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IN THE UNITED STATES DISTRICT COURT

FOR THE DISTRICT OF OREGON

PORTLAND DIVISION

NORTHWEST ENVIRONMENTAL DEFENSE CENTER, et al.,

Plaintiffs,

v.

U.S. ARMY CORPS OF ENGINEERS, et al.,

Defendants,

and

CITY OF SALEM and MARION COUNTY,

Defendant-Intervenors.

Case No.: 3:18-cv-00437-HZ

FEDERAL DEFENDANTS' SECOND BIANNUAL STATUS REPORT

In compliance with the Interim Injunction (ECF 212 at 2), attached is Federal Defendants' second biannual status report. Federal Defendants' next status report will be filed on February 28, 2023.

Dated: August 29, 2022

Respectfully submitted,

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CERTIFICATE OF SERVICE

I hereby certify that on August 29, 2022, a true and correct copy of the above document was electronically filed with the Clerk of Court using CM/ECF. Copies of the document will be served upon interested counsel via the Notices of Electronic Filing that are generated by CM/ECF.

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Willamette Basin
Bi-Annual Status Report
August 29, 2022

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Development of contract(s) for rotary screw trap sampling above Detroit Dam is in progress. Contract award for 2023 sampling is anticipated to occur in Fall 2022, with an anticipated sample

Introduction

On September 1, 2021, the U.S. District Court for the District of Oregon issued an interim injunction order that directs the U.S. Army Corps of Engineers ("Corps") to implement specified actions intended to improve conditions for fish passage and water quality in the Willamette Valley Project (WVP) to avoid irreparable harm to Endangered Species Act (ESA) - listed salmonids during the interim period until the completion of the reinitiated ESA consultation on the operation and maintenance of the WVP. These actions include operational measures; structural improvements; outplanting of adult Chinook salmon above Green Peter Dam; research, monitoring, and evaluation (RM&E); and compliance with maintenance outage schedules and emergency protocols. The injunction also directs the Corps and National Marine Fisheries Service (NMFS) to post the results of all RM&E on a publicly available website and to complete the reinitiated ESA consultation on the WVP and issue a new Biological Opinion (BiOp) by December 31, 2024. The injunction will remain in effect until issuance of a new BiOp.

The injunction requires the Corps and NMFS to provide status reports every six months, beginning February 28, 2022, detailing their progress and compliance with the injunction actions. This is the second Bi-Annual Status Report to be submitted and includes accomplishments and data collected from January 1, 2022 through June 30, 2022.

Purpose

The purpose of this report is to provide a status update to the Court that details the Corps' and NMFS's progress and compliance with the injunction-related actions, including the following information:

1. The injunction measures that have occurred at each dam;
2. Any deviation from outage schedules, emergency protocols, and water quality standards;
3. All RM&E that was conducted during the reporting period and any available results of that research;
4. All RM&E planned for the next six months; and
5. Any proposed changes to the injunction measures based on changed circumstances or the results of RM&E.

Establishment of the Expert Panel

In the injunction, the Court ordered the establishment of an Expert Panel, comprised of two of Plaintiffs' experts, two NMFS biologists, two Corps employees, and two "ad hoc" Federal experts. This panel was charged with jointly developing specific parameters of certain interim measures ordered in the injunction, which were detailed in Implementation Plans or Recommendations submitted to the Court. In April 2022, the Expert Panel finalized the last of the implementation plans and recommendations. The implementation status of the measures recommended by the Expert Panel and adopted by the Court is presented in Table 1 below.

Table 1. Status of Injunction Measures (DSFP – Downstream Fish Passage, DSTM – Downstream Temperature Management)

Injunction Measure	Injunction No.	Date Submitted to the Court	Status	Description
Foster Fall Downstream Fish Passage	13a	August 20, 2021	Implemented in 2021; will be implemented again in fall 2022	Utilize the spillway for improved DSFP in the fall from 01 Oct – 15 Dec.
Cougar Fall Drawdown for Downstream Fish Passage	14	August 20, 2021	Implemented in 2021; will be implemented again in fall 2022	Reservoir drawdown to El. ~1505 ft. 15 Nov – 15 Dec + RO prioritization when <El. 1571 ft.
Detroit Lower Regulating Outlet (LROs) Operation for Downstream Water Temperature Management	10a/Interim Measure 7	September 8, 2021	Implemented in 2021; USGS modeling started to inform 2022 operations	Water temperature management through strategic use of spillway, turbines and upper/lower ROs.
Foster Spring Downstream Fish Passage	13b	October 15, 2021	DSFP implemented in 2022 with fish weir operation implemented through July 2022; will be implemented again in spring 2022. Data on outmigration of active and PIT tagged fish to follow.	Delay refill + utilize spillway in the spring for improved DSFP 01 Feb – 15 June + summer fish weir operation for improved DSTM and upstream fish migration.
Cougar Spring Downstream Fish Passage (Delayed Refill)	15a	October 15, 2021	Implemented in 2022; will be implemented again next spring	Delayed reservoir refill and RO prioritization for improved DSFP Feb – May/June.
Fall Creek Winter/Spring Downstream Fish Passage	20	October 15, 2021	Implemented in 2022; will be implemented again next winter/spring	Delayed reservoir refill to El. 700 ft. + RO prioritization for improved DSFP, 16 Jan – 15 Mar.

Injunction Measure	Injunction No.	Date Submitted to the Court	Status	Description
Green Peter Outplanting Plan	11	November 5, 2021	Green Peter outplanting sites established; first outplanting started in July 2022 in Mid Santiam; Quartzville outplanting planned for September 2022	Spring Chinook salmon outplanting above Green Peter Dam.
Green Peter Spring Downstream Fish Passage	12a	November 5, 2021	Implemented in 2022; will be implemented again next spring. Data on outmigration of active and PIT tagged fish to follow.	Utilize spillway for improved DSFP in the spring; perform spill operation until 01 May or for 30 days, whichever is longer.
Lookout Point/Dexter Spring Downstream Fish Passage and Regulating Outlet Use for Downstream Water Temperature Management	17	December 8, 2021	DSFP operation implemented in spring 2022; RO operations for downstream temperature management started in August 2022	Utilize spillway for improved DSFP in the spring and RO use in the summer/fall for DSTM.

Injunction Measure	Injunction No.	Date Submitted to the Court	Status	Description
Lookout Point Deep Drawdown Landslide Risk Assessment and Recommendation	16	January 31, 2022	Landslide risk assessment completed; implementation of mitigation plan is on-going	The Corps completed a landslide risk assessment that concludes that risk of landslides is low, but potential consequences are high. The Corps recommended that the deep drawdown of Lookout Point Reservoir for improved downstream fish passage not occur without landslide monitoring in place, along with continued coordination with Union Pacific and Oregon Dept. of Transportation, whose assets could be affected by a slide. Monitoring equipment to track potential slides should be installed in time for a deep drawdown to occur in fall 2023.
Research, Monitoring, and Evaluation Plan	4	February 18, 2022	Implementation is on-going	Expert Panel proposed its plan for the RM&E to accompany the injunction measures for the remainder of the injunction.
Green Peter Fall Downstream Fish Passage Operation	12b	April 28, 2022	Drawdown to occur by the fall of 2023; preparations for drawdown on-going.	Deep drawdown and RO prioritization for improved DSFP 15 Nov – 15 Dec.

Cougar RO Modification (Recommendation)	15b	April 28, 2022	Work is on-going	The Expert Panel made two recommendations: resurfacing of the RO chute by 30 Sept. 2023 and an alternatives study complete by 30 June 2023.
Big Cliff Structural TDG Abatement (Recommendation)	10b	February 10, 2022 (Expert Panel's recommendation); August 5, 2022 (Corps' schedule)	Work is on-going	The Expert Panel made a recommendation to move forward with schedule development. The Corps subsequently submitted a reasonable timeline for design and construction of TDG abatement at Big Cliff Dam.

In addition to the injunction measures listed above, four interim measures, developed prior to issuance of the injunction, were carried forward into the injunction. The Court also ordered the Corps to conduct the annual Fall Creek Reservoir deep drawdown operation similar to prior years but extend the dates from December 1 through January 15. These actions did not require Expert Panel development. They include:

Table 2. List of Interim Measures, Adopted as Part of the Injunction Order

Injunction Measure	Injunction No.	Date Submitted to the Court	Status	Description
Detroit Winter Downstream Fish Passage	10/Interim Measure 5	n/a (Revision submitted September 13, 2021)	Implemented in 2021/2022; will be implemented again in fall/winter 2022	Prioritize the ROs at night when <El. 1500 ft for improved DSFP.
Big Cliff TDG Abatement	10/Interim Measure 6	n/a	Implemented in 2021/2022; will continue to be implemented when spilling at Big Cliff	Spread spill to reduce downstream TDG production.
Detroit Spring Downstream Fish Passage and Summer/Fall Downstream Water Temperature Management	10a/Interim Measure 7	n/a (Water Temperature Management Operation submitted October 1, 2021; Interim Measure 7 Modification submitted March 21, 2022)	Implementation started in 2022 and on-going; USGS modeling started to inform 2022 operations	Utilize the spillway, turbines and ROs for downstream water temperature management.
Hills Creek Winter Downstream Fish Passage	8	n/a (Modification submitted October 6, 2021)	Implemented in 2021/2022; will be implemented again in winter 2022/2023	Prioritize the ROs at night when < El. 1460 ft for improved DSFP.

Fall Creek Extended Deep Drawdown	19	n/a	Implemented in 2021/2022; will be implemented again in winter 2022/2023	Extended the deep drawdown prioritizes RO DSFP, 01 Dec – 15 Jan.

The Corps has developed a publicly-accessible website that include details regarding injunction measure implementation plans that have been finalized, along with any associated RM&E data collected during implementation. The link is:
https://www.nwp.usace.army.mil/Locations/Willamette-Valley/Injunction/

Research, Monitoring, and Evaluation

The injunction requires the Corps to continue to fund and/or carry out RM&E to evaluate the effects of the interim injunction measures on Upper Willamette River (UWR) spring Chinook salmon and UWR winter steelhead.

The Expert Panel developed specific RM&E to accompany the injunction measures and submitted the Willamette Project Interim Injunction Measures RM&E Plan to the Court on February 18, 2022. This plan supersedes any measure-specific RM&E that was included in the implementation plans submitted by the Expert Panel prior to the finalization of the RM&E Plan. The RM&E plan will be in effect for the duration of the injunction, which is anticipated to extend through 2024.

Fiscal Year (FY) 2022-Funded RM&E Activities

The Corps completed, or currently expects to complete, a significant number of contracting actions in FY22[1] to fund and carry out RM&E activities contemplated by the RM&E Plan submitted in February 2022, including the following:

- The Corps negotiated and awarded multiple modifications to its rotary screw trap (RST) contract to procure additional screw traps and sampling activities required by the RM&E Plan; the Corps also anticipates awarding further contract modifications for additional RSTs and sampling activities by the end of FY22.
- The Corps awarded a contract for the fabrication and installation of a Passive Interrogation Transponder (PIT) tag detection system (antennas) on the City of Albany's Lebanon Dam to detect PIT-tagged study fish migrating downstream the South Santiam River from Foster Dam.
- The Corps funded Pacific Northwest National Laboratory (PNNL) to conduct the radio telemetry (active) study at Green Peter and Foster dams, awarded the contract to procure the tags necessary for the study in calendar year 2022, and anticipates awarding the contract to procure the tags necessary for the spring 2023 study by the end of FY22.
- The Corps negotiated and awarded a modification to its hatchery production contract with the Oregon Department of Fish and Wildlife (ODFW) for the outplanting of adult UWR spring

[1] FY22 is October 1, 2021 – September 30, 2022.

Chinook above Green Peter Reservoir. The Corps also awarded a contract for spawning surveys above Green Peter Dam.

- The Corps funded the U.S. Geological Society (USGS) to conduct water quality sampling at Fall Creek Dam in fall/winter 2022 and install total dissolved gas (TDG) gauges downstream of Lookout Point, Green Peter, and Hills Creek dams.
- The Corps intends to award a contract for releases of bulk-marked juvenile Chinook, including PIT tagging of sub-yearling Chinook in the fall and yearling Chinook, and bulk-marked Chinook fry, tentatively marked with Visual Implement Elastomer (aka VIE and Elastomer tags), in all sub-basins identified in the RM&E Plan by the end of FY22. It is anticipated that hatchery fish from ODFW hatcheries in the respective sub-basins will be utilized for these releases, following final negotiation and award of contract modifications with ODFW (in-progress). Due to contracting and deployment timelines, it is anticipated that releases will begin in winter 2022/spring 2023.

The Corps also currently anticipates awarding contract actions in early FY23 for additional RM&E activities to occur in calendar year 2023, including for additional RST sites, surrogate fish, additional tags for the fall 2023 Green Peter and Foster radio telemetry study, and reservoir distribution studies at Lookout Point and Green Peter reservoirs.[2]

RM&E Results

RM&E that was conducted for injunction measures implemented from January 01, 2022 through June 30, 2022 is discussed by subbasin in the Operational Measures section below.[3] Detailed results of the RM&E can also be found on the Corps' Willamette Valley Injunction RM&E webpage at https://pweb.crohms.org/tmt/documents/FPOM/2010/Willamette_Coordination/Willamette%20RME/InjunctionRME.html.

RM&E that is planned for injunction measures that will be implemented over the next six months is also identified in the Operational Measures section below.

Rotary Screw Trap Efficiency Tests

The RM&E Plan contemplates the use of numerous RSTs above and below Corps dams. The Plan provides that the Corps estimate the number of juvenile salmon caught in each RST by, in part, determining trap efficiencies at least once a month under a range of flows expected to occur during each injunction measure. The RM&E Plan recommends the Corps use wild subyearlings captured in the RSTs to estimate capture efficiency but recognizes that efficiency could be estimated with juvenile hatchery salmon if too few wild fish are caught.

[2] As the Corps has awarded contracts for additional RM&E activities in 2022 and progressed further in the contracting process to procure the remaining RM&E activities identified in the long-term RM&E plan, the Corps has developed more precise cost estimates for RM&E requirements. Due to a variety of factors, the Corps anticipates that RM&E activities will be costlier than originally estimated, and it may become necessary to prioritize RM&E activities in the Willamette River Basin in FY23 depending on the total amount of funding the Corps receives for RM&E.

[3] RST data collected by the Corps' current RST contractor is summarized in this status report for the period of November 16, 2021 to May 15, 2022 due to current contract requirements for bi-annual RST reports. However, more recent bi-monthly RST reports are available on the Corps' injunction RM&E website.

In anticipation that too few wild Chinook will be caught in the RSTs to conduct the RST capture efficiency estimates, the Corps is utilizing juvenile hatchery fish for all RST sampling locations except in the South Santiam River above Foster Dam and Fall Creek above Fall Creek Dam, where only natural-origin Chinook are present.[4] These hatchery juvenile Chinook are released upstream of the RSTs, with a portion being subsequently recaptured in the RSTs (i.e., RST capture efficiency trials). This recapture information is then be used to calculate capture efficiencies and abundance (i.e., passage) estimates.

The Corps and its RST contractor developed methods for conducting trap efficiency trials based on WVP RST historical monitoring information, U.S. Fish and Wildlife Service (USFWS) RST sampling methods used on the Sacramento River at Red Bluff, CA (https://fws.gov/project/red-bluff-diversion-dam-juvenile-fish-monitoring), and availability of juvenile spring Chinook. In summary, capture efficiency trials are currently being based on combination of anticipated low, medium, and high flows and subyearling/yearling Chinook age class combinations. These combinations result in up to 6 trials per year, per passage route, per monitoring site (i.e., combination of 3 flow and 2 age class conditions).[5] Not all flow and age class combinations will be evaluated at all sites when particular flow and fish combinations do not overlap. Capture efficiency trials will be pooled across years and from previous studies where conditions and results permit valid pooling.

Operational Measures

The injunction requires the Corps to implement the injunction measures "to the greatest extent practicable under existing hydrologic conditions and necessary flood control operations" while making "every effort to comply with the various water quality standards governing the WVP." The Corps implemented all of the operational measures ordered to occur during the period of January 1, 2021 – June 30, 2021 on time. All measures implemented during this timeframe are discussed in detail below.

North Santiam River Injunction Measures

From January 1 – June 30, 2022, multiple injunction measures were implemented at Detroit and Big Cliff dams. These included:

- Detroit Winter Downstream Fish Passage and Prioritized Use of the ROs (IM 10/Interim Measure 5)
- Detroit Spring Downstream Fish Passage and Summer Downstream Water Temperature Management (IM 10a/Interim Measure 7)
- Big Cliff TDG Abatement/Spread Spill (IM 10/Interim Measure 6)

The general operational plan for each of these measures can be found in Table 1 and Table 2 above, while more specific details can be found in respective Implementation Plans found on the Corps'

[4] Use of hatchery fish for conducting rotary screw trap efficiency trials in the South Santiam River above Foster Dam and Fall Creek above Fall Creek Dam will be reassessed once juvenile hatchery fish are utilized in these locations associated with conducting other RM&E activities as recommended in the RM&E Plan.
[5] Future hatchery fish releases for trap efficiency trials will be reassessed during implementation of RM&E Plan components for calendar years 2023 and 2024 and increased to monthly at minimum if/where sufficient numbers of hatchery fish are available.

website https://www.nwp.usace.army.mil/Locations/Willamette-Valley/Injunction/. Information regarding actual implementation during the January – June 2022 season is described below.

As shown in Figure 1, the Detroit Dam upper regulating outlets (UROs) were prioritized at night, with daytime generation, throughout the winter and early spring (November 5 – March 4) to improve downstream fish passage and survival and carry out IM 10. Refill of Detroit Reservoir began on February 01, but due to dry conditions in February, refill fell behind schedule for most of the month. Conditions improved in late February/early March when a large rain event swept through the region. Water conditions continued to improve with additional rain and snowstorms, and Detroit Reservoir was able to refill, reaching spillway crest on April 8, 2022. Spillway operations began on April 8 and will continue throughout the summer for improved downstream fish passage and downstream water temperature management.

Even though Detroit spillway releases began on April 8, 2022 and continue currently, downstream water temperatures as measured at the USGS Niagara gauge were slow to warm in spring and early summer due to the wet and cool weather that persisted. As shown in Figure 2 below, water temperatures generally tracked below average water temperatures for much of the year, remaining below the lower water temperature target (blue line) even into June.

