocky Reach Dam, and ended bypass operations at Wells Dam at midnight on that date. Bypass operations were initiated on April 3 at 00:00 hours, operating continuously until terminated at 24:00 hours on August 10, for a total of 130 days.

The BOP included measures for complying with Federal Energy Regulatory Commission (FERC) requirements for maintaining minimum automatic-gate-opening capacity under the *Wells Project Emergency Action Plan* (EAP). The BOP also included Washington Department of Ecology requirements for compliance with total dissolved gas (TDG) standards as directed by the FERC-approved *2025 Total Dissolved Gas Abatement Plan* (GAP) for the Wells Project. Compliance with the requirements of the EAP and GAP is typically achieved by systematic removal of bypass barriers under increasing discharge, including the concentration of spill through adjacent spillways at the center of Wells Dam and spilling over the discharge from active turbine units, as described in the *2025 BOP*. However, flows and involuntary spill volumes never met the criteria for barrier removal during the 2025 bypass operations, so all barriers remained in place for the duration of bypass operations.

Based on analysis conducted by Drs. Rebecca Buchanan and Richard Townsend of Columbia Basin Research (Appendix A), Douglas PUD achieved the HCP requirement to provide bypass operations during 95 percent of the juvenile migrations of each Plan Species passing Wells Dam in 2025 (Table 1).

Table 1. Percent of migration of Plan Species passing Wells Dam during 2025 bypass operations.

Plan Species	Percent of Migration During Bypass Operations
Sockeye	99.99%
Subyearling Chinook	99.89%
Yearling Chinook	98.78%
Coho	99.53%
Steelhead	99.87%

Appendix A

Proportion of Plan Species Outmigrating through Wells Dam during Juvenile Bypass Operations in 2025

COLUMBIA BASIN RESEARCH

Proportion of Plan Species Outmigrating through Wells Dam during Juvenile Bypass Operations in 2025

18 December 2025

TO: TOM KAHLER
Public Utility District No. 1 of Douglas County
1151 Valley Mall Parkway, East Wenatchee, Washington 98802 - 4497

FROM: REBECCA A. BUCHANAN & RICHARD L. TOWNSEND
Columbia Basin Research, School of Aquatic and Fishery Sciences, University of Washington
1325 Fourth Avenue, Suite 1515, Seattle, Washington 98101-2540

1 Background and Introduction

The Wells Habitat Conservation Plan (HCP) requires that bypass operations at Wells Dam provide protection for 95% of the juvenile outmigration of each salmon and steelhead Plan Species. Starting in 2012, the start and end of annual bypass operations at Wells Dam were defined based on a 5-year analysis of run passage timing that was conducted by Columbia Basin Research, in which the dates of Wells bypass operations were compared to estimates of Wells Dam passage dates computed by adjusting the annual passage timing data collected at Rocky Reach Dam by estimates of travel time between Wells and Rocky Reach for each Plan Species. The HCP Coordinating Committee (CC) requested that Douglas Public Utility District (PUD) provide annual analyses to monitor the performance of the bypass operation dates for providing the required bypass passage for 95% of the outmigrations of each Plan Species (Wells HCP CC 2011). These annual analyses by Columbia Basin Research were also the basis for the adjustment of the Wells bypass termination date for the 2021 season (Wells HCP CC 2021) and the change in methodology for determining the end date of bypass operations in 2023 (Wells HCP CC 2023).

Estimation of a larger than expected proportion of subyearling Chinook Salmon passing after the end of bypass operations in 2022 resulted in changing the method used to determine the bypass operations end date. Starting in 2023, the end date of bypass operations has been determined using the in-season run-timing forecasts produced by Program RealTime for passage of Rocky Reach Dam. It is understood that using the Rocky Reach 95th percentile passage date for stocks migrating from tributaries upstream of Wells Dam would provide a conservative estimate of passage timing at Wells Dam, given the travel time between Wells and Rocky Reach dams. The expectation of the CC was that the new methodology would provide a more robust determination of actual passage timing of subyearling Chinook Salmon (see Methods, below) and would respond to in-season annual and/or seasonal factors influencing passage timing. The end date for Wells Dam bypass operations was determined by Program RealTime in 2023, 2024 and 2025.

In early 2025, a bootstrap algorithm was used to reanalyze historical passage data of yearling Chinook Salmon to determine whether bypass operations should start earlier than the usual start date (9 April). The bootstrap algorithm resampled the wild population of PIT-tagged yearling Chinook to

"boost" the wild sample size to equal the hatchery sample size. Based on the bootstrap reanalysis, the start date of bypass operations at Wells Dam was shifted 6 days earlier to 3 April for 2025.

This report summarizes analysis of the outmigration timing at Wells Dam for five Wells HCP Plan Species (Coho Salmon, yearling and subyearling Chinook Salmon, steelhead, and Sockeye Salmon) for the period 2012–2025 and evaluates timing estimates against respective dates of bypass operations for those years. As in 2023 and 2024, this analysis compares the two methods for estimating subyearling Chinook Salmon passage percentages from data collected at Rocky Reach Dam: (1) those generated by analysis of detections of PIT-tagged subyearling Chinook Salmon originating upstream of Wells Dam and (2) those generated by Program RealTime from index sampling of run-of-river subyearling Chinook Salmon.

2 Methods

Since 2012, estimates of outmigration timing of Plan Species at Wells Dam have been derived from travel-time-adjusted passage-timing data collected at Rocky Reach Dam. Outmigration-timing data have been obtained at Rocky Reach Dam either by enumeration of individuals captured during the four daily index-sampling events at the Juvenile Fish Bypass Sampling Facility (Sockeye Salmon and subyearling Chinook Salmon) or by detections of PIT tags at the Rocky Reach Juvenile Fish Bypass PIT-tag detection system (subyearling and yearling Chinook Salmon, Coho Salmon, and steelhead). Those estimates of passage timing have been compared with the Wells Dam bypass operation dates to identify the proportion of the Plan Species migrations that were accorded bypass passage at Wells Dam.

Table 1 shows the median travel times between Wells Dam and Rocky Reach Dam for PIT-tagged yearling and subyearling Chinook Salmon, steelhead, and Coho Salmon detected at both sites (2016–2025; see Appendix Tables A1, A2) and from three years of Sockeye Salmon acoustic-tag studies (2006, 2008, and 2009) performed by Chelan PUD. Since 2016, annual updates in observed travel times from Wells Dam to Rocky Reach Dam have been used to adjust the estimated median travel time for all species except Sockeye Salmon. There was no change with the addition of 2025 data for most species and median travel times agreed with those established in 2024. The exception was for subyearling Chinook, whose median travel time increased from 10.7 days to 14.1 days, a travel time

more consistent with reporting completed prior to 2023 for this species. These median travel times were used for all Plan Species to derive passage dates at Wells Dam from Rocky Reach Dam passage data and also for the passage evaluations for the historical years starting in 2012 included in this report. In addition, bootstrapping was used to generate 95% confidence intervals for median travel time for each Plan Species. The bootstrap 95% confidence interval for median travel time was widest for subyearling Chinook Salmon (4.2 days to 17.7 days), reflecting the small sample size (22) and wide variability in observed travel time for that population (Table 1). The bootstrap 95% confidence interval was 4.2 days to 7.2 days for yearling Chinook Salmon and 5.4 days to 7.2 days for Coho Salmon, demonstrating moderate variability in travel time for those Plan Species.

Table 1: Median travel times (rounded to nearest day) between Wells and Rocky Reach dams, based on either detection of PIT-tagged fish at both facilities (steelhead, subyearling and yearling Chinook Salmon, Coho Salmon: 2016–2025; see Appendix), or acoustic-tag study results (Sockeye Salmon: 2006, 2008, and 2009). 95% C. I. = 95% bootstrap confidence interval (rounded to nearest 0.1 days). Sample size = number of travel time observations available.

Plan species	Median travel time	95% C. I.	Sample size
Yearling Chinook Salmon	5 days	(4.2, 7.2)	137
Subyearling Chinook Salmon	14 days	(4.2, 17.7)	22
Steelhead	2 days	(1.8, 1.9)	893
Sockeye Salmon	1 days	(0.95, 0.97)	1,348
Coho Salmon	6 days	(5.4, 7.2)	233

As in 2023 and 2024, two distinct methods were used in 2025 to assess the timing of Wells Dam bypass operations for the subyearling Chinook Salmon migration. First, PIT-tag detections at Rocky Reach Dam of subyearling Chinook Salmon PIT-tagged above Wells Dam were adjusted based upon multiyear median travel times from Wells to Rocky Reach to estimate the proportion of the migration passing Wells Dam during bypass operations (method used since 2011). A second estimate of the proportion of the subyearling Chinook Salmon migration covered by bypass operations at Wells Dam was computed using passage predictions generated using Program RealTime. Program RealTime estimates passage proportions by date at Rocky Reach Dam from daily index counts of run-of-river subyearling Chinook Salmon at the juvenile fish bypass sampling

facility (hereafter referred to as the Passage Index or "PI"). This PI-based estimate is derived from systematic index samples of the entire population of migrating subyearling Chinook Salmon passing Rocky Reach Dam via the juvenile fish bypass. In contrast, the PIT-tag-based method is based only on those individuals large enough to implant with a PIT tag from a sample of those individuals available and susceptible to beach-seine capture (primarily) or rotary-screw-trap capture (small minority) during discrete sampling efforts. For this analysis, the 95th percentile passage date at Rocky Reach Dam that was predicted by Program RealTime in 2025 was adjusted by the median travel time between Wells and Rocky Reach to evaluate the proportion of the subyearling Chinook Salmon migration covered by bypass operations at Wells Dam. Therefore, the proportions covered by Wells bypass operations estimated using either PIT-tag detections or by PI with Program RealTime were subjected to the same travel-time adjustment (14 days in 2025; Table 1).

Pursuant to the SOA approved by the Wells HCP CC for determining the termination date for Wells bypass operations in 2023 (Wells HPC CC 2023), the 2025 termination date for Wells bypass operations was selected as the Rocky Reach Dam 95th percentile passage date predicted by Program RealTime and not adjusted for travel time between Wells and Rocky Reach dams. Therefore, the selected date provided a protective and conservative estimate of the subyearling Chinook Salmon passage proportion at Wells Dam. However, for the analysis of the performance of the selected bypass termination date described above, the travel time adjustment was applied to estimate actual Wells Dam passage dates and assess 95% bypass coverage performance at Wells Dam.

3 Results

The onset of bypass operations at Wells Dam was six days earlier in 2025, representing a change from the previous date of 9 April to 00:00 on 3 April. Continuing with the change in 2023, the end date of bypass operations in 2025 was informed by the predicted 95% passage date of subyearling Chinook Salmon at Rocky Reach Dam generated by Program RealTime, as described above. In 2025, bypass operations at Wells Dam ended at midnight on 10 August. Figure 1 shows the annual cumulative outmigration proportions at Rocky Reach Dam (beginning 1 April in 2025) for spring migrants (yearling Chinook Salmon, steelhead, Sockeye Salmon, and Coho Salmon) and summer migrants (subyearling Chinook Salmon) from 2013–2025. The 2025 subyearling Chinook

Salmon passage distribution based on PIT tags was approximately the same length as that of the PI dates used in Program RealTime (Figure 1) despite using a smaller sample size (1,451 tags).

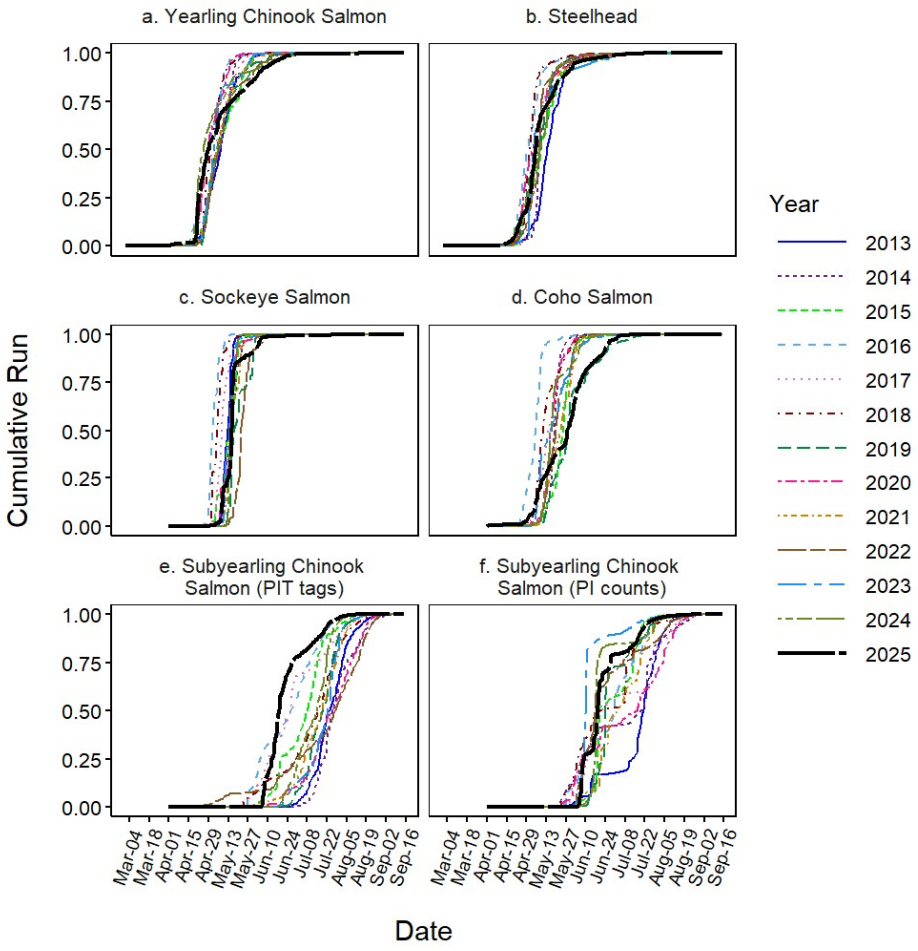

Figure 1. Passage distributions at Rocky Reach Dam juvenile collection facility for spring and summer migrating stocks, 2013–2025. Cumulative proportions for wild and hatchery yearling Chinook Salmon, steelhead, and Coho Salmon proportions were based on PIT-tagged releases above Wells Dam; Sockeye Salmon passage distributions were based on the expanded counts obtained from daily sampling at Rocky Reach Dam from 1 April–31 August; and for wild and hatchery subyearling Chinook, both methods were used (PI = Passage Index [data used in Program RealTime]). There were no Sockeye, Coho, or subyearling Chinook Salmon observed prior to 1 April. Bold black line represents 2025 passage timing.

The percentage of the migration that passed Wells Dam during the Wells bypass operations in 2025 was at or near 100% for PIT-tagged steelhead, Sockeye Salmon, and PIT-tagged Coho Salmon (Table 2). An estimated 74.56% of the wild yearling Chinook migration passed during bypass operations at Wells Dam and an estimated 99.26% of the hatchery yearling Chinook migration passed during bypass operations at Wells Dam. The percentage of the combined wild and hatchery PIT-tagged yearling Chinook Salmon that passed Wells Dam during the Wells bypass operations in 2025 was estimated at 98.78%. An estimated 99.87% of the run-of-river subyearling Chinook salmon migration was covered in 2025, with 0.13% passing after bypass operations ceased (Table 3, Program RealTime). Additionally, bypass operations at Wells Dam covered 99.93% of the PIT-tagged subyearling Chinook Salmon outmigration (hatchery and wild fish combined).