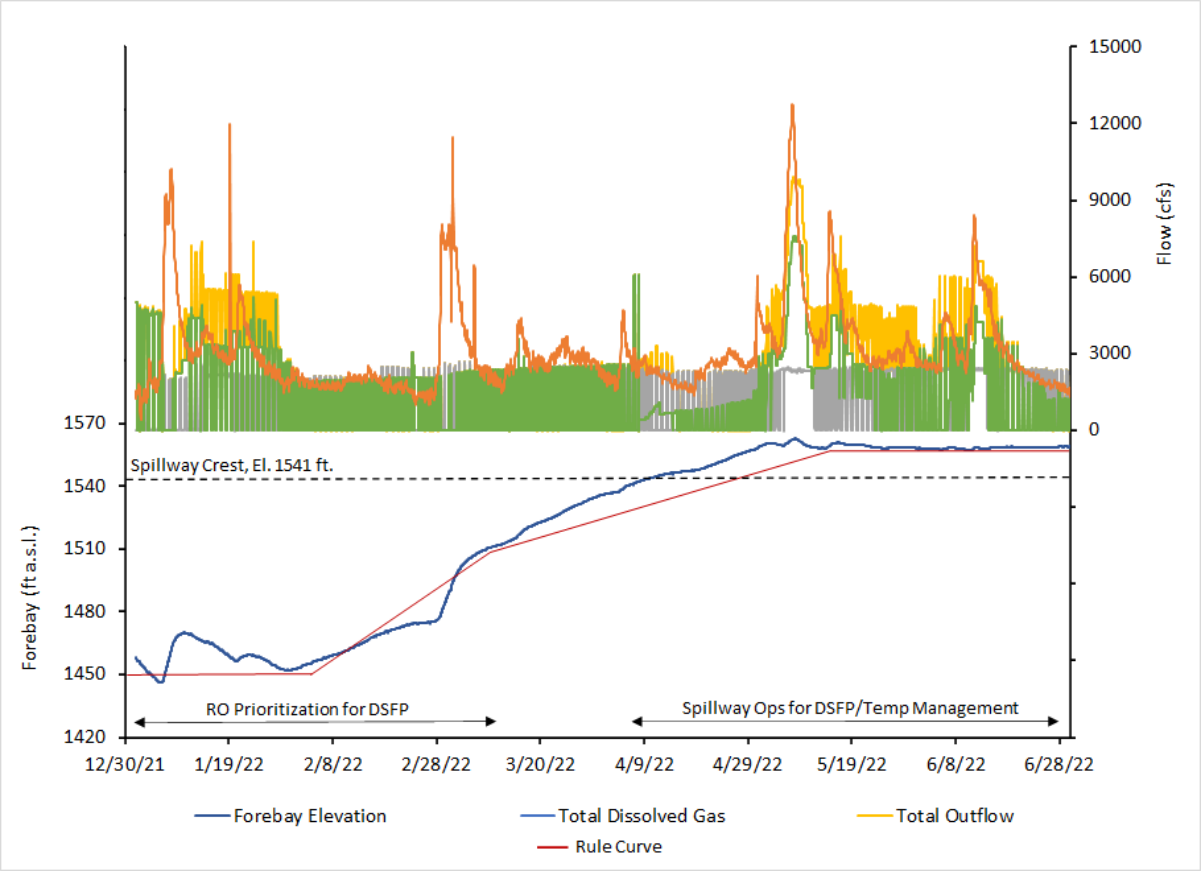

Figure 1. Detroit Dam Operations, January 01 - June 30, 2022

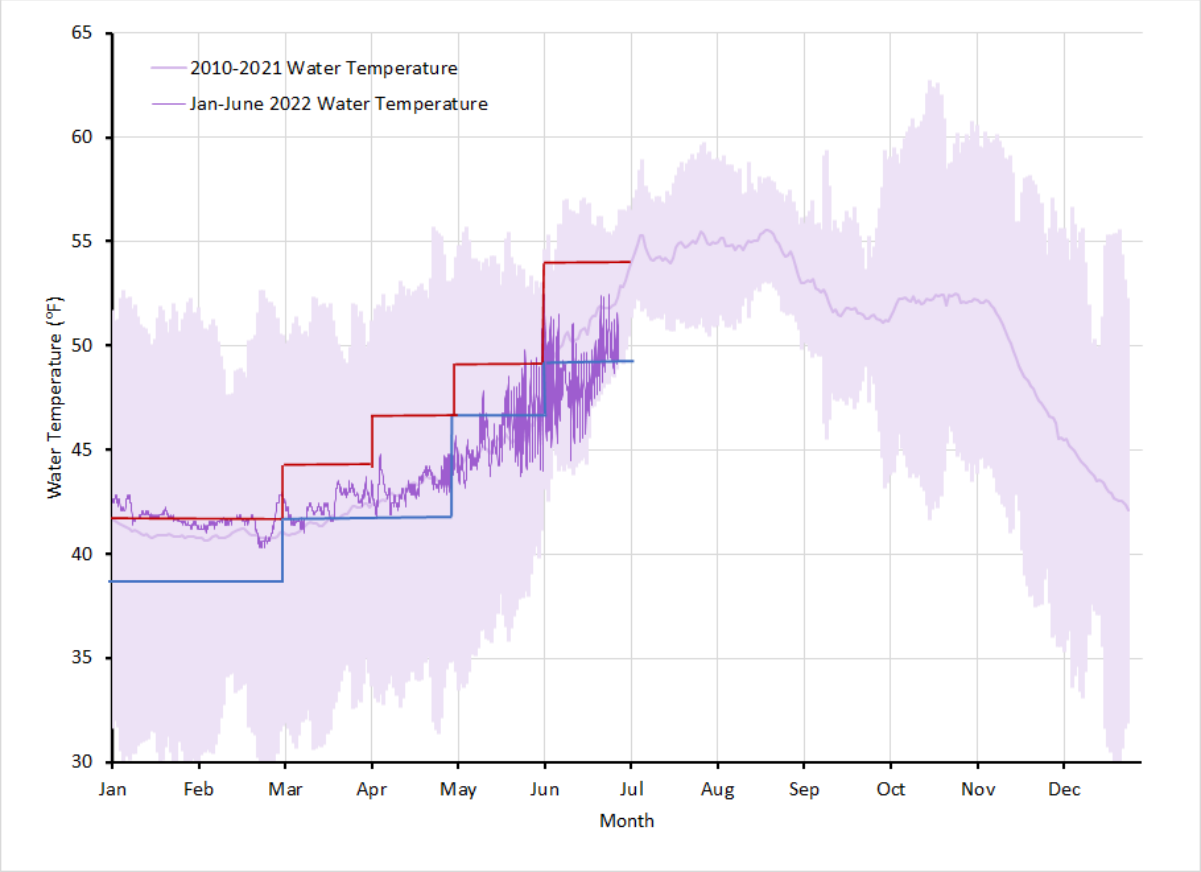

Figure 2. Observed Water Temperatures at the USGS Niagara Gauge Downstream of Detroit and Big Cliff Dams in 2022 as Compared to Maximum and Minimum Water Temperatures from 2010-2021

During the 2022 season, multiple high flow events occurred in the North Santiam Subbasin and TDG was often observed in excess of >110% saturation with the greatest exceedances occurring in late February, mid-May and mid-June (red circles, Figure 3). All three events were due to high inflows and the use of non-turbine units at both Detroit and Big Cliff dams. The first high TDG event in February was due to a line outage affecting the powerhouse at both projects; generation during this time was reduced to zero megawatts. Without the powerhouse, all discharges were transitioned to the UROs at Detroit and the spillway at Big Cliff for about 2.5 days. During this time, TDG peaked to 121.1% saturation. The second large exceedance took place on May 6, 2022 and lasted approximately three days. TDG exceedances were due to a very large rain event and inflows that peaked to just over 12,000 cfs. Since Detroit Reservoir was at full pool, water could not be stored and had to be discharged from the dam. Total outflows during this event peaked to just under 10,000 cfs and TDG saturations peaked to 134%. The last large TDG exceedance occurred in mid-June when a very late category 5 atmospheric river hit the region. Again, due to the full reservoir, much of that water had to be discharged. A combination of strategies to reduce downstream TDG were employed. These consisted of maximum turbine use and spill spread across multiple spillbays at both Detroit and Big Cliff dams when possible. Even so, TDG peaked to >130% saturation during this event.

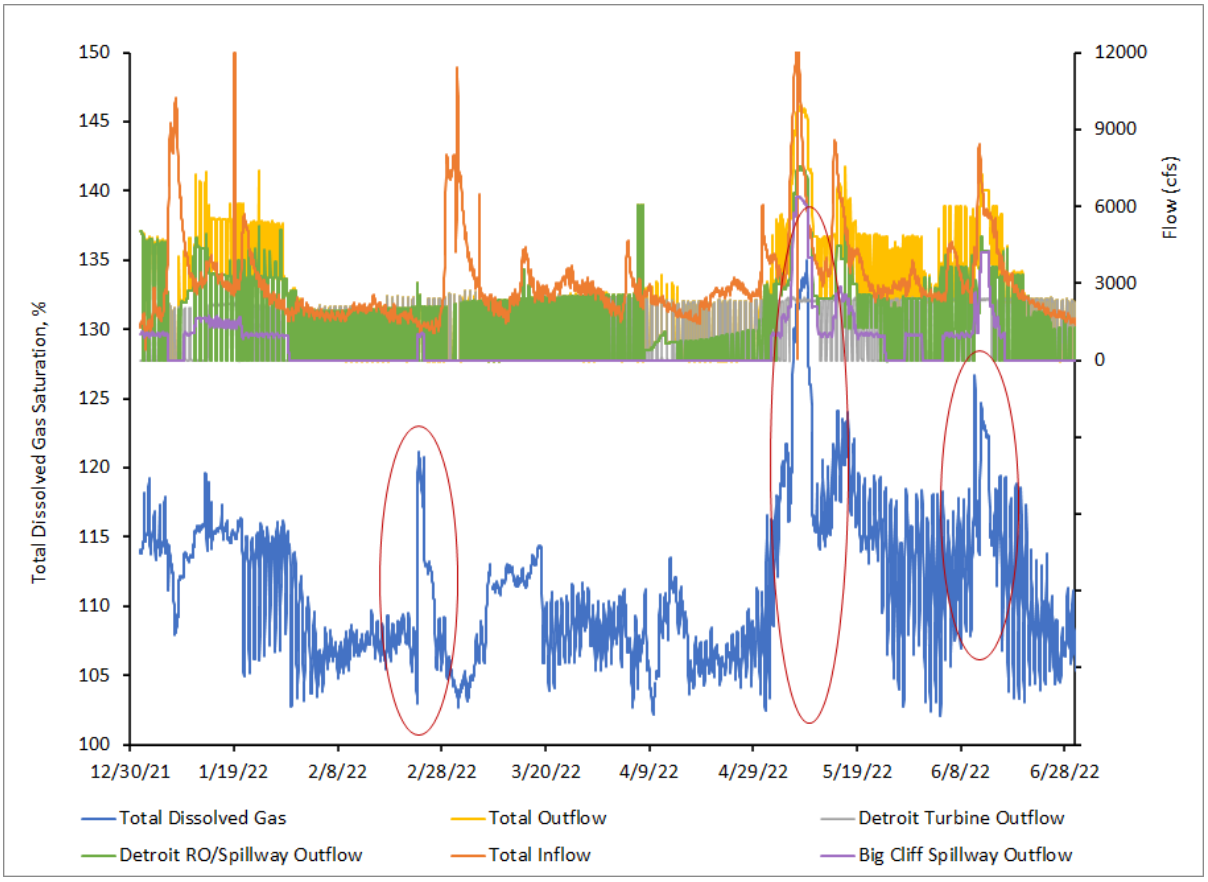

Figure 3. Detroit and Big Cliff Project Operations and Downstream Total Dissolved Gas, January 01 - June 30, 2022

The late spring and early summer rains observed in 2022 were unprecedented. As shown in Figure 4, observed outflows from 2022 were plotted against maximum and minimum outflows monitored over the previous decade. Outflows in May and June were drastically higher than what had been measured below Detroit Dam in recent years, and the same can be said for the TDG saturations measured downstream of Detroit and Big Cliff Dams as well. High TDG conditions were observed for much of May and June at saturations considerably higher than the previous 10 years of observed TDG conditions (Figure 5).

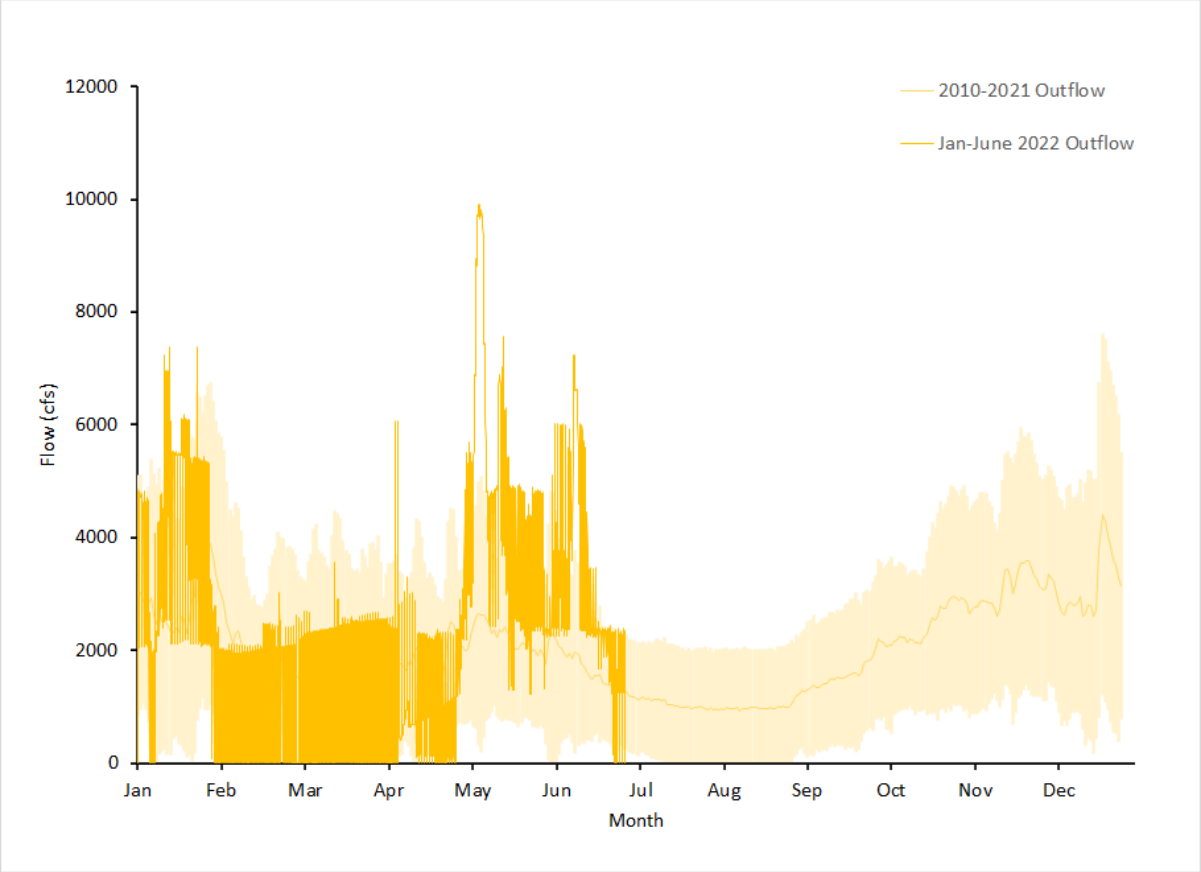

Figure 4. Observed Detroit Outflows in 2022 as Compared to Average, Maximum and Minimum Outflows from 2010-2021

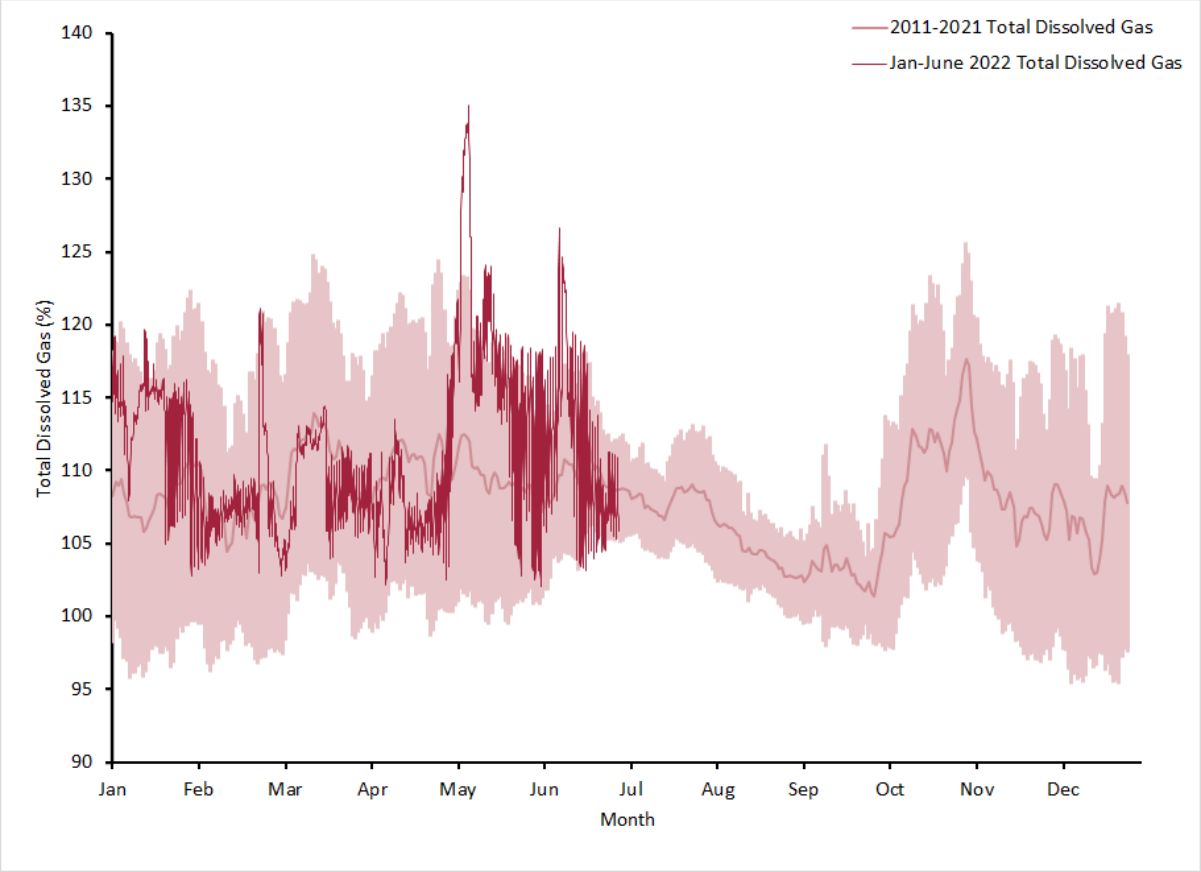

Figure 5. Total Dissolved Gas Downstream of Detroit Dam Measured in 2022 as Compared to Average, Maximum and Minimum Total Dissolved Gas Measured from 2015-2021

From January 1 through June 30, 2022, a hydrolab was deployed downstream of Big Cliff Dam (red line in Figure 6, below) to monitor TDG and determine the difference, or degassing rate, between the Big Cliff tailrace and the Niagara gaging station (blue line in Figure 6, below). Throughout much of the six-month period of time, TDG measured in the Big Cliff tailrace exceeded the State of Oregon water quality standard of 110% TDG whereas conditions measured at the Niagara gauge were slightly lower (Table 3). As shown, elevated TDG was generated during the use of non-turbine outlets at both Detroit and Big Cliff dams, with the largest exceedances occurring when Detroit and Big Cliff were spilling water through non-turbine outlets simultaneously. This mostly occurred during high flow events, but also in early March (see grey box, Figure 6) when the Detroit turbines were offline due to a planned outage.