The 2025 results for PIT-tagged steelhead, Sockeye Salmon, and Coho Salmon were consistent with historical trends (2012–2024) and exceeded the HCP goals of providing bypass operations for equal to or greater than 95% of the spring outmigration of juvenile Plan Species. The 2025 results for run-of-river (passage index data) subyearling Chinook Salmon were also consistent with historical trends (2012–2024) and exceeded the HCP goals of providing bypass operations for at least 95% of the summer outmigration of juvenile Plan Species. The 2025 estimate of bypass operations passage percentage for PIT-tagged combined hatchery and wild yearling Chinook Salmon was slightly lower than previous years (98.78% compared with 99.45% to 99.99% in 2012–2024), with a slightly larger proportion of the combined run estimated to have passed before bypass operations began (1.20% compared with 0.01% to 0.55% in 2012–2024). Nevertheless, the 2025 bypass operations passage percentage for PIT-tagged combined hatchery and wild yearling Chinook Salmon exceeded the HCP goals of providing bypass operations for at least 95% of the spring outmigration of juvenile Plan Species. An estimated 74.56% of PIT-tagged wild yearling Chinook Salmon were estimated to have passed Wells Dam during bypass operations in 2025; this is the lowest bypass operations passage percentage for wild yearling Chinook since monitoring began in 2012, indicating an earlier wild run in 2025 than in previous years.

To assess the effectiveness of the selected start date for bypass operations, we compared the start date for bypass operations each year with the date on which the 5th percentile of the cumulative PIT-tagged yearling Chinook Salmon outmigration passed Wells Dam. For yearling Chinook Salmon in 2025 (hatchery and wild combined), bypass operations began 13 days earlier than the date

when the 5th percentile of the PIT-tagged outmigration passed Wells Dam (16 April; Table 4). The use of the 5th percentile of the outmigration for assessment of the bypass operations start date rests on the assumption that all yearling Chinook Salmon pass Wells Dam before the end of bypass operation in the summer. In 2025, a small number of hatchery yearling Chinook salmon were estimated to have passed Wells Dam after the end of bypass operations in August (2 fish, or 0.02% of the PIT-tagged outmigration). Taking those few late-migrating yearlings into account, the start date of bypass operations required to provide bypass operations to at least 95% of the outmigration was the date of the 4.98th percentile of the cumulative outmigration rather than the 5th percentile. However, both the 4.98th percentile and the 5th percentile fell on the same day for both the wild and hatchery PIT-tagged populations. Thus, the start date for bypass operations remained 13 days earlier than required to achieve the HCP standard of providing bypass passage for equal to or greater than 95% of the combined yearling Chinook outmigration.

Table 5 compares the actual termination date for bypass operations with the date on which bypass operations would have covered 95% of the PIT-tagged subyearling Chinook Salmon outmigration. This year, Douglas PUD ended bypass operations at midnight on 10 August based on monitoring the predicted subyearling Chinook Salmon migration status at Rocky Reach Dam provided by Program RealTime. The subyearling Chinook Salmon passage proportions estimated in this report include both estimates generated by Program RealTime using the PI of run-of-river fish (n = 46,095) and those based on PIT-tagged fish known to have been released above Wells Dam and subsequently detected at Rocky Reach Dam (n = 1,451). The PIT-tagged run is expected to have a concurrent outmigration with the Rocky Reach PI. Comparing the Wells Dam passage timing predictions between the PIT-tagged group (hatchery and wild fish combined) and the run-of-river PI group in 2025 and including an adjustment for the 14-day travel time from Wells Dam to Rocky Reach Dam, the PIT-tagged group had an estimated passage proportion of 99.93% during bypass operations at Wells Dam, while the run-of-river index group had an estimated passage proportion of 99.87% during that time period. The termination of bypass operations at midnight on 10 August was 30 days later than necessary (11 July) to achieve the HCP standard of providing bypass passage for equal to or greater than 95% of the PIT-tagged subyearling Chinook migration, and 31 days after the 95th percentile of run-of-river subyearling Chinook Salmon had passed Wells Dam (10 July). Using the full historical time series and a 14-day travel time as the basis of run-timing estimation, the average date when 95% of the outmigration had passed Wells Dam in the years 2012–2025 was 26

July for combined hatchery and wild PIT-tagged subyearling Chinook Salmon, 28 July for wild-only PIT-tagged subyearling Chinook Salmon, and 18 July for run-of-river subyearling Chinook Salmon (Table 5).

Table 2. Total estimated proportion of Plan Species that passed Wells Dam before, during, and after bypass operations at Wells, based on travel time between Wells and Rocky Reach dams, the cumulative proportion of the annual migration of each stock detected at Rocky Reach during each period, and the start and end dates of Wells bypass operations, 2012–2025, and averaged over all years. At the request of the Coordinating Committee, supplemental information on hatchery and wild-origin PIT-tagged yearling Chinook Salmon releases above Wells Dam was also included. (See Appendix C, tables 2a-2e for accessible version.)

Spring outmigration																
Proportion passed		Yearling Chinook Salmon+						Steelhead+			Sockeye			Coho+		
		Hatchery & wild			Wild only											
Annual migration proportion	Year	before bypass ops	during bypass ops	after bypass ops	before bypass ops	during bypass ops	after bypass ops	before bypass ops	during bypass ops	after bypass ops	before bypass ops	during bypass ops	after bypass ops	before bypass ops	during bypass ops	after bypass ops
	2012	0.0022	0.9978	0.0000	0.0438	0.9562	0.0000	0.0014	0.9986	0.0000	0.0000	1.0000	0.0000	N/A	N/A	N/A
	2013	0.0026	0.9974	0.0000	0.1386	0.8614	0.0000	0.0079	0.9921	0.0000	0.0000	0.9999	0.0001	0.0001	0.9999	0.0000
	2014	0.0055	0.9945	0.0000	0.1823	0.8177	0.0000	0.0021	0.9975	0.0004	0.0000	1.0000	0.0000	0.0001	0.9999	0.0000
	2015	0.0026	0.9974	0.0000	0.1402	0.8598	0.0000	0.0029	0.9969	0.0002	0.0000	0.9999	0.0001	0.0004	0.9996	0.0000
	2016	0.0032	0.9968	0.0000	0.1897	0.8103	0.0000	0.0022	0.9977	0.0001	0.0000	1.0000	0.0000	0.0029	0.9971	0.0000
	2017	0.0017	0.9983	0.0000	0.0708	0.9292	0.0000	0.0000	1.0000	0.0000	0.0000	1.0000	0.0000	0.0000	1.0000	0.0000
	2018	0.0008	0.9992	0.0000	0.1250	0.8750	0.0000	0.0001	0.9999	0.0000	0.0000	1.0000	0.0000	0.0000	1.0000	0.0000
	2019	0.0001	0.9999	0.0000	0.0064	0.9936	0.0000	0.0000	1.0000	0.0000	0.0000	1.0000	0.0000	0.0001	0.9999	0.0000
	2020	0.0042	0.9958	0.0000	0.1085	0.8915	0.0000	0.0002	0.9998	0.0000	0.0000	1.0000	0.0000	0.0033	0.9967	0.0000
	2021	0.0022	0.9978	0.0000	0.1834	0.8166	0.0000	0.0005	0.9995	0.0000	0.0000	1.0000	0.0000	0.0002	0.9998	0.0000
	2022	0.0017	0.9983	0.0000	0.1015	0.8985	0.0000	0.0009	0.9989	0.0002	0.0000	1.0000	0.0000	0.0007	0.9993	0.0000
	2023	0.0001	0.9999	0.0000	0.0060	0.9940	0.0000	0.0002	0.9995	0.0003	0.0000	0.9998	0.0002	0.0000	1.0000	0.0000
	2024	0.0052	0.9946	0.0002	0.1862	0.8138	0.0000	0.0016	0.9982	0.0002	0.0000	1.0000	0.0000	0.0000	1.0000	0.0000
	2025	0.0120	0.9878	0.0002	0.2544	0.7456	0.0000	0.0013	0.9987	0.0000	0.0000	0.9989	0.0011	0.0045	0.9953	0.0002
	Avg	0.0032	0.9968	0.0000	0.1241	0.8759	0.0000	0.0015	0.9984	0.0001	0.0000	0.9999	0.0001	0.0010	0.9990	0.0000

+ Proportion estimated using only PIT-tagged releases above Wells Dam.