Generally, TDG was higher in the Big Cliff tailrace than at the USGS Niagara gauge with the exception of the early May event when releases of over 6,000 were discharged through the Big Cliff spillway and again in June when Big Cliff spillway releases peaked to 4,200 cfs (Figure 6, Table 3).

The information/relationship between the two locations will be applied to the Corps' TDG Calculator (model) and used to shape future operations and design of a structural improvement to abate TDG downstream Detroit and Big Cliff dams. Additional data collection in the Big Cliff tailrace is planned for the remainder of 2022.

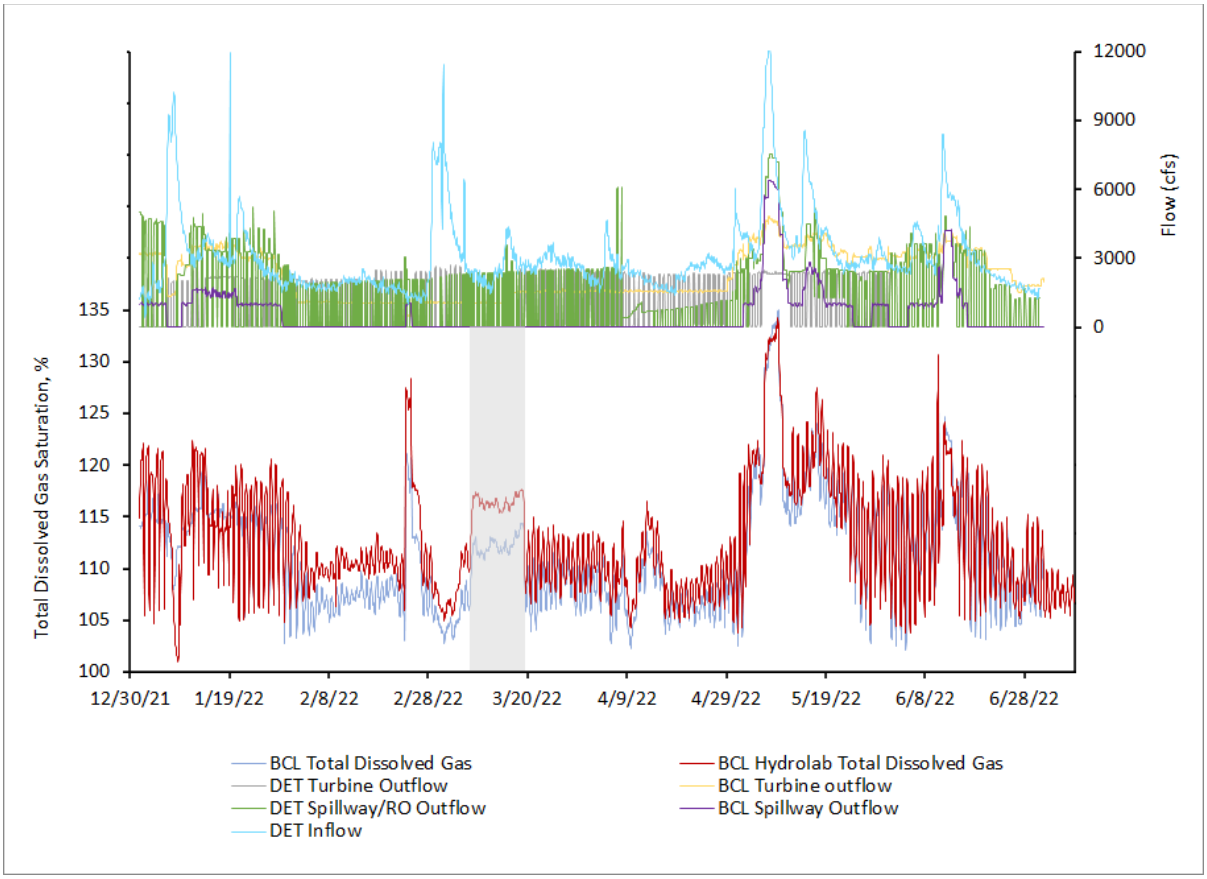

Figure 6. Detroit and Big Cliff Dam Operations and Downstream Total Dissolved Gas Measured in the Big Cliff Tailrace (hydrolab) and at the USGS Niagara Gauge

Table 3. Frequency of Total Dissolved Gas as Measured Downstream of Big Cliff Dam and at the USGS Niagara Gauge

TDG Saturation	Big Cliff Tailrace	USGS Niagara Gauge
< 110%	32%	48%
110% - 115%	31%	28%
115% - 120%	26%	19%
120% - greater	11%	5%

Lessons Learned

TDG abatement strategies employed at Detroit and Big Cliff dams in 2022 did not prevent excessive TDG from being generated, even through the use of maximized turbine operations and spreading spill. Thus, very high TDG saturations were observed, especially during unprecedented late-season high flow events. The Corps has been authorized to begin a study in 2023 to determine the viability of forecast-informed reservoir operations in the Willamette River Basin, which has the potential to inform future water management strategies at Detroit Reservoir to reduce the likelihood of TDG exceedances during high flow events. The study is anticipated to require approximately five years to

complete. Additionally, the Corps will continue to work on a structural improvement to minimize TDG in this subbasin and submitted a timeline for the design and construction of a structural improvement for TDG abatement to the Court on August 5,2022. These actions are further discussed later in this report (see Structural Measures).

Operations Planned for July – December 2022

Over the next six months, water temperature management, downstream fish passage, and TDG abatement operations will continue:

- Detroit Spring Downstream Fish Passage and Summer Downstream Water Temperature Management (IM 10a/Interim Measure 7)
- Detroit Winter Downstream Fish Passage and Prioritized Use of the ROs (IM 10/Interim Measure 5)
- Big Cliff TDG Abatement/Spread Spill (IM 10/Interim Measure 6)

Currently, NMFS and the Corps are working with the USGS to optimize water temperature management operations for the 2022 year based on an analysis of prior years' data. The primary goal is to avoid the high water temperatures observed in the fall/winter of 2021 while avoiding high levels of TDG and providing downstream fish passage during implementation of IM 10a (see Willamette Basin Bi-Annual Status Report, February 28, 2022, ECF No. 242-1). This can be accomplished by understanding the key drivers effecting water temperatures downstream of Detroit and Big Cliff dams. These include the following:

1. Reservoir volume is a key driver in water temperature management. The fuller the reservoir, the greater the options to manage downstream water temperatures. This is because a full reservoir allows for an extended time to evacuate warm surface water throughout the summer, leaving less warm water to contend with in the fall. Additionally, a fully stratified reservoir allows for the greatest volume of cold water—cold water that can be added to the drawdown mix in the fall and early winter to cool downstream river temperatures.
2. Most reservoir heating occurs in July and early August, mostly warming the surface (epilimnion) of the reservoir. By discharging this warm water through surface releases, cooler conditions can be realized in the fall and early winter.
3. In order to release warm surface water, the Detroit spillway should remain available for as long as possible to discharge some of the warm water from the reservoir.
4. Cold water stored in Detroit Reservoir should be reserved for the most critical time periods (incubation). The sooner cold water is used, the sooner it is depleted.
5. Drawing Detroit Reservoir down below spillway elevation and using the upper regulating outlets (UROs) may induce lake turnover earlier.
6. The lower regulating outlets (LROs) can access cold water, but only for a limited time depending on flow and reservoir thermocline depth.
7. Once the reservoir has turned over (become isothermal), there is no further opportunity for operational temperature management.

Based on these key take-aways, the Corps proposes keeping Detroit Reservoir full, and the spillway accessible, for as long as possible this summer to discharge warm, surface water. This water is

combined with turbine water to meet downstream flow and temperature targets for spawners. Once the reservoir is drawn down below the spillway, a combination of the turbines and UROs will be used to manage downstream water temperatures. Detroit Reservoir will not be drawn down early (to El. 1465 ft. by 15-October) but instead will be drawdown to El. 1465 ft. in early November.. Once the reservoir is at, or below, El. 1465 ft. in early November, the LROs will be used to cool downstream water temperatures. And, once the reservoir turns over and becomes isothermal, IM 10/Interim Measure 5 (winter downstream fish passage operations) will begin.

Research, Monitoring, and Evaluation (RM&E)

An eight-foot diameter RST was placed below Big Cliff Dam starting in 2021 to sample run-of-river juvenile salmonids passing downstream of the Detroit and Big Cliff Dam complex. This rotary screw trap was operated from May 2021 through November 30, 2022 by Cramer Fish Sciences. Subsequently, the RST was operated by Environmental Assessment Services (EAS) from December 1, 2021 to February 15, 2022 and then continuously since March 15, 2022 except during high flows (May 6, 2022 to May 13, 2022) when operations could have damaged the rotary screw trap (EAS 2022). Sampling at the Big Cliff Dam tailrace during this period is listed in Table 4 - Rotary Screw Trap (RST) sampling downstream of Big Cliff Dam during December 2021 to 15 May 2022. (EAS 2022).

Table 4 - Rotary Screw Trap (RST) sampling downstream of Big Cliff Dam during December 2021 to 15 May 2022.

Rotary Screw Trap Sampling Site	Trap Efficiency Trials	Target Species	Biological and Injury Data	Scale and DNA Samples	24-hr Holds (Post Collection)	PIT Tagging (<65 mm)	Elastomer Tagging (>65 mm)
Big Cliff Dam Tailrace	Yes- Hatchery Fish	Spring Chinook and Winter Steelhead	Yes- weight (nearest 0.1 g), FL (mm), Injuries	Scales taken on subset of collected fish	Yes	Yes- on fish not included in 24-hr holds.	No

Detailed results of this RST sampling can be found in preliminary reporting by Cramer Fish Sciences and EAS in their respective in-season reports available on the Corps' Willamette Valley Injunction RM&E webpage at https://pweb.crohms.org/tmt/documents/FPOM/2010/Willamette_Coordination/Willamette%20RME/InjunctionRME.html. Reporting of RST monitoring results, with detailed comparisons to historical passage data and current operations, will be done once per year, with the final report posted to the Corps' Willamette Valley Injunction RM&E webpage, anticipated to occur in early May annually (e.g., EAS's annual report including this 2022 period will be finalized and posted by May 2023 for sampling period of fall 2021 to fall 2022).

Operational data and preliminary data results for the December 1, 2021 to May 15, 2022 sample period are presented in EAS 2022 and summarized in the tables and figures below.

Table 5 - Rotary Screw Trap (RST) sampling at Big Cliff Dam tailrace for the current reporting period. The specified 'End' date is that which is currently contracted for and funded; RST sampling is slated to continue beyond this date (EAS 2022).

Site	Task	Start	End	Days
Big Cliff Dam RST	Operation	12/01/2021	2/15/2022	292
Big Cliff Dam RST	Operation	3/15/2022	10/15/2022	
Big Cliff Dam Tailrace	Trap Efficiency Release (1,000 Fish)	12/22/2021	12/22/2021	1

Table 6 - Rotary Screw Trap (RST) sampling outage periods at Big Cliff Dam tailrace during the December 2021 to 15 May 2022 period.

Site	Date(s) of Trap Outage	Reason for Outage
Big Cliff Dam	02/16/2022 to 03/16/2022	Monitoring paused while passage measures were not being implemented.
Big Cliff Dam	05/03/2022 to 05/13/2022	Flows increased to levels where the trap could not be accessed or fished safely.

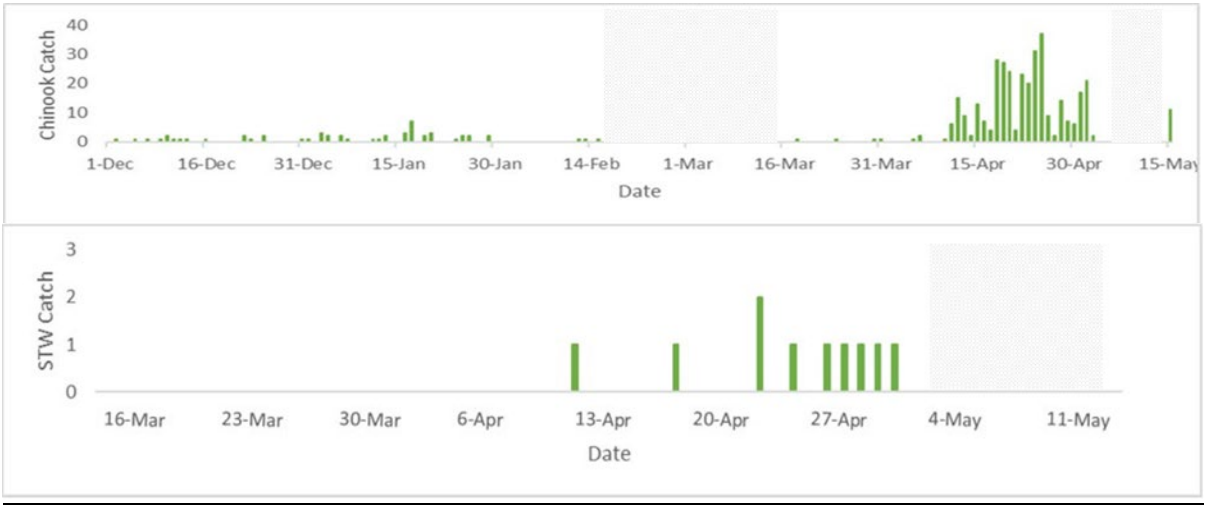

Figure 7. The number of all Chinook (top graph) and steelhead (bottom graph) collected from the rotary screw trap (RST) located in the Big Cliff Dam tailrace. Shaded regions are periods when the RST was not operated.

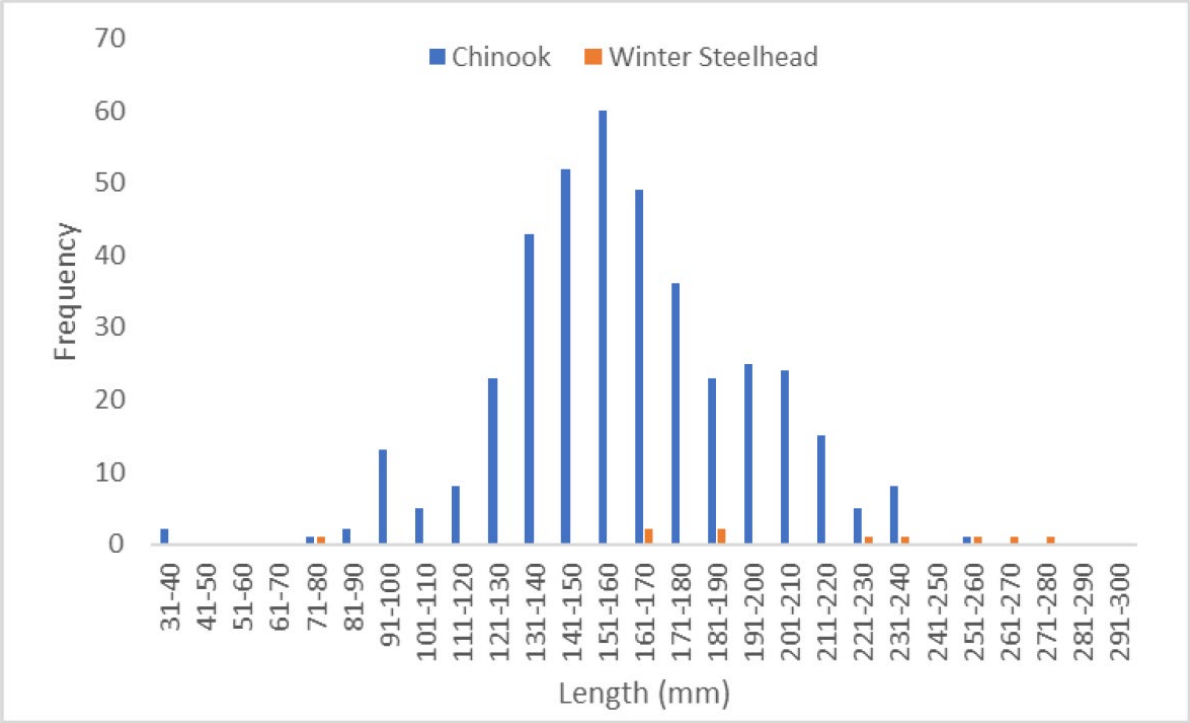

Figure 8. The size distribution of all Chinook and steelhead collected in the rotary screw trap (RST) located in the Big Cliff Dam tailrace from 01 Dec 2021 through 15 May 2022. Total numbers of Chinook and winter steelhead collected are listed in the table below.

Table 7. Descriptive statistics of Chinook and winter steelhead caught in the Rotary Screw Trap (RST) on the North Santiam River below Big Cliff Dam during the 01 December 2021 to 15 May 2022 period.

December 1, 2021 to May 15 ,2022											
Site	Route	Species	Life stage	Collected	Length (mm)*			Weight (g)*			
					Min	Max	Mean	Min	Max	Mean	
Big Cliff	PWR	CHS	Fry	2	32	33	32.5	N/A	N/A	N/A	
		CHS	Parr	19	78	130	101.2	6.1	20.1	11.9	
		CHS	Smolt	380	108	260	164.9	11.7	180.6	46.9	
		STW	Parr	1	75	75	75	5.2	5.2	5.2	
		STW	Smolt	9	161	280	218.3	38.4	230.5	104.8	

Up to 60 live non-immediately moribund juvenile Chinook and winter steelhead per week were held for 24 hours post-collection (i.e., from time of sampling, typically once per day). In summary, during the December 1, 2021 to May 15, 2022 period, a total of 199 Chinook and 4 Winter Steelhead were captured during the most current reporting period and held for 24 hours. 30 Chinook (15.1%) and 0 Winter Steelhead (0%) died during the 24-hour holding period (EAS 2022).

Information regarding condition of juvenile salmonids, PIT-tagging efforts, collection of scales and fin-clips for future analysis, non-target fish capture, and other summary statistics caught in RSTs

during this period is available in the data reports posted to the Corps' Willamette Valley Injunction RM&E webpage (i.e., EAS 2022 and biweekly in-season reports).

RM&E Planned for July – December 2022

The Corps will continue operating the RST and collecting associated data below Big Cliff Dam, under contract with EAS, through the remainder of 2022. This RST will be operated continuously under contract, as environmental conditions allow, as warranted to meet future monitoring requirements.

The Corps has begun the coordination and contracting processes necessary to meet additional RM&E requirements identified in the long-term RM&E plan. This includes development of contract actions for the following activities:

- Releases of bulk-marked juvenile Chinook, including PIT tagging of sub-yearling Chinook in the fall and yearling Chinook in the spring. It is anticipated that hatchery fish from ODFW hatcheries in the respective sub-basins will be utilized following final coordination and contract modifications with ODFW (in-progress). Due to contracting and deployment timelines, it is anticipated that releases will begin with yearling Chinook in the winter/spring 2023.
- Releases of bulk-marked Chinook fry in the spring, tentatively marked with Visual Implement Elastomer (aka VIE and Elastomer tags). It is anticipated that hatchery fish from ODFW hatcheries in the respective sub-basins will be utilized following final coordination and contract modifications with ODFW (in-progress). Due to contracting and deployment timelines, it is anticipated that releases will begin with Chinook fry in the winter/spring 2023.
- Development of contract(s) for RST sampling above Detroit Dam is in progress. Contract award for 2023 sampling is anticipated to occur in Fall 2022, with an anticipated sample start date of approximately February 1, 2023. The RST sampling plan for above Detroit Dam is shown in Table 8, below. Table 8.

Table 9 - Upcoming Rotary Screw Trap (RST) sampling periods in the North Santiam River basin.

Rotary Screw Trap Sample Site	Sample Period	Juvenile Chinook and Winter Steelhead					
		Trap Efficiency Trials	PIT Tag >65mm	Elastomer Tag (<65 mm)	Scale Samples	Tissue Sample (DNA)	24-hour Holding (Post Collection)
Big Cliff Dam Tailrace	Year-round starting March 2022	Yes	Yes	No	No	No	Yes
Breitenbush River	01 February - 30 June	Yes	Yes	Yes	Yes	Yes	No
North Santiam above Detroit Dam & Reservoir	01 February - 30 June	Yes	Yes	Yes	Yes	Yes	No

South Santiam River Injunction Measures

Green Peter Dam

From January 1 – June 30, 2022, multiple injunction measures were implemented at Green Peter Dam. These included:

- Green Peter Spring Downstream Fish Passage (IM 12a)
- Green Peter Outplanting (IM 11)

The general operational plan for each of these measures can be found in Table 1 above, while more specific details can be found in respective Implementation Plans found on the Corps' website https://www.nwp.usace.army.mil/Locations/Willamette-Valley/Injunction/. Information regarding actual implementation during the January – June 2022 season is described below.

Beginning in the spring, the Green Peter spillway was utilized to discharge surface flows downstream and test two downstream fish passage operations at Green Peter Dam. An active tag study was conducted during these operations to better understand spill operations and fish passage response and survival. The study fish were also tagged with PIT tags.

As shown in Figure 9, spillway crest elevation at Green Peter was reached on March 17 and a continuous (24 hour) spill operation commenced using a minimum spill gate opening of 1.5 ft. On April 02 -15, operations shifted to a nighttime spill operation using a 3 ft. gate opening, with no power generation during this operation. The regulating outlet was used to pass 50 cfs flow during the day to keep the river flowing downstream of the dam. Spillway releases were conducted from one hour before sunset to one hour after sunrise during the operation. On April 16, operations transitioned back to a continuous (24/7) spill operation through the remainder of the month. No generation was conducted during this continuous spill operation. Spring downstream fish passage spill operations concluded on May 1, 2022.

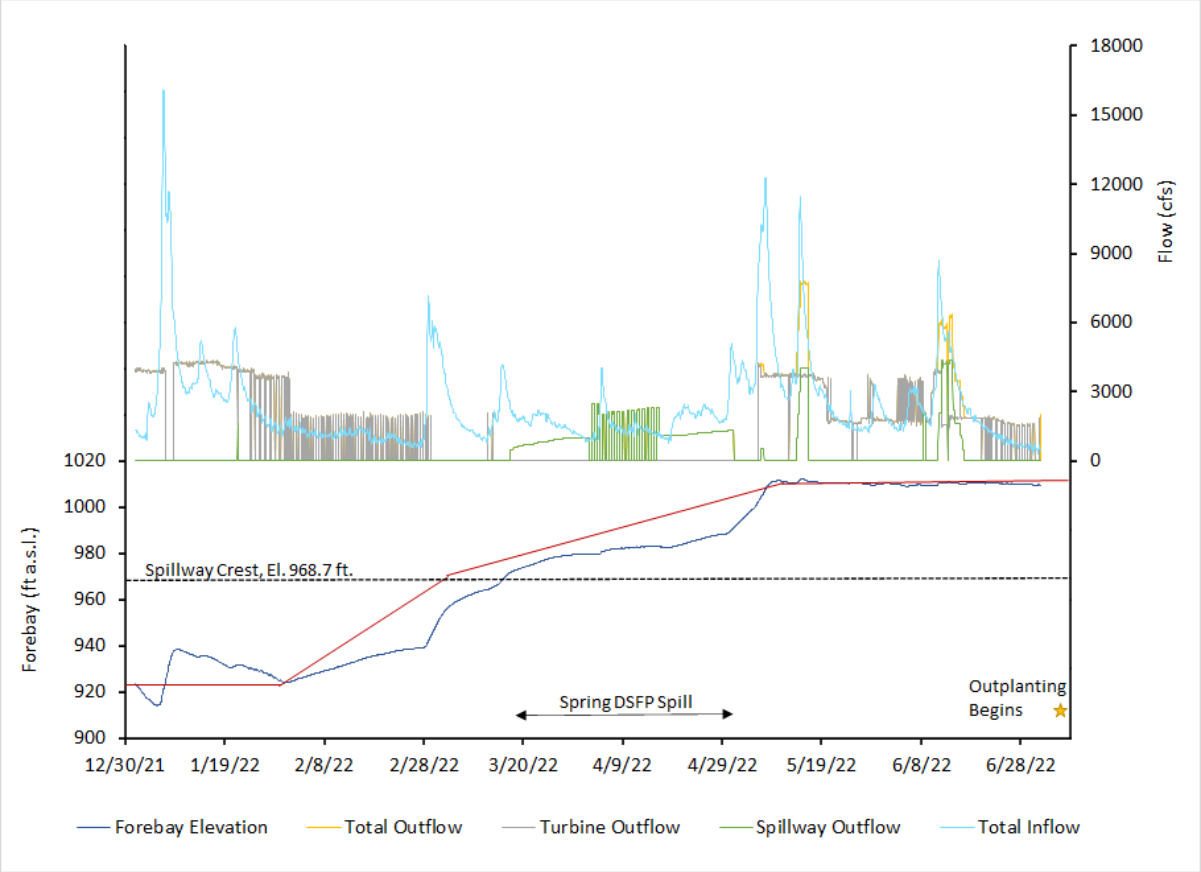

Figure 9. Green Peter Dam Operations, January 01 - June 30, 2022

Prior to the spill operations at Green Peter Dam, the Corps funded the installation of a real-time TDG gauge downstream of Green Peter Dam. Due to the steep-sided canyon downstream of Green Peter Dam, accessible locations for gauge installation were limited. Therefore, the TDG gauge was installed in the tailrace near the location of the screw trap and closer to the dam than many other Willamette Basin TDG gauges. As shown in Figure 10, below, anytime the spillway was used to release water downstream of Green Peter Dam, TDG in excess of 110% was measured. This did not only occur during high flow events, but during smaller spillway releases that were part of the downstream fish passage injunction measure (Figure 11).

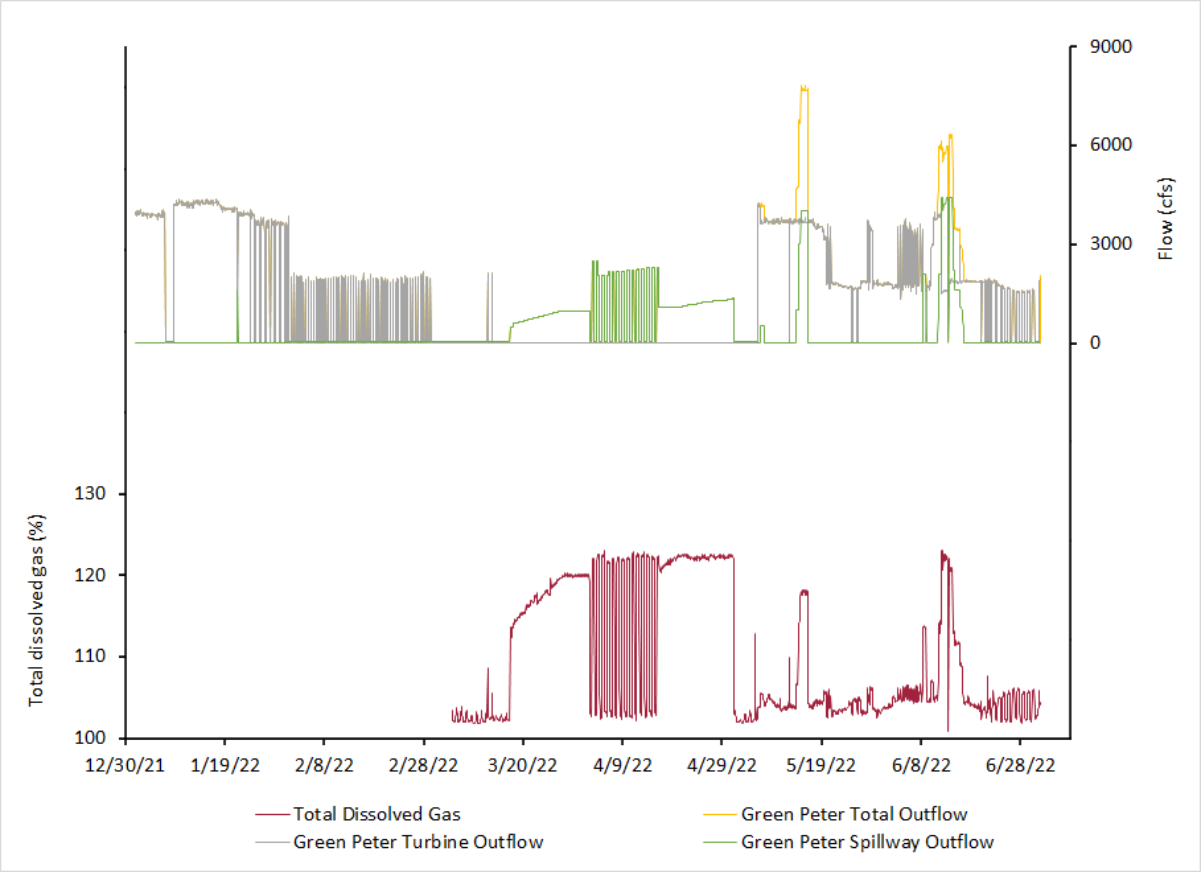

Figure 10. Green Peter Dam Operations and Downstream Total Dissolved Gas, January 01 - June 30, 2022

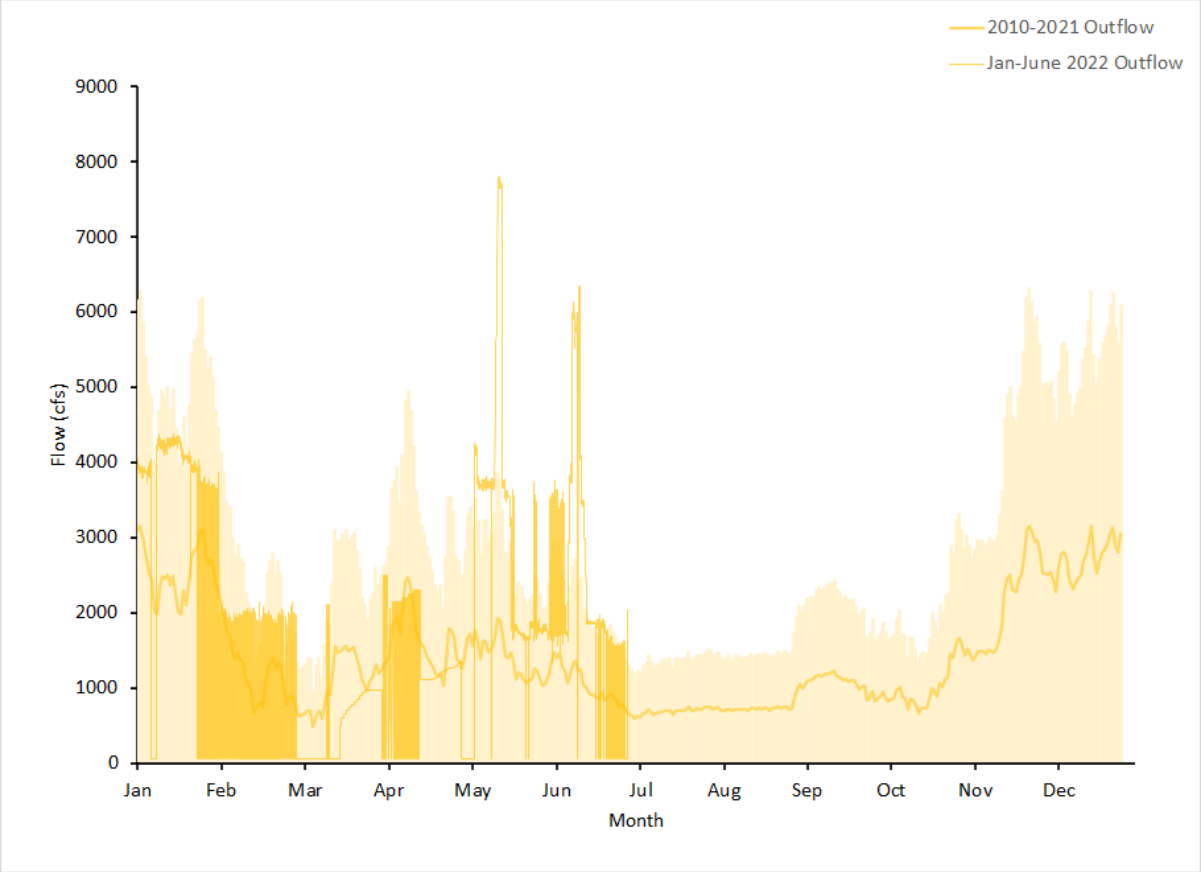

Figure 11. Observed Green Peter Outflows in 2022 as Compared to Maximum and Minimum Outflows from 2010-2021

Lessons Learned

TDG appears to be problematic when the non-turbine units are used at Green Peter Dam to discharge water downstream. The Corps would like to investigate further by deploying additional TDG monitors farther downstream of Green Peter Dam to better understand the extent of the elevated TDG, how quickly it dissipates, and whether the current location of the USGS TDG gauge is the most representative measure of TDG or not. Access to the reach of river downstream of Green Peter Dam is difficult, so it is likely that the deployment of TDG equipment by boat may be the best option for a more detailed TDG study. The Corps hopes to secure funding and a contractor so that this study may be accomplished over the next few years.

Green Peter Outplanting

The Corps obtained a right-of-entry from a private landowner to access their property to transport and outplant salmon in the Middle Santiam River above Green Peter Dam between July 1, 2022 and September 30, 2022. Access for future years has not yet been granted. Outplanting of adult spring Chinook salmon began on July 11, 2022, in the Middle Santiam River. Prior to fish release, genetic samples were taken, sex was determined, fish were measured for length, scale samples were

collected, and fish were Floy-Tagged. Further, temperature thermistors were deployed at release sites.

A total of 600 adult spring Chinook salmon were outplanted (1:1 male: female) in the Middle Santiam River during 2022. On July 11, there were 240 fish were released along with 120 fish released on each of July 14, 19, and 26. Due to rising temperatures, the fish releases planned for August were completed by July 26. As of July 26, no mortalities have been observed and salmon were seen swimming and jumping in the river post release.

The Corps also obtained authorization from the Bureau of Land Management (BLM) for access to BLM-managed land to transport and outplant salmon in Quartzville Creek above Green Peter Dam. There will be 200 adult spring Chinook salmon released in Quartzville Creek above Green Peter Dam in late August or in September depending on environmental conditions (e.g., water temperature, level of recreation).

Spawning surveys are planned to begin in August in Quartzville Creek. Spawning surveys on the Middle Santiam River require access to private lands, which has not been granted at the time of this writing.

Operations Planned for July – December 2022

Outplanting above Green Peter Dam will continue into August/September. The Corps is also continuing to work towards the implementation of IM 12b, the deep drawdown at Green Peter Dam for winter/fall downstream fish passage, which is planned for implementation in the fall of 2023. Following the Expert Panel's submission of its implementation plan for IM 12b, the Corps established a technical team to design, procure, and install an alternative backup power supply (diesel generator) to be available for a deep drawdown of Green Peter Reservoir. While it was not attainable to have the generator and related remote start and monitoring system designed, procured, and installed in 2022, the Corps anticipates installation will be completed in time for the deep drawdown to occur in fall 2023.

RM&E

Baseline Active Passage and Survival (Active Tag) Study

Information is lacking for downstream fish passage and survival through Green Peter reservoir and dam, specifically at the spillway. The spring spill operation at Green Peter Dam was evaluated for juvenile Chinook salmon passage and survival rates with PIT and active-tagged (radio telemetry) surrogate yearling Chinook salmon. The objective of the study was to collect baseline information of reservoir entry timing and downstream passage of juvenile Chinook salmon during two spill treatments:

1) Nighttime only spill during April 1-15
2) 24-hour spill during April 16-30

This baseline study will provide information on downstream reach survival estimates of the tagged fish to the confluence of the South Santiam River with the mainstem Willamette River. Additionally, survival estimates will be evaluated for fish detected at Willamette Falls Dam. This Green Peter baseline study is being conducted concurrent with the Foster Dam spring spill study by Pacific Northwest National Laboratory (PNNL).

PNNL was able to determine radio telemetry receiver locations to monitor the Green Peter reservoir, tailrace, and further downstream and complete the field tasks of the spring 2022 study (tagged and released fish and data collection), which will inform the spring 2023 study.

In spring 2022, a total of 419 tagged fish were released at head of reservoir (HOR) (n=207) and middle of reservoir (MOR) (n=212) for this baseline study (Table 1). For the nighttime only spill treatment (April 1-15), 211 tagged fish were released at HOR (n=104) and MOR (n=107), and 208 tagged fish were released at HOR (n=103) and MOR (n=105) for the continuous spill treatment (April 16-30) (Table 1). All of fish were tagged with both radio tags and PIT tags.

Additionally, 74 radio tagged dead fish were released into the Green Peter tailrace (Table 10). Tagged dead fish were released into the tailrace as part of the PNNL study design for survival estimates using the virtual release/dead fish correction (ViRDCt) model; dead fish releases allow for the single-release dam passage survival of the virtual release group to be adjusted for the bias that occurs when dead fish are misidentified as alive at the Sunnyside radio antenna detection site (6 river kilometers downstream of Green Peter Dam).

Table 10. Spring 2022 sample sizes at Green Peter Dam by reservoir elevation, fish release dates, spill treatment, species, and release location. CH1 refers to juvenile Chinook salmon (yearling).

Reservoir Elevation (ft)	Fish Release Dates	Spill Treatment	Species	Head-of-Reservoir	Mid-of-Reservoir	Green Peter Tailrace (dead fish)	Actual Total	*Proposed Total*
979.4	Apr 2 & 4	Nighttime spill	CH1	104	107	36	247	*250*
982.8	Apr 16–17	Continuous spill	CH1	103	105	38	246	*250*
Grand Total				**207**	**212**	**74**	**493**	***500***
Note: Fewer fish were tagged during each treatment than the proposed total due to radio telemetry tag failure rates (~1% fail rate).								

Data collection is ongoing, concurrent with the Foster Dam spring and fall spill data collection. PNNL will submit a preliminary in-season data report by December 2022, with a Draft Final Report documenting the methods, data collection and analysis, and draft results by March 31, 2023, and a Final Report by December 31, 2023. The preliminary results of the 2022-2023 study will inform the spill operations during 2023. Because data collection is ongoing and the results are not available for this report, recommendations for the 2023 spill operations will be determined at a later date, but prior to the start of the 2023 spill operations.