Table 3. Total estimated proportion of subyearling Chinook Salmon that passed Wells Dam before, during, and after bypass operations at Wells, based on travel time between Wells and Rocky Reach dams, the cumulative proportion of the annual migration detected at Rocky Reach during each period, and the start and end dates of Wells bypass operations, 2012–2025, and averaged over all years. At the request of the Coordinating Committee, supplemental information on hatchery and wild-origin PIT-tagged subyearling Chinook Salmon releases above Wells Dam was also included. Finally, travel-time-adjusted estimates generated by Program RealTime of the proportion of the run-of-river subyearling Chinook Salmon migration that passed Wells Dam within the period of bypass operations are included to the right of those estimated by PIT-tag detections. (See Appendix C, tables 3a-3c for accessible version.)

		Summer outmigration								
		Subyearling Chinook+								
		Hatchery & wild PIT-tag			**Wild-only PIT-tag**			**Program RealTime**		
Proportion passed	Year	before bypass ops	during bypass ops	after bypass ops	before bypass ops	during bypass ops	after bypass ops	before bypass ops	during bypass ops	after bypass ops
Annual migration proportion	2012	0.0000	1.0000	0.0000	0.0000	1.0000	0.0000	0.0000	1.0000	0.0000
	2013	0.0000	1.0000	0.0000	0.0000	1.0000	0.0005	0.0000	1.0000	0.0000
	2014	0.0000	0.9967	0.0033	0.0000	0.9967	0.0033	0.0000	1.0000	0.0000
	2015	0.0000	1.0000	0.0000	0.0000	1.0000	0.0000	0.0000	1.0000	0.0000
	2016	0.0000	1.0000	0.0000	0.0000	1.0000	0.0000	0.0000	1.0000	0.0000
	2017	0.0000	1.0000	0.0000	0.0000	1.0000	0.0000	0.0000	1.0000	0.0000
	2018	0.0000	1.0000	0.0000	0.0000	1.0000	0.0000	0.0000	1.0000	0.0000
	2019	0.0000	1.0000	0.0000	0.0000	1.0000	0.0000	0.0000	1.0000	0.0000
	2020	0.0000	1.0000	0.0000	0.0000	1.0000	0.0000	0.0000	1.0000	0.0000
	2021	0.0000	0.9990	0.0010	0.0000	0.9986	0.0014	0.0000	0.9994	0.0006
	2022	0.0025	0.9494	0.0481	0.0000	0.9292	0.0708	0.0000	0.9955	0.0045
	2023	0.0000	0.9570	0.0430	0.0000	0.9570	0.0430	0.0000	0.9951	0.0049
	2024	0.0000	0.9985	0.0015	0.0000	0.9923	0.0077	0.0000	0.9963	0.0037
	2025	0.0000	0.9993	0.0007	0.0000	0.9973	0.0027	0.0000	0.9987	0.0013
	Avg	0.0002	0.9929	0.0070	0.0000	0.9908	0.0092	0.0000	0.9989	0.0011

+ PIT-tag proportion estimated using only PIT-tagged releases above Wells Dam; Program RealTime proportion estimated using spill-adjusted Passage Index at Rocky Reach Dam.

Table 4. Comparisons of the actual start date of bypass operations at Wells Dam versus the date on which the 5th percentile of the PIT-tagged yearling Chinook Salmon migration passed Wells Dam each year, 2012–2025. Operations began at 00:01 on the date listed in column 2. "Bypass start date compared to actual 5% passage date" (column 6) indicates whether the bypass start date was before (early) or after (late) the date on which the 5th percentile of the PIT-tagged yearling Chinook Salmon migration passed Wells Dam and by how many days. (See Appendix C, tables 4a-4b for accessible version.)

Migration year	Actual bypass start date	Cumulative proportion passed before bypass start date	Proportion covered by bypass ops	Date on which the 5th percentile passed	Bypass start date compared to actual 5% passage date
Hatchery & wild					
2012	April 9	0.0022	0.9978	April 15	6 days early
2013	April 9	0.0026	0.9974	April 18	9 days early
2014	April 9	0.0055	0.9945	April 17	8 days early
2015	April 9	0.0026	0.9974	April 18	9 days early
2016	April 9	0.0032	0.9968	April 12	3 days early
2017	April 9	0.0017	0.9983	April 17	8 days early
2018	April 9	0.0008	0.9992	April 19	10 days early
2019	April 9	0.0001	0.9999	April 21	12 days early
2020	April 9	0.0042	0.9958	April 16	7 days early
2021	April 9	0.0022	0.9978	April 19	10 days early
2022	April 9	0.0017	0.9983	April 20	11 days early
2023	April 9	0.0001	0.9999	April 20	11 days early
2024	April 9	0.0052	0.9946	April 14	5 days early
2025	April 3	0.0120	0.9878	April 16	13 days early
14-yr avg:		0.0032	0.9968	April 17	8 days early
Wild only					
2012	April 9	0.0438	0.9562	April 10	1 day early
2013	April 9	0.1386	0.8614	April 4	5 days late
2014	April 9	0.1823	0.8177	April 5	4 days late
2015	April 9	0.1402	0.8598	April 2	7 days late
2016	April 9	0.1897	0.8103	April 2	7 days late
2017	April 9	0.0708	0.9292	April 6	3 days late
2018	April 9	0.1250	0.8750	April 1	8 days late
2019	April 9	0.0064	0.9936	April 13	4 days early
2020	April 9	0.1085	0.8915	April 3	6 days late
2021	April 9	0.1834	0.8166	April 7	2 days late
2022	April 9	0.1015	0.8985	April 2	7 days late
2023	April 9	0.0060	0.9940	April 12	3 days early
2024	April 9	0.1862	0.8138	March 24	16 days late
2025	April 3	0.2544	0.7456	March 27	7 days late
14-yr avg:		0.1241	0.8759	April 4	4 days late

Table 5. Comparison of the actual end date of bypass operations at Wells Dam versus the end date necessary to have covered at least 95% of the PIT-tagged or run-of-river (Program RealTime) subyearling Chinook Salmon outmigration each year (operations ended at 24:00), 2012–2025. "Bypass end date compared to actual 95% passage date" (column 5) indicates whether the bypass end date was before (early) or after (late) the date on which the 95th percentile of the monitored subyearling Chinook Salmon migration passed Wells Dam and by how many days. "Wild Only" passage dates are shown for reference. (See Appendix C, tables 5a-5c for accessible version.)