Rotary Screw Trap Sampling

An eight-foot diameter RST was deployed below Green Peter Dam in the tailrace for sampling during the spring spill season to gain preliminary information on fish passage during the 2022 spring spill operations (Table 11). With a new/additional screw trap required for this site and supply chain issues making it difficult to procure the necessary materials (specifically procurement of perforated plate), it took longer than anticipated to begin sampling at this site. Completion of RST deployment

and associated hardware occurred on March 2, 2022 with sampling subsequently beginning March 3, 2022. The screw trap successfully sampled through the spring spill operations. However, the high line holding the RST in its sampling position was damaged on May 6, 2022 in high powerhouse flows, resulting in sampling ending on May 7, 2022. Upon further inspection of the highline and screw trap, a substantive redesign of the anchor points will be necessary to redeploy the RST. Since the spill test had ended for the 2022 spring season, the RST was removed from the river for the remainder of the season. The deployment hardware including highline and anchor points will be redesigned prior to the 2023 sample period based on lessons learned from the 2022 sample period.

Table 11 - Rotary Screw Trap Sampling below Green Peter Dam during spring 2022 season.

Green Peter Tailrace- Middle Santiam River RST	Trap Install	03/02/2022	03/02/2022	1
Green Peter Tailrace- Middle Santiam River RST	Operation	03/03/2022	05/12/2022*	70
Green Peter Tailrace- Middle Santiam River RST	Trap Efficiency Release (643 Fish)	03/29/2022	03/29/2022	1
Green Peter Tailrace- Middle Santiam River RST	Trap Efficiency Release (521 Fish)	04/30/2022	04/30/2022	1

Sampling at the Green Peter Dam tailrace site during the 2022 spring season included standard biological and environmental sampling metrics consistent across all RST sites as well as the information found in Table 12.

Table 12 - Rotary Screw Trap (RST) Sampling Conducted Below Green Peter Dam during the 2022 Spring Season.

Rotary Screw Trap Sampling Site	Trap Efficiency Trials	Target Species	Biological and Injury Data	Scale and DNA Samples	24-hr Holds (Post Collection)	PIT Tagging (<65 mm)	Elastomer Tagging (>65 mm)
Green Peter Dam Tailrace- Middle Santiam	Yes- Hatchery Fish	Spring Chinook and Winter Steelhead	Yes- weight (nearest 0.1 g), FL (mm), Injuries	Yes	Yes	Yes- on fish not included in 24-hr holds.	No

Detailed results of this RST sampling can be found in preliminary reporting by EAS in their in-season reports available on the Corps' Willamette Valley Injunction RM&E webpage at https://pweb.crohms.org/tmt/documents/FPOM/2010/Willamette_Coordination/Willamette%20RME/InjunctionRME.html. Reporting of RST monitoring results, with detailed comparisons to historical passage data and current operations will be done once per year, with the final report posted to the Corps' Willamette Valley Injunction RM&E webpage, anticipated to occur in early May annually (e.g., EAS's annual report including this 2022 period will be finalized and posted by May 2023 for sampling period of fall 2021 to fall 2022).

Operational data and preliminary data results for the sample period through May 15, 2022 are presented in EAS 2022 and summarized in the tables and figures below (Table 13, Table 14, Figure 12). Information regarding condition of juvenile salmonids, PIT-tagging efforts, collection of scales and fin-clips for future analysis, non-target fish capture, and other summary statistics caught in RSTs during this period is available in the data reports posted to the Corps' Willamette Valley Injunction RM&E webpage (i.e., EAS 2022 and biweekly in-season reports).

Table 13 - Rotary Screw Trap (RST) sampling outages at Green Peter Dam Tailrace during spring 2022 sampling period.

Site	Date(s) of Trap Outage	Reason for Outage
Green Peter Tailrace-Middle Santiam River	04/02/2022 to 04/13/2022	Initiation of spill resulted in high debris load that created fish health concerns and resulted in the cone being raised.
Green Peter Tailrace-Middle Santiam River	05/06/2022 to end of period	Rapid increase in flow caused damage to the highline anchor, trap was removed to prevent further damage to highline or trap.

Table 14 - Rotary Screw Trap (RST) sample results for run-of-river steelhead caught in the Green Peter Dam tailrace trap during spring 2022. While radio tagged Chinook released by DOE-PNNL were captured in the RST, no run-of-river Chinook caught in the RST during this sample period.

November 16, 2021 to May 15 ,2022										
Site	Route	Species	Life stage	Collected	Length (mm)*			Weight (g)*		
					Min	Max	Mean	Min	Max	Mean
Green Peter Dam Tailrace-Middle Santiam	Spill	STW	Parr	0	0	0	0	0	0	0
		STW	Smolt	6	175	320	213.7	46.2	316.1	107.1

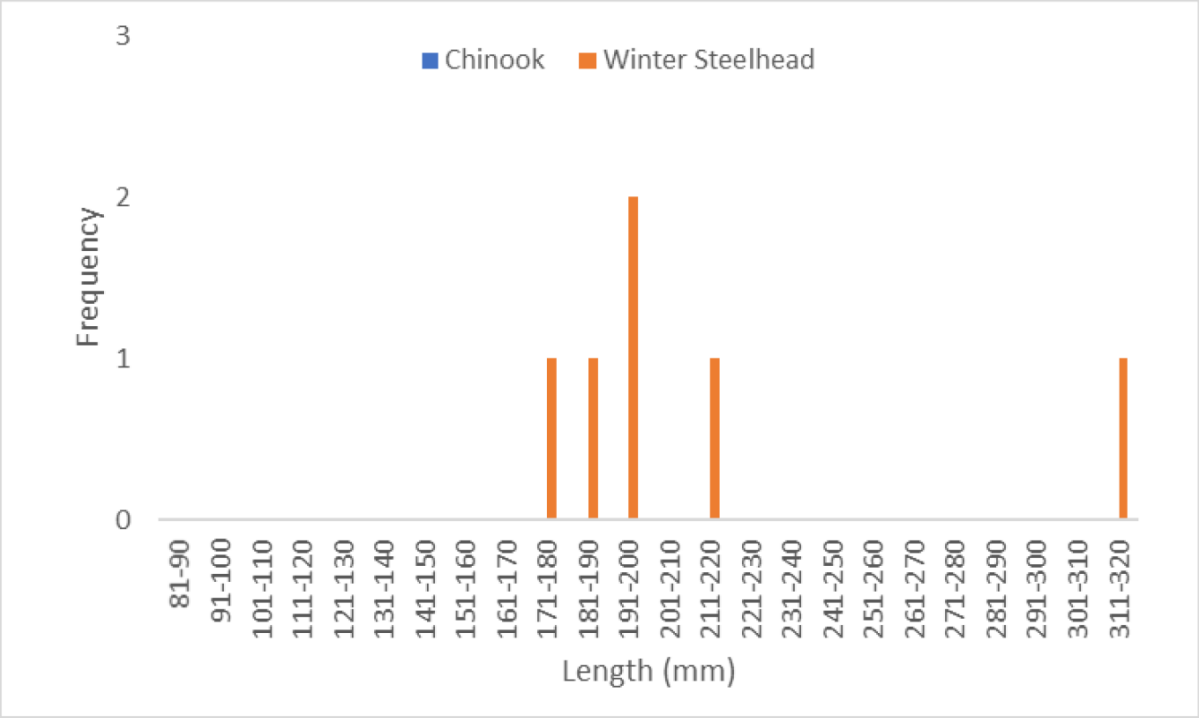

*Figure does not include fish without heads or fish used for trapping efficiency trials.

Figure 12. Size range of the six steelhead collected from the Green Peter Dam tailrace screwtrap, which operated from 03 March – 07 May 2022. No Chinook were collected

No spring Chinook were captured at the Green Peter Dam tailrace site during the sampling period; six *Oncorhynchus mykiss* were captured during the sample period. The six O. mykiss were held for 24 hours post collection with all six fish dying during holding. No live target fish (i.e., Chinook and *O. mykiss*) were captured for the reporting period and, thus, no scale or DNA samples were collected. In the future, scales and tissue samples will be collected from mortalities as well as from live fish.

RM&E Planned for July – December 2022

The Corps is working with its rotary screw trap contractor (EAS) to redesign the deployment hardware for the Green Peter Dam tailrace rotary screw trap for the next sampling period of February to November 2023.

The Corps has begun the coordination and contracting processes necessary to meet additional RM&E requirements identified in the long-term RM&E plan. This includes development of contract actions for the following activities:

- Releases of bulk-marked juvenile Chinook, including PIT tagging of sub-yearling Chinook in the fall and yearling Chinook in the spring. It is anticipated that hatchery fish from ODFW hatcheries in the respective sub-basins will be utilized following final coordination and contract modifications with ODFW (in-progress). Due to contracting and deployment timelines, it is anticipated that releases will begin with yearling Chinook in the winter/spring 2023.
- Releases of bulk-marked Chinook fry in the spring, marked with Visual Implement Elastomer (aka VIE and Elastomer tags). It is anticipated that hatchery fish from ODFW hatcheries in the respective sub-basins will be utilized following final coordination and contract modifications with ODFW (in-progress). Due to contracting and deployment timelines, it is anticipated that releases will begin with Chinook fry in the winter/spring 2023.
- Development of sampling the nearshore distribution of juvenile salmon within Green Peter Reservoir has been initiated internally within the Corps. Contracting for development and implementation of a 2023 study is underway and is anticipated to be awarded in time for a field study to occur beginning in spring 2023. It is anticipated that this study will follow the timing and location of previous studies to provide a basis for comparing fry and subyearling distribution relative to reservoir conditions.
- Development of contract(s) and real estate access permits for RST sampling above Green Peter Dam is in progress. Contract award for 2023 sampling is anticipated to occur in fall 2022, with anticipated sample start date of approximately February 1, 2023. Tentative sample areas have been identified upstream of the Green Peter Reservoir on BLM-managed land. As of August 2022, deployment of an RST on BLM property on the Middle Santiam River above Green Peter Reservoir is anticipated to be possible in 2023. Authorization to deploy an RST on BLM property on Quartzville Creek in 2023 has not been granted at this time, although the Corps continues to discuss with the BLM. The Corps continues to explore options for moving forward with RST sampling at these sites. The RST sampling plan for above and below Green Peter Dam in 2023 is shown in Table 12 below.

Table 15. Sampling Planned in the Middle Santiam River Above and Below Green Peter Dam Beginning in 2023

Rotary Screw Trap Sample Site	Sample Period	Juvenile Chinook and Winter Steelhead (*O. mykiss*)					
		Trap Efficiency Trials	PIT Tag >65mm	Elastomer Tag (<65 mm)	Scale Samples	Tissue Sample (DNA)	24-hour Holding (Post Collection)
Green Peter Dam Tailrace	01 February - 30 November	Yes	Yes	No	Yes	Yes	Yes
Quartzville Creek*	01 February - 30 November	Yes	Yes	Yes	Yes	Yes	No
Middle Santiam above Green Peter Dam	01 February - 30 November	Yes	Yes	Yes	Yes	Yes	No
*Contingent upon receiving authorization for placement.							

Foster Dam

As shown in Figure 13, from January 1 – June 30, 2022, a delayed refill and downstream fish passage operation and water temperature management operation using the fish weir were implemented at Foster Dam (IM 13b). The general operational plan for this measure can be found in Table 1 above, while more specific details can be found in the Implementation Plan found on the Corps' website https://www.nwp.usace.army.mil/Locations/Willamette-Valley/Injunction/. Information regarding actual implementation during the January – June 2022 season is described below.

From February 1 – May 15, the refill of Foster Reservoir was delayed, and elevations were held at minimum conservation pool (El. 613-615 ft.). Throughout this operation, the spillway was operated at night while generation occurred during the day except for station service power (~300 cfs) or during high flow events and FRM operations. From May 16 – June 15, Foster Reservoir was refilled, and the nighttime spillway-only operation continued. On June 16, operation of the Foster fish weir began and continued through the month of July to provide warmer water temperatures and encourage upstream migration consistent with operations conducted in years previous.

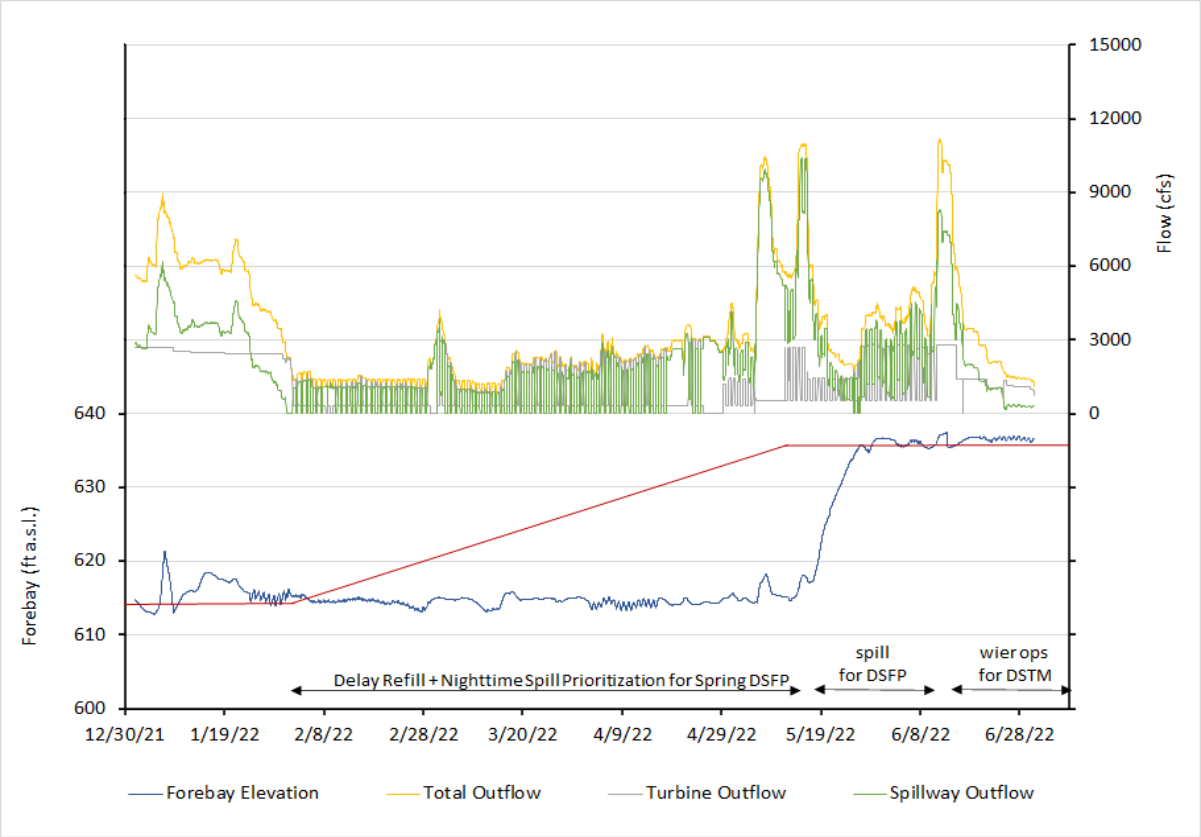

Figure 13. Foster Dam Operations, January 01 - June 30, 2022

To date, water temperatures as monitored downstream of Foster Dam have been relatively cool compared to the last 11 years. Warm surface releases from the reservoir through the Foster fish weir, which began on June 16, have resulted in a marked increase in downstream water temperatures, which should continue to stimulate fish to migrate upstream to the Foster adult fish facility (Figure 14).

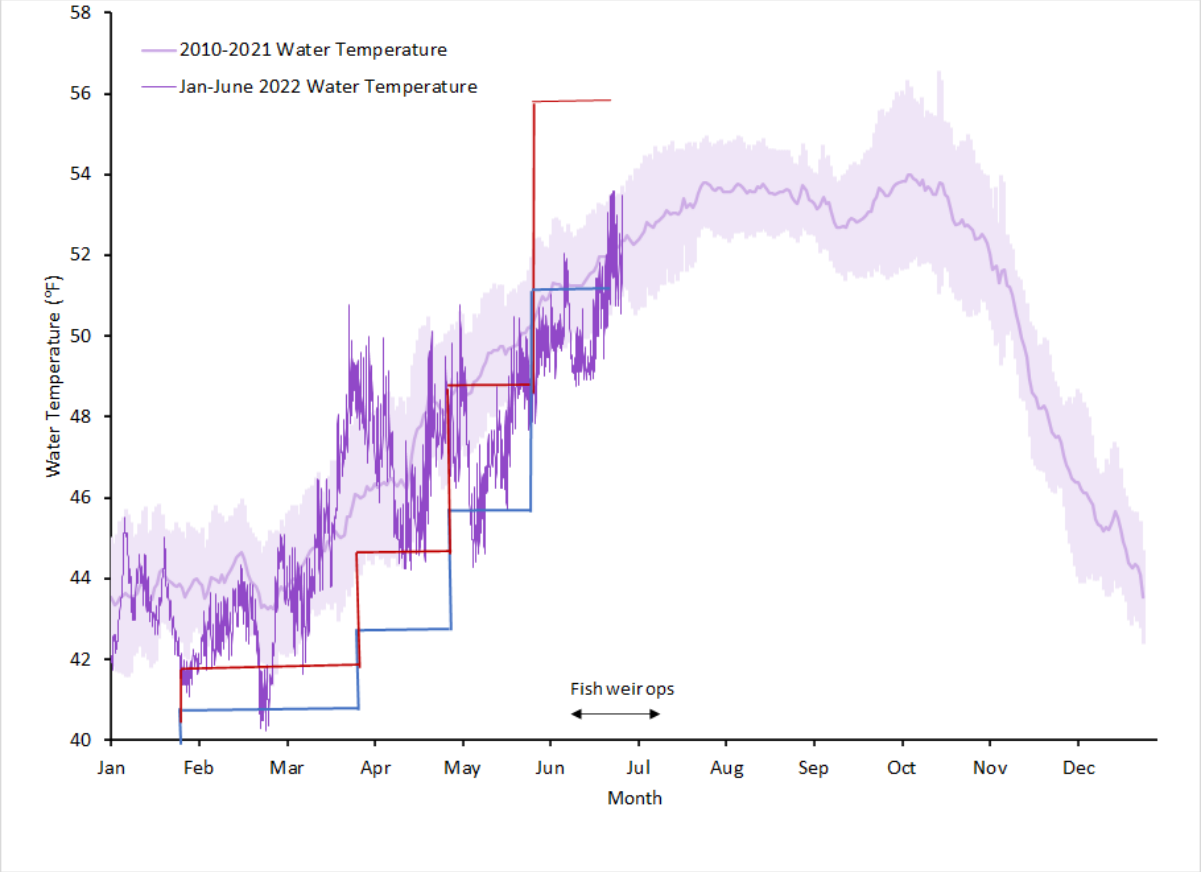

Figure 14. Observed Water Temperatures at the USGS Gauge Downstream of Foster Dam in 2022 as Compared to Maximum and Minimum Water Temperatures from 2010-2021

Relatively speaking, Foster Dam does not produce TDG levels as high as other high-head dams in the Willamette Basin, such as Green Peter and Detroit. That said, there were instances throughout the winter, spring, and early summer where TDG exceeded the State of Oregon water quality standard of 110% saturation. This occurred when the turbines were offline due to repairs, testing, or unplanned outages, or during high flow events and spillway discharges in excess of 3,000 cfs (Figure 15).