Migration year	Actual bypass stop date	Cumulative proportion passed by 24:00 of bypass stop date	Date on which the 95% standard was achieved	Bypass end date compared to actual 95% passage date
Hatchery & wild PIT-tag				
2012	August 19	1.0000	August 7	12 days late
2013	August 19	1.0000	August 2	17 days late
2014	August 19	0.9967	August 9	10 days late
2015	August 19	1.0000	July 18	32 days late
2016	August 19	1.0000	July 11	39 days late
2017	August 19	1.0000	July 25	25 days late
2018	August 19	1.0000	July 29	21 days late
2019	August 19	1.0000	July 22	28 days late
2020	August 19	1.0000	August 6	12 days late
2021	August 9	0.9990	July 25	15 days late
2022	August 9	0.9494	August 10	1 day early
2023	July 24	0.9570	July 21	3 days late
2024	August 5	0.9985	July 16	20 days late
2025	August 10	0.9993	July 11	30 days late
14-yr avg:		0.9929	July 26	19 days late
Wild-only PIT-tag				
2012	August 19	1.0000	August 7	12 days late
2013	August 19	1.0000	August 2	17 days late
2014	August 19	0.9967	August 9	10 days late
2015	August 19	1.0000	July 23	27 days late
2016	August 19	1.0000	July 15	35 days late
2017	August 19	1.0000	July 27	23 days late
2018	August 19	1.0000	July 30	20 days late
2019	August 19	1.0000	July 23	27 days late
2020	August 19	1.0000	August 7	12 days late
2021	August 9	0.9986	July 27	13 days late
2022	August 9	0.9292	August 11	2 days early
2023	July 24	0.9570	July 21	3 days late
2024	August 5	0.9923	July 22	14 days late
2025	August 10	0.9973	July 27	14 days late

14-yr avg:		0.9908	July 28	17 days late
Program RealTime run-of-river (Passage Index or PI)				
2012	August 19	1.0000	July 17	33 days late
2013	August 19	1.0000	July 26	24 days late
2014	August 19	1.0000	August 3	16 days late
2015	August 19	1.0000	July 7	43 days late
2016	August 19	1.0000	July 16	34 days late
2017	August 19	1.0000	July 31	19 days late
2018	August 19	1.0000	July 14	36 days late
2019	August 19	1.0000	July 14	36 days late
2020	August 19	1.0000	August 2	17 days late
2021	August 9	0.9994	July 15	25 days late
2022	August 9	0.9955	July 26	14 days late
2023	July 24	0.9951	June 30	24 days late
2024	August 5	0.9963	July 16	20 days late
2025	August 10	0.9987	July 10	31 days late
14-yr avg:		0.9989	July 18	27 days late

4 Discussion

In 2025, bypass operations covered between 98.78% and 99.89% of the outmigration for each of the five Plan Species at Wells Dam. The coverage rates achieved this year are typical of past performance in 2012–2024 for all Plan Species except yearling Chinook Salmon. The 3 April start date for bypass operations was appropriate for providing bypass operations for the required minimum 95% for combined hatchery and wild yearling Chinook Salmon, steelhead, Sockeye Salmon, and Coho Salmon (see Table 2).

Bypass operations in 2025 covered an estimated 98.78% of PIT-tagged yearling Chinook Salmon, combined over hatchery and wild stocks. While this value exceeded the minimum required 95%, it was lower than any previous estimate from 2012–2024, despite starting bypass operations earlier in 2025. Review of the cumulative detections of yearling Chinook at Rocky Reach Dam suggests that the spring Chinook Salmon migration may have been early in 2025, especially the start of the combined hatchery and wild run (Figure 1). Further examination of the tagging data suggests that the wild run in particular was early in 2025. Only 74.56% of PIT-tagged wild yearling Chinook Salmon originating upstream of Wells Dam were estimated to have passed Wells during bypass operations in 2025, whereas annual estimates have ranged from 81.03% to 99.40% historically (Table 2). The lower estimated coverage percentage for wild

yearling Chinook in 2025 was unexpected because bypass operations started on 3 April, six days earlier than usual. Additionally, when averaged over all available years (2012–2025), the date on which the 5th percentile of the wild PIT-tagged yearling Chinook Salmon run was estimated to have passed Wells Dam was 4 April, providing a reasonable expectation that starting bypass operations on 3 April would provide protection to at least 95% of the wild population of yearling Chinook Salmon. The unexpectedly early wild run in 2025 resulted in a lower percentage that passed Wells Dam during bypass operations. Bypass operations nevertheless provided protection to more than 95% of the combined population of wild and hatchery yearling Chinook passing Wells Dams, based on the PIT-tag data. The small sample size of wild yearling Chinook Salmon in 2025 (n = 228) may have contributed to the estimation of the early run.

In 2025, the predicted passage status of subyearling Chinook Salmon at Rocky Reach Dam provided by Program RealTime was again used for determining when to end bypass spill operations at Wells Dam (HPC CC 2023). Douglas PUD monitored the predicted passage status provided by Program RealTime and made the decision to terminate bypass operations at Wells Dam when they were confident that the estimated 95% date of Rocky Reach passage was achieved for subyearling Chinook. Although Program RealTime initially predicted the 95th percentile passage date at Rocky Reach to be 23 July based on the run-of-river PI counts at that dam, the final estimate of the 95th percentile of run-of-river passage at Wells for subyearling Chinook Salmon was 10 July, accounting for the full observed outmigration and adjusting for travel time to Rocky Reach (Table 5). The actual termination date for bypass operations at Wells Dam in 2025 was 10 August.

This year, Program RealTime and the available PIT-tag data produced nearly the same estimate of the 95th percentile passage date at Wells Dam for wild and hatchery subyearling Chinook Salmon (10 July for Program RealTime and 11 July using PIT-tag data). The estimated date of the 95th percentile passage for the wild-only PIT-tagged subyearling Chinook salmon (27 July) was 16 days later than for combined hatchery and wild subyearling Chinook, but the small sample size of the PIT-tagged wild group (n = 368) limited the precision with which the passage timing could be estimated. Regardless of the dataset used for comparisons, using the Program RealTime-estimated Rocky Reach passage date of the 95th percentile of the subyearling Chinook Salmon run as the date for ending bypass operations at Wells Dam resulted in a conservative and

protective end date (10 August) for Wells bypass operations in 2025 whereby the 95th percentile requirement was exceeded.

5 Summary

Bypass operations at Wells Dam in 2025 achieved the HCP-required coverage of equal to or greater than 95% of the migration for all five Plan Species. Program RealTime proved an effective and conservative methodology for selecting the termination date for operation of the Wells bypass system in 2025.

6 References

Wells HCP CC. 2011. Statement of Agreement to Adjust the Timing of the Annual Initiation and Termination of Bypass Operations at Wells Dam. Date of Approval: July 26, 2011.

Wells HCP CC. 2021. Statement of Agreement to Adjust the Timing of the Annual Termination of Bypass Operations at Wells Dam. Date of Approval: January 26, 2021.

Wells HCP CC. 2023. Statement of Agreement (SOA). Wells Dam 2023 Bypass Operations and Methods. Approved: January 24, 2023.

7 Appendix A: Wells Dam and Rocky Reach Dam PIT-tag Detections

The year 2025 was the tenth year with PIT-tag detections available at Wells Dam (PTAGIS interrogation site WEJ), with 385 unique tag codes identified as juveniles. These tag codes comprised 45 yearling and 30 subyearling Chinook Salmon, 40 Coho Salmon, 269 steelhead, and 1 Sockeye Salmon. Table A1 summarizes the number of detections at Wells Dam, the number of those fish detected both at Wells Dam and subsequently at Rocky Reach Dam, and the estimated travel times between Wells and Rocky Reach Dam in 2025. With the exception of steelhead, these numbers were too few to estimate credible travel times. Pooling across the ten years of available data improves the available information for all species except Sockeye Salmon (Table A2). Mean travel times are influenced by outliers (i.e., the few fish with much longer travel times). Therefore, the median travel time is recommended as the basis for adjusting the Rocky Reach detection dates to estimate Wells Dam passage dates. There was little to no change with the addition of a tenth year to median travel times for most species (change ≤ 0.1 days in median travel time with the addition of 2025 data). For subyearling Chinook Salmon, the median travel time increased from 10.7 days to 14.1 days with the addition of 2025 data. Bootstrap confidence intervals were computed for the pooled data for each Plan Species (Table A2). Bootstrap 95% confidence intervals for the median travel time demonstrated large uncertainty in the travel time of subyearling Chinook Salmon (4.2 days to 17.7 days), moderate uncertainty in the travel time of yearling Chinook Salmon (4.2 days to 7.2 days) and Coho Salmon (5.4 days to 7.2 days), and low uncertainty in the travel time of steelhead (1.8 days to 1.9 days). Travel time estimation using PIT tags was not possible for Sockeye Salmon; instead, the 95% confidence interval of median travel time from the available acoustic telemetry data was 0.95 days to 0.97 days. The width of the confidence interval was largely inversely proportional to the sample size of tags detected at both Wells and Rocky Reach Dams.

Table A1. Detection counts and travel time summary for PIT-tagged juvenile fish detected at both Wells Dam and Rocky Reach Dam PIT-tag detectors in 2025.

Run species	Detected at Wells	Detected at Rocky Reach	Mean (SE) travel time (days)	Median travel time (days)	Range (days)
Yearling Chinook	45	11	13.5 (4.3)	7.2	3.0-42.2
Subyearling Chinook	30	6	12.6 (3.0)	15.9	2.5-20.0
Coho	40	10	9.9 (2.9)	7.2	1.0-25.5
Steelhead	269	116	3.8 (0.7)	1.7	0.8–51.2
Sockeye	1	0	NA	NA	NA

Table A2. Pooled detection counts and travel time summary for PIT-tagged juvenile fish detected at both Wells Dam and Rocky Reach Dam PIT-tag detectors in 2016–2025. 95% C. I. = 95% bootstrap confidence interval of the median.

Run species	Detected at Wells	Detected at Rocky Reach	Mean (SE) travel time (days)	Median travel time (days)	95% C.I. (days)	Range (days)
Yearling Chinook	431	137	9.0 (0.7)	5.3	(4.2, 7.2)	1.3–42.2
Subyearling Chinook	109	22	13.9 (2.5)	14.1	(4.2, 17.7)	0.8–43.7
Coho	545	233	8.2 (0.4)	6.3	(5.4, 7.2)	0.6–28.1
Steelhead	1730	893	3.0 (0.2)	1.8	(1.8, 1.9)	0.7–51.2
Sockeye	6	1	4.1 (NA)	4.1	NA	NA

Sample sizes of combined hatchery and wild PIT-tagged juvenile salmon and steelhead originating above Wells Dam and detected at Rocky Reach Dam in 2025, not restricted to those that were also detected at Wells Dam, ranged from 1,451 subyearling Chinook Salmon to 16,302 steelhead (Table A3). Passage-index (PI) sampling yielded 46,095 subyearling Chinook Salmon and 33,668 Sockeye Salmon. Sample sizes of wild PIT-tagged Chinook Salmon originating above Wells Dam and detected at Rocky Reach Dam were 228 for yearlings and 368 for subyearlings.

Table A3. Detection counts for PIT-tagged juvenile fish originating above Wells Dam and detected at Rocky Reach Dam PIT-tag detectors in 2025 (Chinook and Coho Salmon and steelhead) and Passage Index (PI) sampling for subyearling Chinook Salmon and Sockeye Salmon.

Run species	Data type	Hatchery & Wild	Wild only
Yearling Chinook	PIT	11,736	228
Subyearling Chinook	PIT	1,451	368
Subyearling Chinook	PI	46,095	
Coho	PIT	4,212	
Steelhead	PIT	16,302	
Sockeye	PI	33,668	

8 Appendix B: Bootstrap Methods for Travel Time Data

For each Plan Species, let $t_1, t_2, \ldots, t_T$ denote the observed travel times between Wells Dam and Rocky Reach Dam for all PIT-tagged fish (or acoustic-tagged fish in the case of Sockeye Salmon) that originated upstream of Wells Dam and were detected at both dams, pooled across years. Define B to be the number of bootstrap iterations ($B = 10{,}000$).

For each bootstrap iteration b, for $b = 1, \ldots, B$, we randomly selected a single sample, with replacement, of size T from the full set of travel-time data for the given Plan Species. Denote this travel time sample $\tilde{t}_1^{(b)}, \tilde{t}_2^{(b)}, \ldots, \tilde{t}_T^{(b)}$. We recorded the median from this bootstrap sample, denoted $m_t^{(b)}$. These steps were repeated for $B = 10{,}000$ bootstrap iterations and generated a bootstrap distribution of median travel time from Wells Dam to Rocky Reach Dam: $\left\{m_t^{(1)}, \ldots, m_t^{(B)}\right\}$. The 95% bootstrap confidence interval for the median travel time was computed using the 0.025 quantile and the 0.975 quantile of the bootstrap sampling distribution.

9 Appendix C: Tabulated Passage Proportion Results

This appendix provides the passage proportion results shown in Table 2–Table 5 in a series of tables that are more appropriate for screen readers and for easy extraction in tabular format.

Table 2a. Annual spring outmigration: Total estimated proportion of hatchery and wild yearling Chinook Salmon that passed Wells Dam before, during, and after bypass operations at Wells, based on travel time between Wells and Rocky Reach dams, the cumulative proportion of the annual migration detected at Rocky Reach during each period, and the start and end dates of Wells bypass operations, 2012–2025, and averaged over all years. The Rocky Reach passage distribution was estimated using PIT-tagged releases above Wells Dam.

Year	Prior to bypass ops period	During bypass ops period	After bypass ops period
2012	0.0022	0.9978	0.0000
2013	0.0026	0.9974	0.0000
2014	0.0055	0.9945	0.0000
2015	0.0026	0.9974	0.0000
2016	0.0032	0.9968	0.0000
2017	0.0017	0.9983	0.0000
2018	0.0008	0.9992	0.0000
2019	0.0001	0.9999	0.0000
2020	0.0042	0.9958	0.0000
2021	0.0022	0.9978	0.0000
2022	0.0017	0.9983	0.0000
2023	0.0001	0.9999	0.0000
2024	0.0052	0.9975	0.0002
2025	0.0120	0.9878	0.0002
Average	**0.0032**	**0.9968**	**0.0000**

Table 2b. Annual spring outmigration: Total estimated proportion of wild-only yearling Chinook Salmon that passed Wells Dam before, during, and after bypass operations at Wells, based on travel time between Wells and Rocky Reach dams, the cumulative proportion of the annual migration detected at Rocky Reach during each period, and the start and end dates of Wells bypass operations, 2012–2025, and averaged over all years. The Rocky Reach passage distribution was estimated using PIT-tagged releases above Wells Dam.

Year	Prior to bypass ops period	During bypass ops period	After bypass ops period
2012	0.0438	0.9562	0.0000
2013	0.1386	0.8614	0.0000
2014	0.1823	0.8177	0.0000
2015	0.1402	0.8598	0.0000
2016	0.1897	0.8103	0.0000
2017	0.0708	0.9292	0.0000
2018	0.1250	0.8750	0.0000
2019	0.0064	0.9936	0.0000
2020	0.1085	0.8915	0.0000
2021	0.1834	0.8166	0.0000
2022	0.1015	0.8985	0.0000
2023	0.0060	0.9940	0.0000
2024	0.1862	0.8138	0.0000
2025	0.2544	0.7456	0.0000
Average	**0.1241**	**0.8759**	**0.0000**

Table 2c. Annual spring outmigration: Total estimated proportion of Steelhead that passed Wells Dam before, during, and after bypass operations at Wells, based on travel time between Wells and Rocky Reach dams, the cumulative proportion of the annual migration detected at Rocky Reach during each period, and the start and end dates of Wells bypass operations, 2012–2025, and averaged over all years. The Rocky Reach passage distribution was estimated using PIT-tagged releases above Wells Dam.