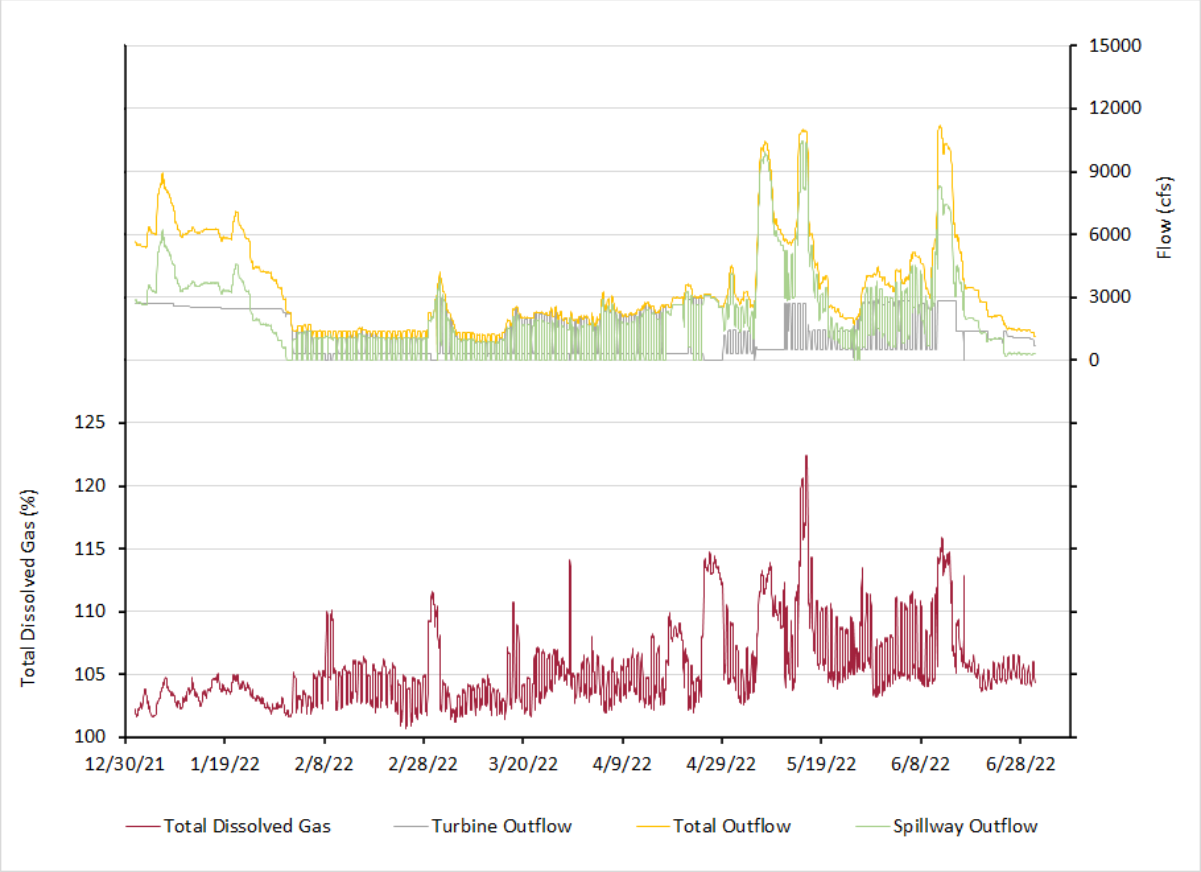

Figure 15. Foster Dam Operations and Downstream Total Dissolved Gas, January 01 - June 30, 2022

Three high flow events were observed in the South Santiam subbasin in the spring of 2022 that created TDG saturations above what is typically observed. Of these three events, spillway releases, as well as TDG was highest on May 15 with saturations peaking to ~122% (Figure 16 and Figure 17).

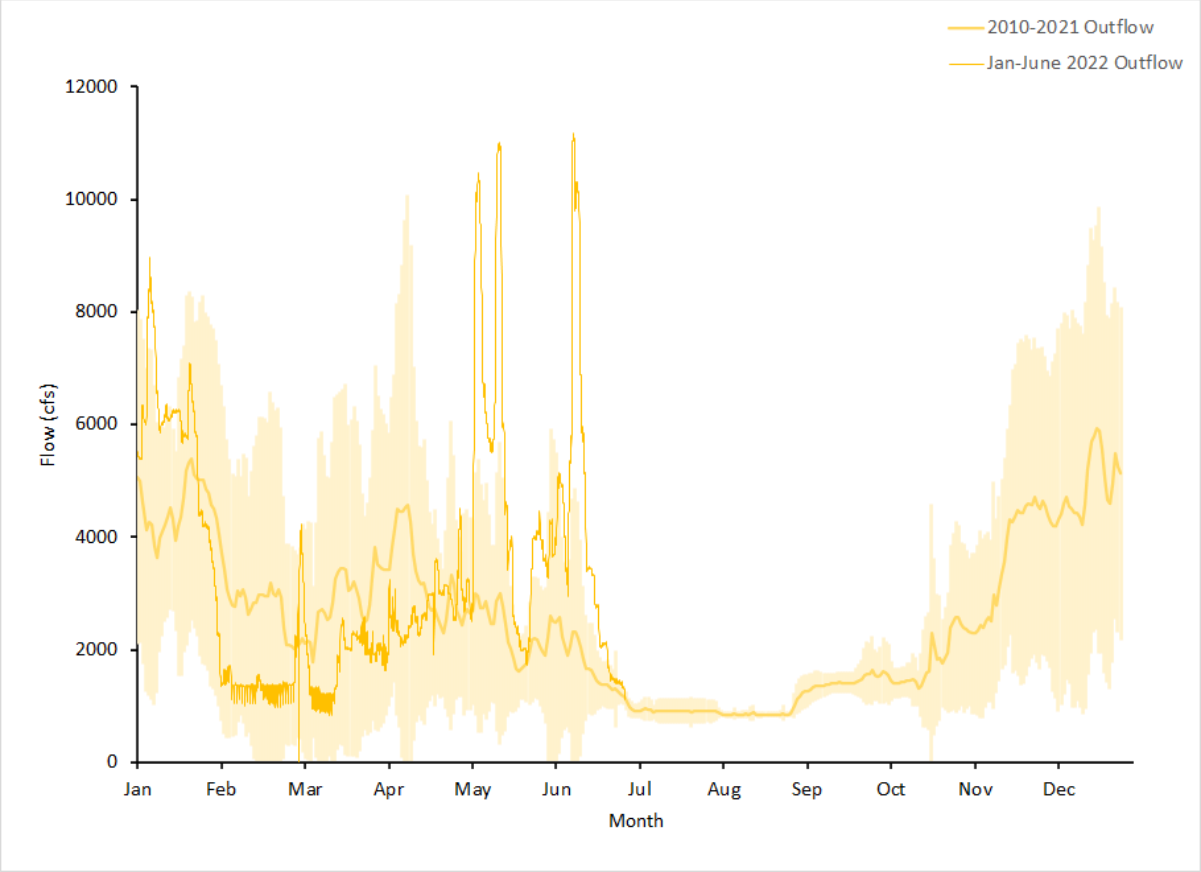

Figure 16. Observed Foster Outflows in 2022 as Compared to Maximum and Minimum Outflows from 2010-2021

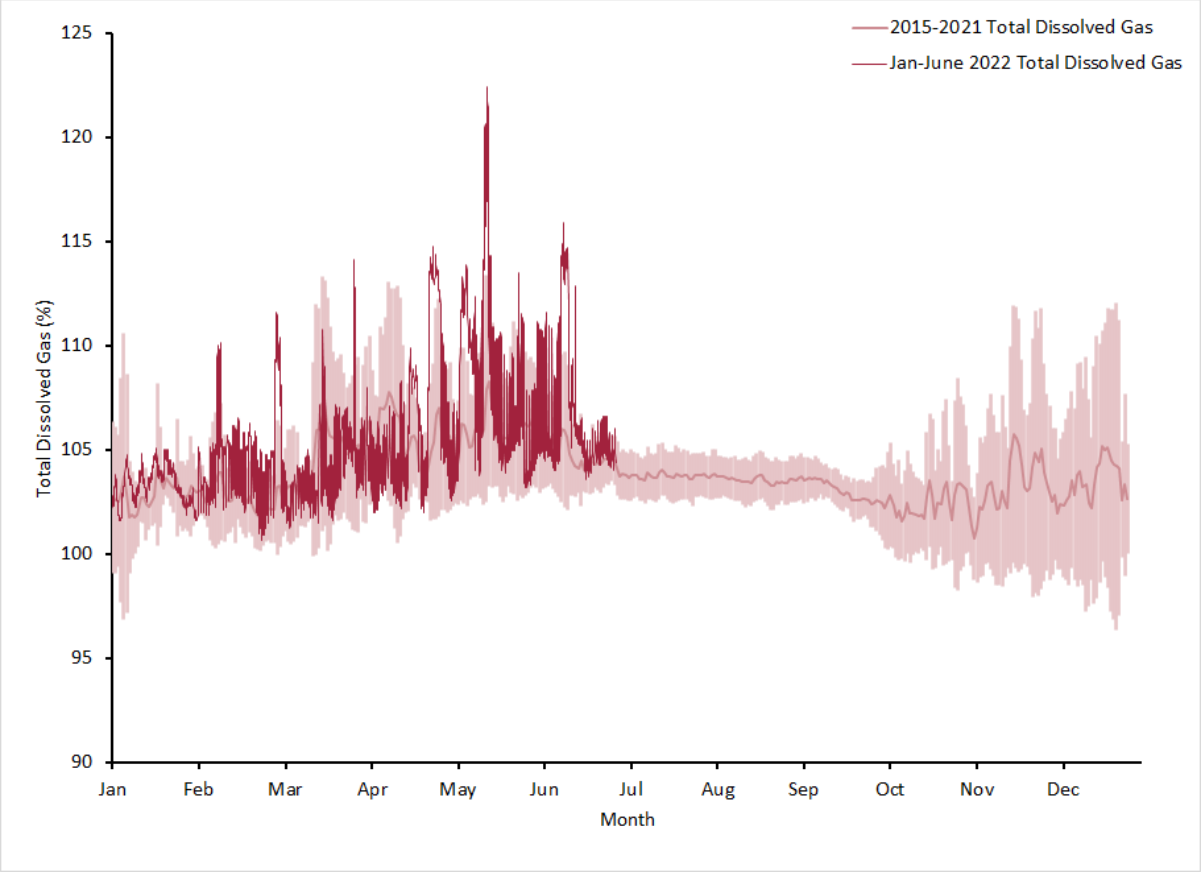

Figure 17. Total Dissolved Gas Downstream of Foster Dam Measured in 2022 as Compared to Maximum and Minimum Total Dissolved Gas Measured from 2015-2021

Lessons Learned

This operation was carried out without incident. No modifications to this operation are being considered for next year.

Operations Planned for July – December 2022

The Corps operated the Foster fish weir through the month of July to ensure adult upstream salmon migration and the collection of broodstock at the Foster Adult Fish Facility. Starting in August, injunction-driven dam operations are considered complete for the summer. Starting just after Labor Day weekend, Foster Reservoir will be gradually drawn down to target a forebay elevation of 620-625 ft. by October 1 to carry out IM 13a for improved fall downstream fish passage and survival through Foster Dam. Starting on October 1, the spillway will be utilized to pass fish at night, with generation occurring during the day. This operation will be carried out through December 15.

RM&E

Active Passage and Survival (Active Tag) Study

The spring nighttime spill operation at Foster Dam was evaluated for route-specific and overall dam passage survival of juvenile Chinook salmon and steelhead with active-tagged (radio telemetry)

surrogate yearling Chinook salmon and age 2 steelhead. The spring spill operation was evaluated with two reservoir elevations: 1) minimum conservation pool (delayed refill) and 2) full summer conservation pool. The duration of the delayed refill (low pool) spill operation was from February 1 through May 15, and the full summer conservation pool (full pool) was from May 27 through June 15. The objectives of the study were to describe the following:

1) Approach patterns, behavior, and timing into Foster Dam forebay.
2) Estimates of route-specific (nighttime spillway vs. turbine passage) diel passage and survival.
3) Estimates of downstream reach survival to the confluence of the South Santiam River with the mainstem Willamette River and estimates of survival for fish detected at Willamette Falls Dam.

The results of this study will be compared to the results of the previous downstream passage and survival studies conducted at Foster Dam to evaluate spring spill operations. This Foster spring spill study is being conducted by PNNL, who also conducted the previous juvenile fish passage and survival studies. As in previous studies, the research fish were "surrogate" fish raised at Oregon State University (OSU) in an attempt to simulate the behavior of wild juvenile fish.

Although the delayed refill spill operation commenced on February 1, PNNL was not able to start the fish passage and survival (active tag) study until March 1 because the radio transmitters (tags) were not available until the end of February due to supply chain issues.

Two release groups of radio tagged surrogate yearling Chinook salmon and age 2 steelhead were released in the head of reservoir (HOR) and middle of reservoir (MOR) for the delayed refill spill operation evaluation (Table 16). For each release group, fish were released over a four-day period, and the two release groups were separated by approximately three weeks to cover the delayed refill spill operation period (Table 16). A total of 965 radio tagged yearling Chinook salmon and age 2 steelhead were released in HOR (n=481) and MOR (n=484) for the evaluation (Table 16).

Similar to the delayed refill spill operation evaluation, two release groups of radio tagged surrogate yearling Chinook salmon and age 2 steelhead were released in the HOR and MOR for the full summer conservation pool spill operation (Table 16). However, fish were released over a five-day period for each release group, and the two release groups were separated by approximately one week to cover the summer pool spill operation period (Table 16). The first group of tagged fish were released one day (May 27) prior to the reservoir reaching the full summer pool elevation (635.6 ft; May 28). A total of 1,441 radio tagged yearling Chinook salmon and age 2 steelhead were released at HOR (n=719) and MOR (n=722) for the summer pool spill operation evaluation (Table 16).

Additionally, 200 radio tagged dead fish were released into the Foster Dam tailrace during the delayed refill (n=99 fish) and summer pool (n=101 fish) spill operations evaluation (Table 16). Tagged dead fish were released into the tailrace as part of the PNNL study design for survival estimates using the virtual release/dead fish correction (ViRDCt) model; dead fish releases allow for the single-release dam passage survival of the virtual release group to be adjusted for the bias that occurs from misidentifying dead fish as alive at the egress radio antenna detection site (2.5 river kilometers downstream of Foster Dam).

Table 16. Spring 2022 sample sizes at Foster Dam by reservoir elevation, release dates, species, and release location. CH1 refers to juvenile Chinook salmon (yearling) and STH-2 refers to winter steelhead (age-2).

Mean Reservoir Elevation (ft)	Release Dates	Species	Head-of-Reservoir	Mid-of-Reservoir	Foster Dam Tailrace (dead fish)	Actual Total	*Proposed Total*
Low pool 614.5	Mar 2–5	CH1	79	79	25	183	*187*
		STH-2	160	160	25	345	*350*
	Mar 29–Apr 1	CH1	79	81	25	185	*188*
		STH-2	163	164	24	351	*350*
		Total	**481**	**484**	**99**	**1,064**	***1,075***
Full Pool 636.5	May 27–31	CH1	147	149	25	321	*320*
		STH-2	211	210	25	446	*450*
	Jun 6–10	CH1	126	125	25	276	*320*
		STH-2	235	238	26	499	*450*
		Total	**719**	**722**	**101**	**1,542**	***1,540***
Grand Total			**1,200**	**1,206**	**200**	**2,606**	***2,615***

Note: During the full pool tests, PNNL tagged 43 fewer CH1 than anticipated due to an outbreak of ichthyophthirius multifilis ("ich"). To achieve overall desired sample sizes, PNNL supplemented by tagging additional STH-2. Fewer fish were tagged during spring low pool than the proposed total due to radio telemetry tag failure rates (~1% fail rate).

The Foster spring spill operation delayed refill of the reservoir until after May 15, keeping the reservoir at low conservation pool and conducting nighttime spill for downstream fish passage, followed by refilling the reservoir starting on May 16 to summer conservation pool and continuing nighttime spill operations through June 15. PNNL released fish for the summer pool spill evaluation during May 27-June 10.

During the full summer pool spill evaluation, PNNL researchers and OSU, which provided the surrogate fish for the study, noticed several tanks of surrogate Chinook salmon had ichthyophthirius multifilis ("ich") (a parasite that affects fish health and could lead to mortality) while the PNNL researchers were tagging fish for the study. Furthermore, the health of some of the other (non-ich infected) surrogate Chinook salmon and steelhead were degrading. Although the cause of the ich outbreak, and the reason only juvenile Chinook salmon tanks were affected, are unknown and this parasite had not been previously experienced at OSU, it is possible that fish health had started to deteriorate. These fish were held at the OSU surrogate program facility for a longer duration than previous study years (i.e., tagging and fish release periods for previous studies were March - mid-May).

The earlier spring spill evaluations were conducted under the following operation: 1) delayed refill from February 1- approximately April 20, refill the reservoir by May 1, and 2) summer conservation pool from May 1-June 15. Tagging and releasing juvenile salmon and steelhead into June, as was conducted this year, required fish to be held at the facility for approximately one month longer than previous study years. Holding the fish at the facility and in captivity for too long and delaying natural migration timing can potentially result in adverse effects to the fish. Even though the inflow water temperature at the facility remained constant, daylight hours and intensity of the sunlight increased (note: the fish tanks are outside and covered with nets). It is possible that fish health was deteriorating because they were experiencing physiological changes in preparation for migration and smolting due to these environmental cues. Although several tanks of surrogate fish were infected by ich and had to be euthanized and other, non-ich infected, fish showed signs of degrading health, OSU had enough healthy fish for PNNL's sample size for the summer pool spill fish releases. PNNL only tagged healthy fish, and all fish were held overnight after surgery to verify they were still alive and healthy before release. Because several tanks of Chinook salmon were infected by ich, PNNL had to supplement the Chinook salmon sample size with 43 steelhead to maintain the total sample size for the summer pool releases (Table 17).

Rotary Screw Trap Sampling

A five-foot diameter RST was placed above Foster Dam on the South Santiam River at the same location as historically operated by ODFW. A new/additional RST was required for this location; due to supply chain issues throughout the broader industry, supplies for this screw trap were late in arriving at the manufacturer's facility. Following delivery of this screw trap, it was installed and began sampling on March 16, 2022. In addition to the standard biological and environmental sampling metrics, Table 17, shows other monitoring activities conduct at this site.