Year	Prior to bypass ops period	During bypass ops period	After bypass ops period
2012	0.0014	0.9986	0.0000
2013	0.0079	0.9921	0.0000
2014	0.0021	0.9975	0.0004
2015	0.0029	0.9969	0.0002
2016	0.0022	0.9977	0.0001
2017	0.0000	1.0000	0.0000
2018	0.0001	0.9999	0.0000
2019	0.0000	1.0000	0.0000
2020	0.0002	0.9998	0.0000
2021	0.0005	0.9995	0.0000
2022	0.0009	0.9989	0.0002
2023	0.0002	0.9995	0.0003
2024	0.0016	0.9982	0.0002
2025	0.0013	0.9987	0.0000
Average	**0.0015**	**0.9984**	**0.0001**

Table 2d. Annual spring outmigration: Total estimated proportion of Sockeye Salmon that passed Wells Dam before, during, and after bypass operations at Wells, based on travel time between Wells and Rocky Reach dams, the cumulative proportion of the annual migration detected at Rocky Reach during each period, and the start and end dates of Wells bypass operations, 2012–2025, and averaged over all years. The Rocky Reach passage distribution was estimated using expanded counts obtained from daily sampling at Rocky Reach Dam from 1 April–31 August.

Year	Prior to bypass ops period	During bypass ops period	After bypass ops period
2012	0.0000	1.0000	0.0000
2013	0.0000	0.9999	0.0001
2014	0.0000	1.0000	0.0000
2015	0.0000	0.9999	0.0001
2016	0.0000	1.0000	0.0000
2017	0.0000	1.0000	0.0000
2018	0.0000	1.0000	0.0000
2019	0.0000	1.0000	0.0000
2020	0.0000	1.0000	0.0000
2021	0.0000	1.0000	0.0000
2022	0.0000	1.0000	0.0000
2023	0.0000	0.9998	0.0002
2024	0.0000	1.0000	0.0000
2025	0.0000	0.9989	0.0011
Average	**0.0000**	**0.9999**	**0.0001**

Table 2e. Annual spring outmigration: Total estimated proportion for Coho Salmon that passed Wells Dam before, during, and after bypass operations at Wells, based on travel time between Wells and Rocky Reach dams, the cumulative proportion of the annual migration detected at Rocky Reach during each period, and the start and end dates of Wells bypass operations, 2012–2025, and averaged over all years. The Rocky Reach passage distribution was estimated using PIT-tagged releases above Wells Dam.

Year	Prior to bypass ops period	During bypass ops period	After bypass ops period
2013	0.0001	0.9999	0.0000
2014	0.0001	0.9999	0.0000
2015	0.0004	0.9996	0.0000
2016	0.0029	0.9971	0.0000
2017	0.0000	1.0000	0.0000
2018	0.0000	1.0000	0.0000
2019	0.0001	0.9999	0.0000
2020	0.0033	0.9967	0.0000
2021	0.0002	0.9998	0.0000
2022	0.0007	0.9993	0.0000
2023	0.0000	1.0000	0.0000
2024	0.0000	1.0000	0.0000
2025	0.0045	0.9953	0.0002
Average	**0.0010**	**0.9990**	**0.0000**

Table 3a. Annual summer outmigration: Total estimated proportion of hatchery and wild PIT-tagged subyearling Chinook Salmon that passed Wells Dam before, during, and after bypass operations at Wells, based on travel time between Wells and Rocky Reach dams, the cumulative proportion of the annual migration detected at Rocky Reach during each period, and the start and end dates of Wells bypass operations, 2012–2025, and averaged over all years. The Rocky Reach passage distribution was estimated using PIT-tagged releases above Wells Dam. Estimates provided at the request of the Coordinating Committee.

Year	Prior to bypass ops period	During bypass ops period	After bypass ops period
2012	0.0000	1.0000	0.0000
2013	0.0000	1.0000	0.0000
2014	0.0000	0.9967	0.0033
2015	0.0000	1.0000	0.0000
2016	0.0000	1.0000	0.0000
2017	0.0000	1.0000	0.0000
2018	0.0000	1.0000	0.0000
2019	0.0000	1.0000	0.0000
2020	0.0000	1.0000	0.0000
2021	0.0000	0.9990	0.0010
2022	0.0025	0.9494	0.0481
2023	0.0000	0.9570	0.0430
2024	0.0000	0.9985	0.0015
2025	0.0000	0.9993	0.0007
Average	**0.0002**	**0.9929**	**0.0070**

Table 3b. Annual summer outmigration: Total estimated proportion of wild-only PIT-tagged subyearling Chinook Salmon that passed Wells Dam before, during, and after bypass operations at Wells, based on travel time between Wells and Rocky Reach dams, the cumulative proportion of the annual migration detected at Rocky Reach during each period, and the start and end dates of Wells bypass operations, 2012–2025, and averaged over all years. The Rocky Reach passage distribution was estimated using PIT-tagged releases above Wells Dam. Estimates provided at the request of the Coordinating Committee.

Year	Prior to bypass ops period	During bypass ops period	After bypass ops period
2012	0.0000	1.0000	0.0000
2013	0.0000	1.0000	0.0005
2014	0.0000	0.9967	0.0033
2015	0.0000	1.0000	0.0000
2016	0.0000	1.0000	0.0000
2017	0.0000	1.0000	0.0000
2018	0.0000	1.0000	0.0000
2019	0.0000	1.0000	0.0000
2020	0.0000	1.0000	0.0000
2021	0.0000	0.9986	0.0014
2022	0.0000	0.9292	0.0708
2023	0.0000	0.9570	0.0430
2024	0.0000	0.9923	0.0077
2025	0.0000	0.9973	0.0027
Average	**0.0000**	**0.9908**	**0.0092**

Table 3c. Annual summer outmigration: Total estimated proportion of run-of-river subyearling Chinook Salmon that passed Wells Dam before, during, and after bypass operations at Wells, based on travel time between Wells and Rocky Reach dams, the cumulative proportion of the annual migration detected at Rocky Reach during each period, and the start and end dates of Wells bypass operations, 2012–2025, and averaged over all years. The Rocky Reach passage distribution was generated by Program RealTime using spill-adjusted Passage Index data at Rocky Reach Dam.

Year	Prior to bypass ops period	During bypass ops period	After bypass ops period
2012	0.0000	1.0000	0.0000
2013	0.0000	1.0000	0.0000
2014	0.0000	1.0000	0.0000
2015	0.0000	1.0000	0.0000
2016	0.0000	1.0000	0.0000
2017	0.0000	1.0000	0.0000
2018	0.0000	1.0000	0.0000
2019	0.0000	1.0000	0.0000
2020	0.0000	1.0000	0.0000
2021	0.0000	0.9994	0.0006
2022	0.0000	0.9955	0.0045
2023	0.0000	0.9951	0.0049
2024	0.0000	0.9963	0.0037
2025	0.0000	0.9987	0.0013
Average	**0.0000**	**0.9989**	**0.0011**

Table 4a. Comparisons of the actual start date of bypass operations at Wells Dam versus the date on which the 5th percentile of the PIT-tagged hatchery and wild yearling Chinook Salmon migration passed Wells Dam each year, 2012–2025. Operations began at 00:01 on the date listed in column 2. "Bypass start date compared to actual 5% passage date" (column 6) indicates whether the bypass start date was before (early) or after (late) the date on which the 5th percentile of the PIT-tagged yearling Chinook Salmon migration passed Wells Dam and by how many days.

Migration year	Actual bypass start date	Cumulative proportion passed before bypass start date	Proportion covered by bypass ops	Date on which the 5th percentile passed	Bypass start date compared to actual 5% passage date
2012	April 9	0.0022	0.9978	April 15	6 days early
2013	April 9	0.0026	0.9974	April 18	9 days early
2014	April 9	0.0055	0.9945	April 17	8 days early
2015	April 9	0.0026	0.9974	April 18	9 days early
2016	April 9	0.0032	0.9968	April 12	3 days early
2017	April 9	0.0017	0.9983	April 17	8 days early
2018	April 9	0.0008	0.9992	April 19	10 days early
2019	April 9	0.0001	0.9999	April 21	12 days early
2020	April 9	0.0042	0.9958	April 16	7 days early
2021	April 9	0.0022	0.9978	April 19	10 days early
2022	April 9	0.0017	0.9983	April 20	11 days early
2023	April 9	0.0001	0.9999	April 20	11 days early
2024	April 9	0.0052	0.9946	April 14	5 days early
2025	April 3	0.0120	0.9878	April 16	13 days early
14-yr avg:		**0.0032**	**0.9968**	**April 17**	**8 days early**

Table 4b. Comparisons of the actual start date of bypass operations at Wells Dam versus the date on which the 5th percentile of the PIT-tagged wild yearling Chinook Salmon migration passed Wells Dam each year, 2012–2025. Operations began at 00:01 on the date listed in column 2. "Bypass start date compared to actual 5% passage date" (column 6) indicates whether the bypass start date was before (early) or after (late) the date on which the 5th percentile of the PIT-tagged yearling Chinook Salmon migration passed Wells Dam and by how many days.

Migration year	Actual bypass start date	Cumulative proportion passed before bypass start date	Proportion covered by bypass ops	Date on which the 5th percentile passed	Bypass start date compared to actual 5% passage date
2012	April 9	0.0438	0.9562	April 10	1 day early
2013	April 9	0.1386	0.8614	April 4	5 days late
2014	April 9	0.1823	0.8177	April 5	4 days late
2015	April 9	0.1402	0.8598	April 2	7 days late
2016	April 9	0.1897	0.8103	April 2	7 days late
2017	April 9	0.0708	0.9292	April 6	3 days late
2018	April 9	0.1250	0.8750	April 1	8 days late
2019	April 9	0.0064	0.9936	April 13	4 days early
2020	April 9	0.1085	0.8915	April 3	6 days late
2021	April 9	0.1834	0.8166	April 7	2 days late
2022	April 9	0.1015	0.8985	April 2	7 days late
2023	April 9	0.0060	0.9940	April 12	3 days early
2024	April 9	0.1862	0.8138	March 24	16 days late
2025	April 3	0.2544	0.7456	March 27	7 days late
14-yr avg:		**0.1241**	**0.8759**	**April 4**	**4 days late**

Table 5a. Comparison of the actual end date of bypass operations at Wells Dam versus the end date necessary to have covered at least 95% of the PIT-tagged hatchery and wild subyearling Chinook Salmon outmigration each year (operations ended at 24:00), 2012–2025. "Bypass end date compared to actual 95% passage date" (column 5) indicates whether the bypass end date was before (early) or after (late) the date on which the 95th percentile of the PIT-tagged subyearling Chinook Salmon migration passed Wells Dam and by how many days.

Migration year	Actual bypass stop date	Cumulative proportion passed by 24:00 of bypass stop date	Date on which the 95% standard was achieved	Bypass end date compared to actual 95% passage date
2012	August 19	1.0000	August 7	12 days late
2013	August 19	1.0000	August 2	17 days late
2014	August 19	0.9967	August 9	10 days late
2015	August 19	1.0000	July 18	32 days late
2016	August 19	1.0000	July 11	39 days late
2017	August 19	1.0000	July 25	25 days late
2018	August 19	1.0000	July 29	21 days late
2019	August 19	1.0000	July 22	28 days late
2020	August 19	1.0000	August 6	12 days late
2021	August 9	0.9990	July 25	15 days late
2022	August 9	0.9494	August 10	1 day early
2023	July 24	0.9570	July 21	3 days late
2024	August 5	0.9985	July 16	20 days late
2025	August 10	0.9993	July 11	30 days late
14-yr avg:		**0.9929**	**July 26**	**19 days late**

Table 5b. Comparison of the actual end date of bypass operations at Wells Dam versus the end date necessary to have covered at least 95% of the PIT-tagged wild subyearling Chinook Salmon outmigration each year (operations ended at 24:00), 2012–2025. "Bypass end date compared to actual 95% passage date" (column 5) indicates whether the bypass end date was before (early) or after (late) the date on which the 95th percentile of the PIT-tagged subyearling Chinook Salmon migration passed Wells Dam and by how many days.

Migration year	Actual bypass stop date	Cumulative proportion passed by 24:00 of bypass stop date	Date on which the 95% standard was achieved	Bypass end date compared to actual 95% passage date
2012	August 19	1.0000	August 7	12 days late
2013	August 19	1.0000	August 2	17 days late
2014	August 19	0.9967	August 9	10 days late
2015	August 19	1.0000	July 23	27 days late
2016	August 19	1.0000	July 15	35 days late
2017	August 19	1.0000	July 27	23 days late
2018	August 19	1.0000	July 30	20 days late
2019	August 19	1.0000	July 23	27 days late
2020	August 19	1.0000	August 7	12 days late
2021	August 9	0.9986	July 27	13 days late
2022	August 9	0.9292	August 11	2 days early
2023	July 24	0.9570	July 21	3 days late
2024	August 5	0.9923	July 22	14 days late
2025	August 10	0.9973	July 27	14 days late
14-yr avg:		**0.9908**	**July 28**	**17 days late**

Table 5c. Comparison of the actual end date of bypass operations at Wells Dam versus the end date necessary to have covered at least 95% of the run-of-river subyearling Chinook Salmon outmigration each year (operations ended at 24:00), 2012–2025. "Bypass end date compared to actual 95% passage date" (column 5) indicates whether the bypass end date was before (early) or after (late) the date on which the 95th percentile of the run-of-river subyearling Chinook Salmon migration passed Wells Dam and by how many days. The Rocky Reach passage distribution was generated by Program RealTime using spill-adjusted Passage Index (PI) data at Rocky Reach Dam.

Migration year	Actual bypass stop date	Cumulative proportion passed by 24:00 of bypass stop date	Date on which the 95% standard was achieved	Bypass end date compared to actual 95% passage date
2012	August 19	1.0000	July 17	33 days late
2013	August 19	1.0000	July 26	24 days late
2014	August 19	1.0000	August 3	16 days late
2015	August 19	1.0000	July 7	43 days late
2016	August 19	1.0000	July 16	34 days late
2017	August 19	1.0000	July 31	19 days late
2018	August 19	1.0000	July 14	36 days late
2019	August 19	1.0000	July 14	36 days late
2020	August 19	1.0000	August 2	17 days late
2021	August 9	0.9994	July 15	25 days late
2022	August 9	0.9955	July 26	14 days late
2023	July 24	0.9951	June 30	24 days late
2024	August 5	0.9963	July 16	20 days late
2025	August 10	0.9987	July 10	31 days late
14-yr avg:		**0.9989**	**July 18**	**27 days late**

COLUMBIA BASIN RESEARCH

SCHOOL OF AQUATIC AND FISHERY SCIENCES | UNIVERSITY OF WASHINGTON