Table 17. Sampling Conducted Above Foster Dam in the South Santiam River During the 2022 Spring Season

Rotary Screw Trap Sample Site	Sample Period	Juvenile Chinook and Winter Steelhead (*O. mykiss*)					
		Trap Efficiency Trials	PIT Tag >65mm	Elastomer Tag (<65 mm)	Scale Samples	Tissue Sample (DNA)	24-hour Holding (Post Collection)
Above Foster Reservoir - South Santiam River	16 March to 15 July 2022	*No	Yes	No	Yes	Yes	No
*Hatchery fish were not used above Foster Dam in the South Santiam River for screw trap efficiency trials historically. Starting in fall 2022, hatchery fish will be used if available from ODFW.							

Detailed results from this RST sampling are in preliminary biweekly reporting by EAS in the in-season reports available on the Corps' Willamette Valley Injunction RM&E webpage at https://pweb.crohms.org/tmt/documents/FPOM/2010/Willamette_Coordination/Willamette%20RME/InjunctionRME.html. RST monitoring results, with detailed comparisons to historical passage

data and current operations, will also be in an annual final report posted to the Corps' Willamette Valley Injunction RM&E webpage, anticipated to occur in early May annually (e.g., EAS's annual report including this 2022 period will be finalized and posted by May 2023 for sampling between fall 2021 and fall 2022).

Operational data (Table 25) and preliminary data results for the sample period of March 16, 2022 to May 15, 2022 are presented in EAS 2022 and summarized in the tables and figures below. Information regarding condition of juvenile salmonids, PIT-tagging efforts, collection of scales and fin-clips for future analysis, non-target fish capture, and other summary statistics caught in RSTs during this period is available in the data reports posted to the Corps' Willamette Valley Injunction RM&E webpage (i.e., EAS 2022 and biweekly in-season reports).

Table 18 - Rotary Screw Trap sampling outages for the RST deployed above Foster Dam on the South Santiam River during the 16 March to 15 May 2022 period.

Site	Date(s) of Trap Outage	Reason for Outage
Foster Dam Head of Reservoir- South Santiam River	03/01/2022 to 03/16/2022	Trap was not available until 03/16/2022. It was installed the same day.
Foster Dam Head of Reservoir- South Santiam River	05/05/2022 to 05/10/2022	Flows and debris load increased to levels that made it unsafe to access and fish the trap.

Figure 18 - Rotary Screw Trap (RST) catch of Chinook and Winter steelhead in the South Santiam River above Foster Dam during the 16 March to 15 May 2022 period.

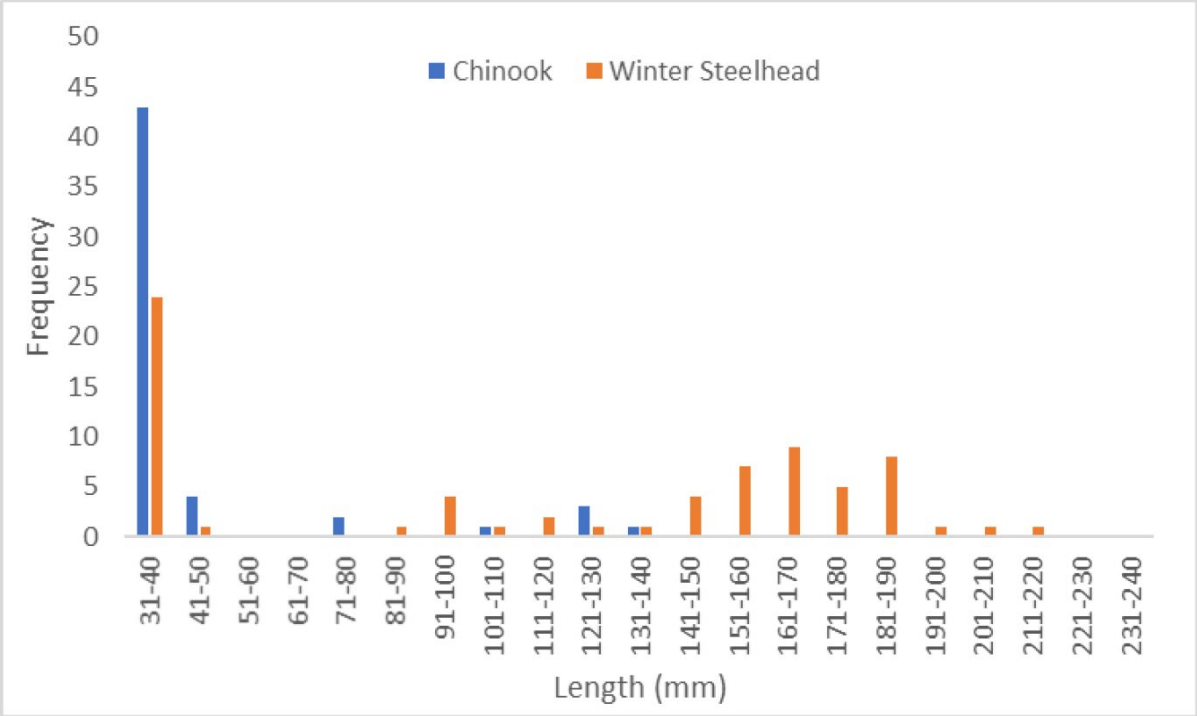

Figure 19 - Size distribution of Chinook and Winter steelhead caught in the Rotary Screw Trap (RST) sampling in the South Santiam River above Foster Dam during the 16 March to 15 May 2022 period.

Table 19 - Descriptive statistics of Chinook and winter steelhead caught in the Rotary Screw Trap (RST) on the South Santiam River above Foster Dam during the 16 March to 15 May 2022 period.

Descriptive Statistics of Target Species Captured at the Foster Dam Head of Reservoir South Santiam Site - 16 March to 15 May 2022										
Site	Trap	Species	Life stage	Collected	Length (mm)*		Weight (g)*			
					Min	Max	Mean	Min	Max	Mean
Foster Dam Head of Reservoir-South Santiam	5 ft	CHS	Fry	54	32	49	35.7	N/A	N/A	N/A
		CHS	Parr	4	73	127	97	3.1	24.7	11.7
		CHS	Smolt	3	120	138	129	19.6	27.5	23.5
		STW	Fry	29	31	46	35.0	N/A	N/A	N/A
		STW	Parr	13	65	183	118.5	2.4	63.6	22.6
		STW	Smolt	42	112	213	168.7	11.2	75.3	47.4

For this period, fin clips (DNA samples) were collected from 20 Winter Steelhead and 4 Spring Chinook. Scale samples were collected from 9 Winter Steelhead. All other target fish were too small to sample (less than 45 mm fork length for fin clips and less than 50 mm fork length for scales).

RM&E Planned for July – December 2022

The 2022 fall nighttime spill operation at Foster Dam will be evaluated for route-specific and overall dam passage survival of sub-yearling Chinook salmon with active-tagged surrogate sub-yearling Chinook salmon. The objectives of the study are to describe the following:

1) Approach patterns, behavior, and timing into Foster Dam forebay.
2) Estimates of route-specific (nighttime spillway v turbine passage) diel passage and survival.
3) Estimates of downstream reach survival to the confluence of the South Santiam River with the mainstem Willamette River and estimates of survival for fish detected at Willamette Falls Dam.

The results of this study will be compared to the results of the previous downstream passage and survival studies conducted at Foster Dam to evaluate spring spill operations. PNNL will also conduct the Foster fall spill study.

The Corps has begun the coordination and contracting processes necessary to meet additional RM&E requirements identified in the long-term RM&E plan. This includes development of contract actions for the following activities:

- Releases of bulk-marked juvenile Chinook, including PIT tagging of sub-yearling Chinook in the fall and yearling Chinook in the spring. It is anticipated that hatchery fish from ODFW hatcheries in the respective sub-basins will be utilized following final coordination and contract modifications with ODFW (in-progress). Due to contracting and deployment timelines, it is anticipated that releases will begin with yearling Chinook in the winter/spring 2023.
- Releases of bulk-marked Chinook fry in the spring, marked with Visual Implement Elastomer (aka VIE and Elastomer tags). It is anticipated that hatchery fish from ODFW hatcheries in the respective sub-basins will be utilized following final coordination and contract modifications with ODFW (in-progress). Due to contracting and deployment timelines, it is anticipated that releases will begin with Chinook fry in the winter/spring 2023.
- Development of contract(s) for RST sampling above Foster Reservoir on the South Santiam River is in progress. Contract award for rotary screw trap sampling above Foster Reservoir for the September 1, 2022 to November 30, 2022 period is anticipated to occur in August 2022. Future RST sampling is anticipated to occur February 1, 2023 to November 20, 2023. In addition to the standard biological and environmental metrics associated with RST sampling, this sampling is anticipated to include the information found in Table 20, below.

Table 20. Sampling Planned Above Foster Dam on the South Santiam River Beginning in the Fall of 2022

Rotary Screw Trap Sample Site	Sample Period	Juvenile Chinook and Winter Steelhead (*O. mykiss*)					
		Trap Efficiency Trials	PIT Tag >65mm	Elastomer Tag (<65 mm)	Scale Samples	Tissue Sample (DNA)	24-hour Holding (Post Collection)
Above Foster Reservoir	09/01*01 September to2022 11/30to 30 November 2022 02/*01 to February to-11/30 November 2023 & 2024	Yes	Yes	No	Yes	Yes	No

The Corps is also continuing work to have a PIT tag detection system installed on the City of Albany's Lebanon Dam on the South Santiam River. See the Structural Measures section, below, for additional information.

McKenzie River Injunction Measures

As shown in Figure 20, from January 1 – June 30, 2022, a delayed refill and downstream fish passage operation was implemented at Cougar Dam for improved downstream fish passage and survival throughout the spring (IM 15a). The general operational plan for this measure can be found in Table 1 above, while more specific details can be found in the Implementation Plan found on the Corps' website https://www.nwp.usace.army.mil/Locations/Willamette-Valley/Injunction/. Information regarding actual implementation during the January – June 2022 season is described below.

Starting on February 1, the refill of Cougar Reservoir was delayed and held at minimum conservation pool (El. 1532 ft.) from February 1 – early March, when a further drawdown to El. 1520 ft. was initiated. El. 1520 ft. was reached on March 14 and held until May 27, when refill commenced. The refill date was determined through review and discussion between the Corps and NMFS of water conditions, weather forecasts, and (limited, but informative) screwtrapping information. The Corps and NMFS agreed to begin refill of Cougar Reservoir on May 27 based on this information and the interest in ensuring that Cougar Reservoir would refill high enough to operate the Cougar water temperature control tower during the summer for downstream water temperature management. Throughout this operation, the ROs were operated at night while generation occurred during the day except during the high flow events and flood risk management (FRM) operations that occurred in early and mid-May (Figure 20).

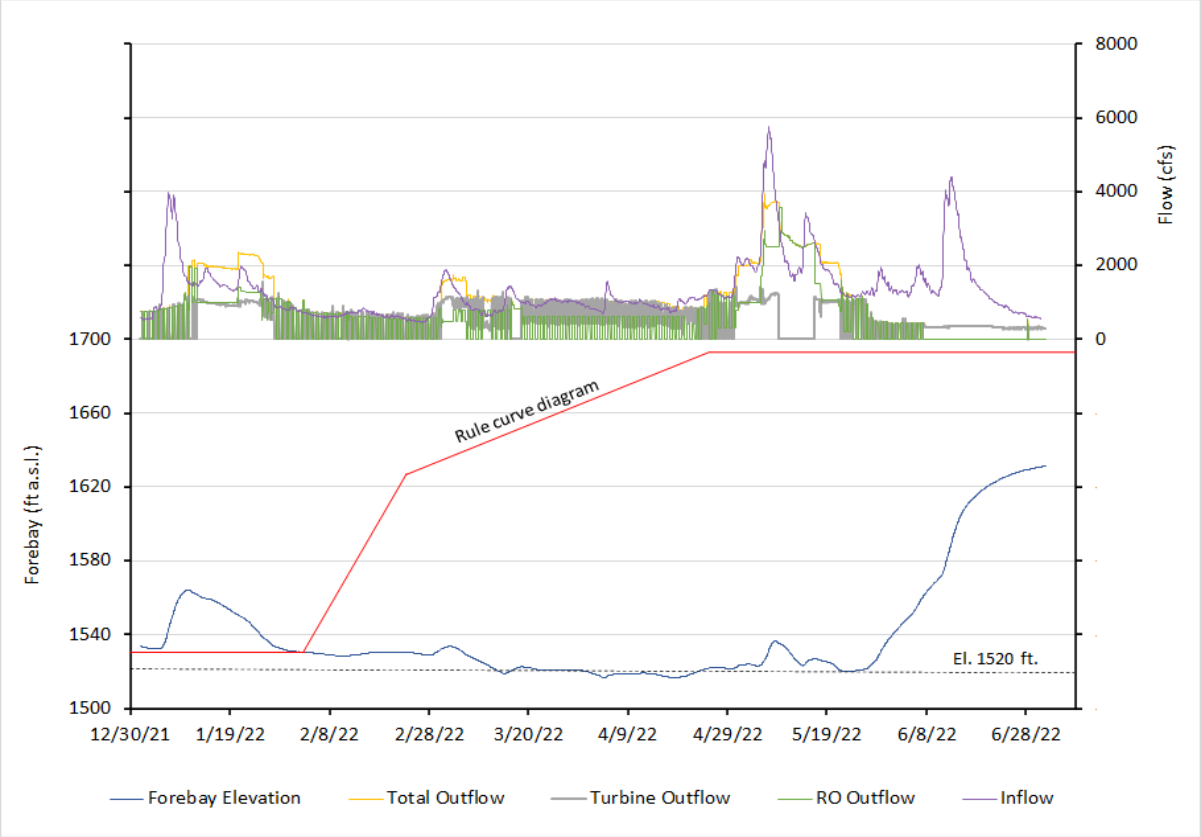

Figure 20. Cougar Dam Operations, January 01 - June 30, 2022

Throughout the winter and spring and prior to refill, multiple high flow events occurred in the McKenzie subbasin causing elevated TDG. However, the largest TDG production was observed in May when a planned turbine outage coincided with an unexpected large rain event. RO outflows were increased to ~3,500 cfs to pass the event but were capped at that discharge. The goal was to limit TDG production while also limiting the elevation to which the reservoir refilled during the rain event so that the reservoir could be drafted back down to El. 1520 as soon as possible following the rain event. By the end of the storm, the reservoir elevation had increased to El. 1536 ft., but the reservoir was drafted back to El. 1520 ft. as quickly as safely possible for the duration of the fish passage operation.

Cougar Reservoir refill commenced on May 27, and the high flow events that passed through the region in late May and June were absorbed. Unlike other reservoirs that were full and forced to pass the high inflows brought by the rains, Cougar stored the inflows from those events, thus avoiding elevated TDG and allowing the reservoir to refill to a sufficient level for summer temperature management operations. As the summer continues, water temperature management operations will continue (Figure 22).

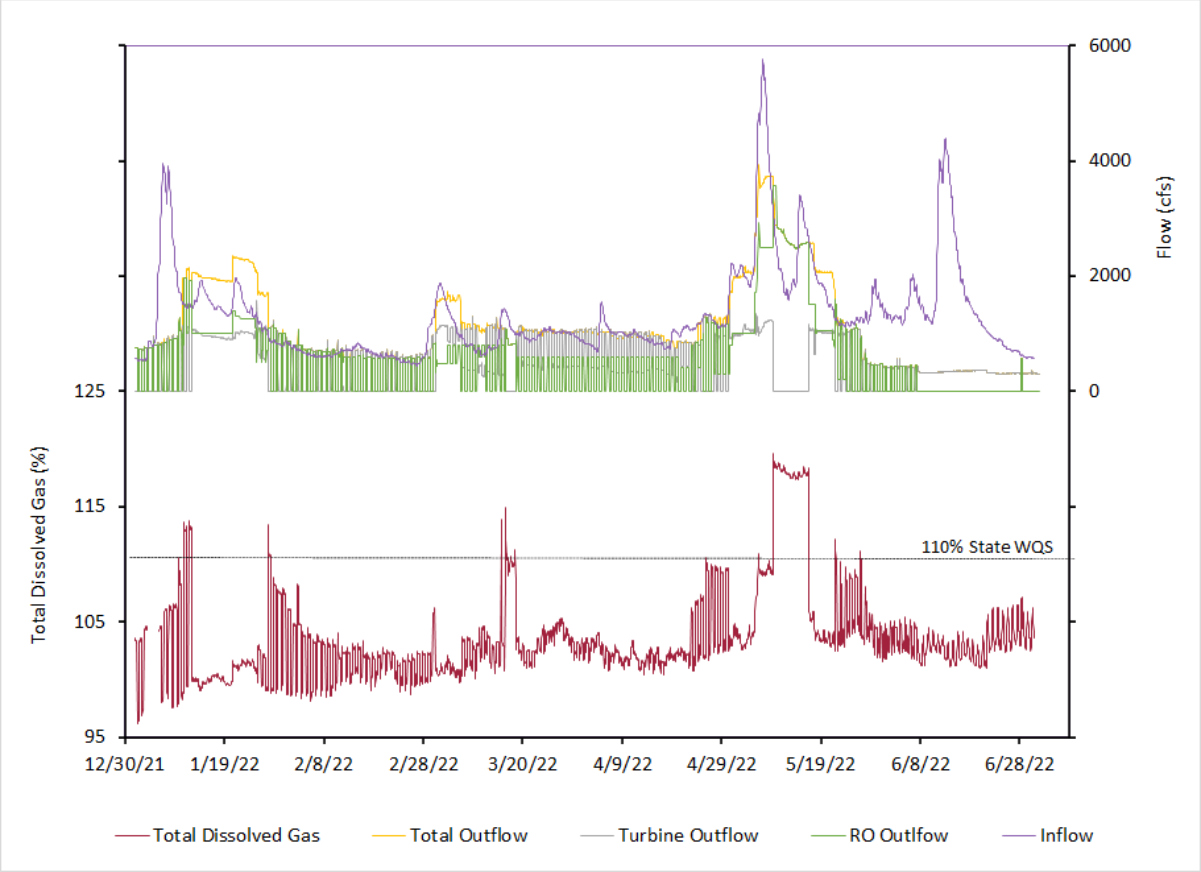

Figure 21. Cougar Dam Operations and Downstream Total Dissolved Gas, January 01 - June 30, 2022

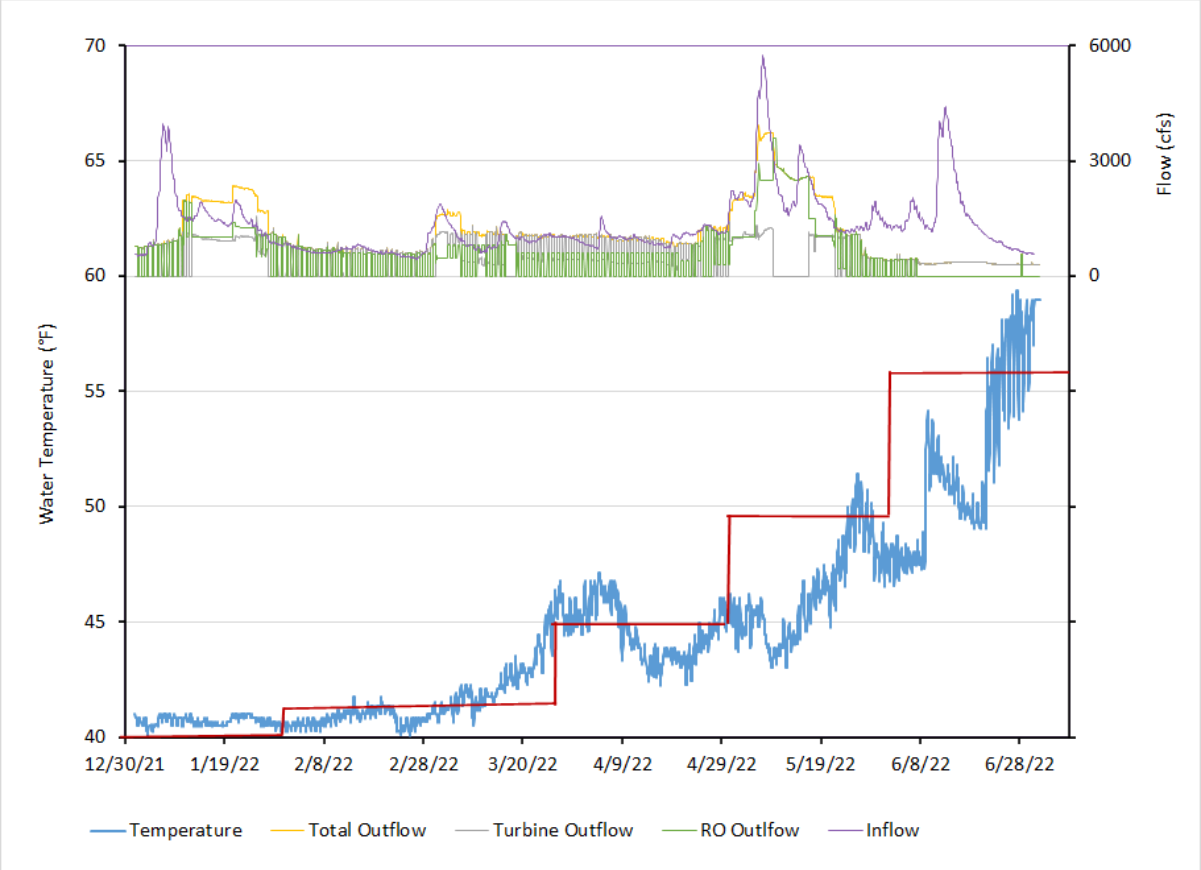

Figure 22. Cougar Dam Operations and Downstream Water Temperatures, January 01 - June 30, 2022

Lessons Learned

The large snowpack combined with late and unseasonably heavy rains observed in the spring of 2022 resulted in quite a successful delayed refill of Cougar Reservoir. Not only was the reservoir held low for fish passage until late May, but once refill began, Cougar Reservoir water surface elevations easily reached targeted levels to allow for summer water temperature management. The 2022 year was encouraging and shows that the Cougar delayed refill operation is quite possible during a wet spring. Moving forward, however, drier years can be expected, so the Corps plans continued close coordination with NMFS regarding the timing of spring refill.

Operations Planned for July – December 2022:

The Corps plans to continue to operate Cougar Dam for downstream water temperature management through the remainder of the summer season. While managing for water temperatures, the reservoir is also being slowly drafted so that it reaches the targeted elevation of El. 1505 ft. by no later than November 15. Once at or below El. 1571 ft., releases through the ROs will be prioritized for downstream fish passage so that IM 14 can commence.

During last year's implementation of IM 14, the main dam embankment was subject to enhanced monitoring. This consisted of visual inspections and weekly review of embankment piezometer and toe drain weir readings while the reservoir was below 1532 ft.

Overall, there were no observable changes to the embankment during drawdown and subsequent refill, and instrumentation readings remained within historic ranges and trends. Based on the observed and measured performance during this first drawdown, the Corps intends to conduct dam safety monitoring in fall 2022 consisting of a single low pool visual inspection at the target minimum pool, one set of inclinometer and extensometer readings during the target minimum pool, and bi-weekly review of automated piezometer and weir data during the refill above elevation 1532 ft. to maximum conservation levels. The scope of monitoring will then continue to be re-evaluated at the end of each drawdown and refill cycle depending on observed and measured performance

RM&E:

Three RSTs have been deployed below Cougar Dam in the tailrace since 2021 to monitor fish and have continued to sample in the respective powerhouse and RO channels during this period (Table 21). The only exceptions during the December 1, 2021 to May 15, 2022 sample period are those noted below (EAS 2022). A single five-foot diameter RST was deployed upstream of Cougar Dam reservoir on March 7, 2022 and sampled from March 8, 2022 to June 30, 2022 to monitor entry of juvenile Chinook into the Cougar Reservoir. Sampling at these sites includes the standard biological and environmental metrics in addition to the information found in Table 21, below.

Table 21. Sampling Conducted in the South Fork McKenzie River Above and below Cougar Dam During the 2022 Spring Season

Rotary Screw Trap Sample Site	Sample Period	Juvenile Chinook					
		Trap Efficiency Trials	PIT Tag >65mm	Elastomer Tag (<65 mm)	Scale Samples	Tissue Sample (DNA)	24-hour Holding (Post Collection)
Cougar Dam Tailrace PH & RO Channels	Year-round	Yes	Yes	No	No	No	Yes
Cougar Head of Reservoir	08 March - 30 June 2022	Yes	Yes	No*	Yes	Yes	No
*Marking of Chinook <65mm with Elastomer/VIE tags started in June 2022 and will continue during future sample periods at the Cougar Dam head of reservoir trap.							

Detailed results of this RST sampling can be found in preliminary reporting by EAS in their in-season reports available on the Corps' Willamette Valley Injunction RM&E webpage at https://pweb.crohms.org/tmt/documents/FPOM/2010/Willamette_Coordination/Willamette%20RME/InjunctionRME.html. Reporting of RST monitoring results, with detailed comparisons to historical passage data and current operations, will be done once per year, with the final report posted to the Corps' Willamette Valley Injunction RM&E webpage, anticipated to occur in early May annually (e.g., EAS's annual report including this 2022 period will be finalized and posted by May 2023 for sampling period of fall 2021 to fall 2022).

Operational data (Table 22) and preliminary data results for the December 1, 2021 to May 15,2022 sample period are presented in EAS 2022 and summarized in the tables and figures below.

Table 22 - South Fork McKenzie Rotary Screw Trap (RST) Sampling Outages during December 2021 to 15 May 2022 period.

Site	Date(s) of Trap Outage	Reason for Outage
Cougar Dam RO RST	05/05/2022	Trap was raised due to large increase in flow. Flow was reduced to a safe level during the night and the trap resumed fishing.
Cougar Dam RO RST	05/09/2022	Flows increased to a level that prevented safe access onto the trap. Flows were decreased later that night.
Cougar Dam Head of Reservoir	04/08/2022 to 04/22/2022	A large snow event restricted access to the site. Cone was raised the day before the storm in anticipation of the event. Road conditions were checked daily during this time.
Cougar Dam Head of Reservoir	05/05/2022 to 05/09/2022	Flows and debris load increased to levels that made it unsafe to fish or access the trap

Cougar Dam Tailrace RST summary data for Chinook captured during the December 1, 2021 to May 15, 2022 sample period, including the single five-foot diameter RST sampling in the Regulating Outlet (RO) and two eight-foot diameter RSTs sampling in the Powerhouse channel (PWR), is provided below.

Table 23 - Descriptive statistics of Chinook caught in the Cougar Dam tailrace Rotary Screw Traps (RST) including the Regulating Outlet (RO) and Powerhouse (PWR) channels during the 01 December 2021 to 15 May 2022 period.

Descriptive Statistics of Target Species Captured at the Cougar Dam Tailrace – 01 December 2021 to 15 May 2022										
Site	**Route**	**Species**	**Life stage**	**Collected**	**Length (mm)***			**Weight (g)***		
					Min	**Max**	**Mean**	**Min**	**Max**	**Mean**
Cougar Dam	RO	CHS	Fry	15	34	48	39.6	N/A	N/A	N/A
		CHS	Parr	129	56	164	108.2	1.2	41.1	14.6
		CHS	Smolt	210	92	230	140.0	8.8	86.1	29.1
Cougar Dam	PWR	CHS	Fry	331	27	47	37.5	N/A	N/A	N/A
		CHS	Parr	224	58	165	100.3	1.6	41.0	10.9
		CHS	Smolt	169	76	167	134.3	4.2	45.6	25.0

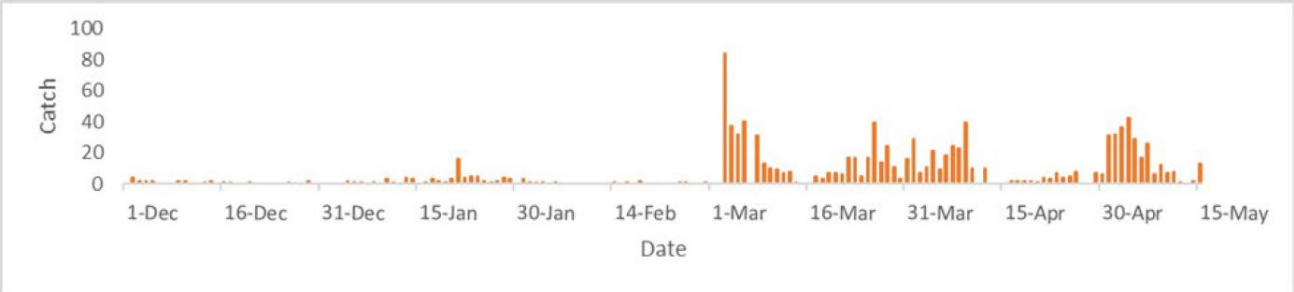

Figure 23 - Chinook captured in the Cougar Dam tailrace powerhouse and regulating outlet rotary screw traps (RSTs) during the 01 December 2021 to 15 May 2022 period.

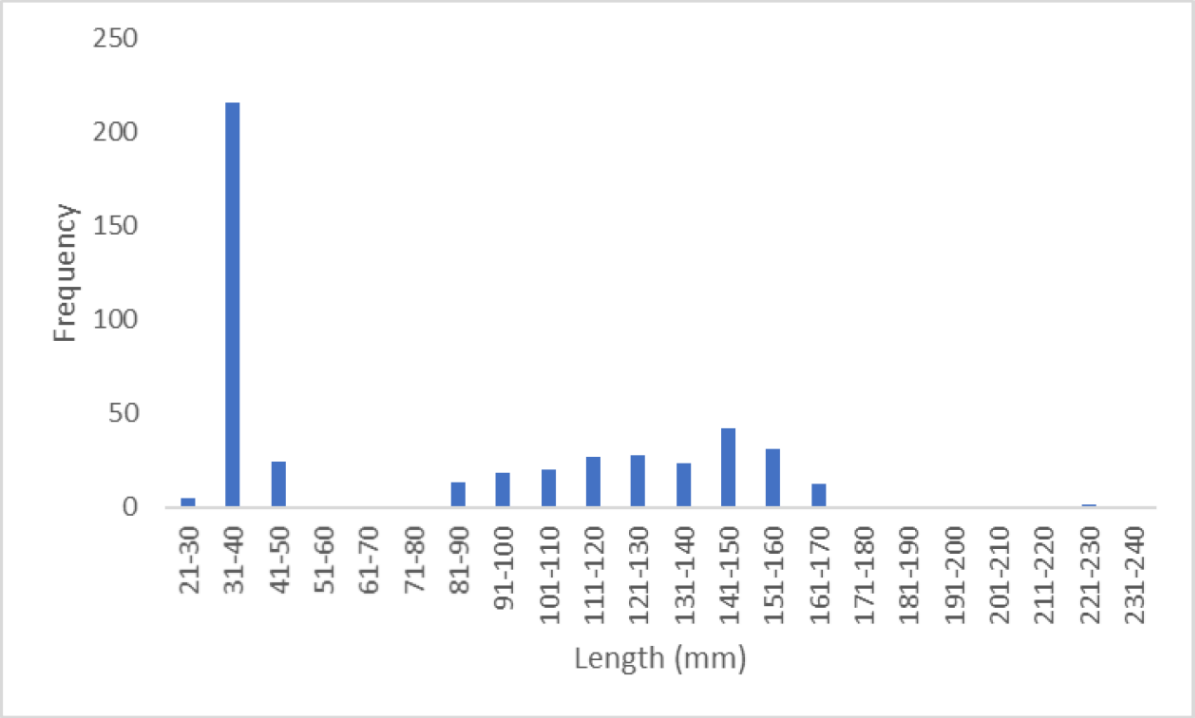

Figure 24 - Length frequency distribution of Chinook caught in all Cougar Dam tailrace rotary screw traps (RSTs), powerhouse and regulating outlet routes combined, for the 01 December 2021 to 15 May 2022 period combined.

For the December 1, 2021 to May 15, 2022 sample period, a total of 589 Chinook captured in the tailrace RSTs were held for ~24 hours in holding tanks and then evaluated for survival rates. Of the 589 total Chinook held for this effort, 300 fish were from the powerhouse (PWR) RST and 289 from the RO RST. In total, 472 of the fish (80.1%) held during this period were released alive. 31 of the 300 PWR RST captured fish (10.3%) died during holding and 86 of the 289 RO RST captured fish (29.8%) died during holding.

Cougar Dam Head of Reservoir RST summary data for Chinook captured in the five-foot diameter RST sampled upstream of the Cougar Dam reservoir on the South Fork McKenzie River for the sampling period of March 8 - June 30, 2022 is provided below:

November 16, 2021 to May 15 ,2022										
Site	Route	Species	Life stage	Collected	Length (mm)*			Weight (g)*		
					Min	Max	Mean	Min	Max	Mean
Cougar Dam Head of Reservoir	5 ft	CHS	Smolt	0	0	0	0	0	0	0
		CHS	Parr	36	58	150	90.3	2.3	11.2	7.4
		CHS	Fry	314	28	49	36.4	N/A	N/A	N/A

*Most fry are too small to collect accurate weights and thus some metrics are not available for them.

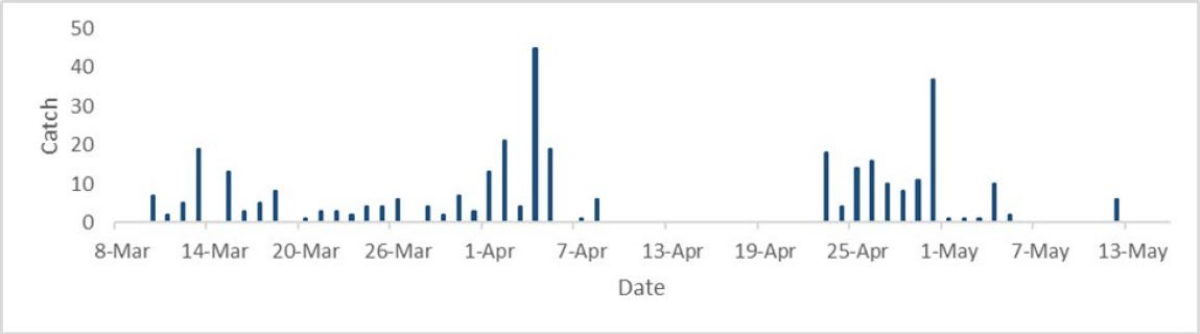

Figure 25 - Juvenile Chinook salmon capture timing for Cougar Dam head of reservoir rotary screw trap during the 08 March to 15 May 2022 sample period.

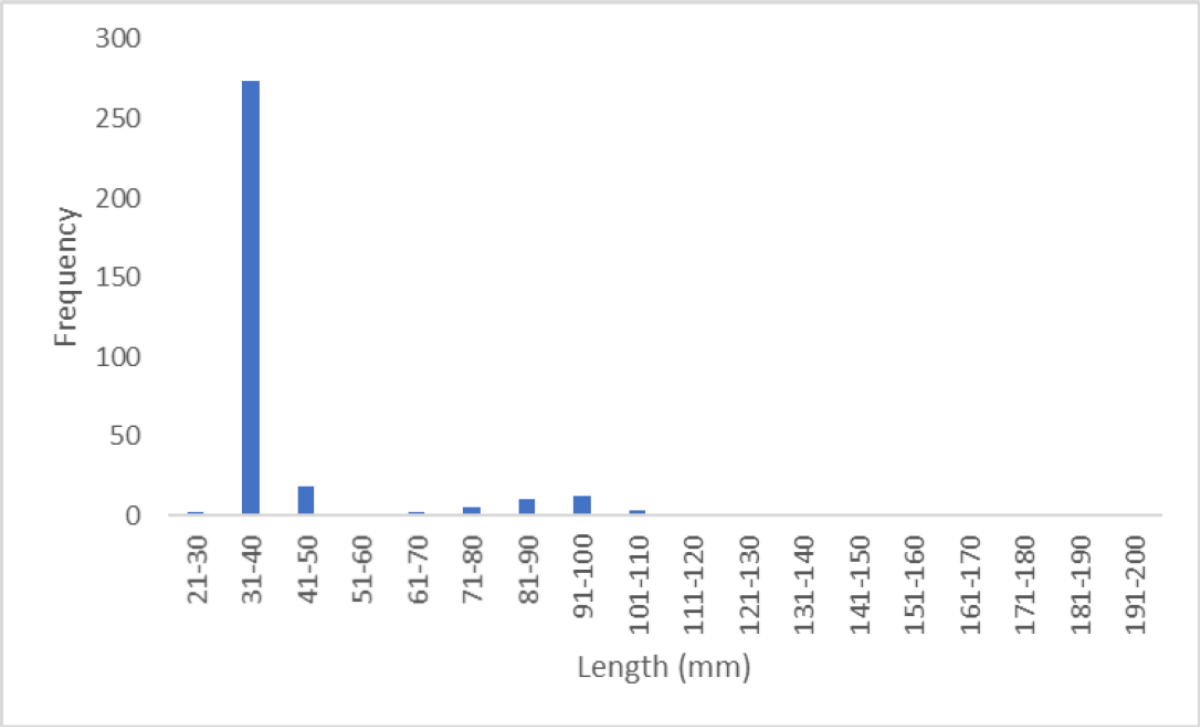

Figure 26 - Length frequency distribution of juvenile Chinook caught in the Cougar Dam head of reservoir Rotary Screw Trap during the 08 March to 15 May 2022 sample period.

Scales and fin clips (for DNA) were collected from 45 of the 350 Chinook captured (12.9%) during the March 8, 2022 - May 15, 2022 sample period. The rest of the captured fish were under the minimum fork length threshold and samples were not collected (less than 45 mm fork length for DNA and less than 50 mm fork length for scales).

Information regarding condition of juvenile salmonids, PIT-tagging efforts, collection of scales and fin-clips for future analysis, non-target fish capture, and other summary statistics caught in RSTs during this period is available in the data reports posted to the Corps' Willamette Valley Injunction RM&E webpage (i.e., EAS 2022 and biweekly in-season reports).

RM&E Planned for July – December 2022

The Corps has begun the coordination and contracting processes necessary to meet future RM&E requirements identified in the long-term RM&E plan. This includes development of contract actions for the following activities:

- RST monitoring is slated to be reinitiated at the Cougar Dam head of reservoir site on September 1, 2022 and occur February 1 to November 30 annually going forward, pending completion of the contracting process anticipated for August 2022.
- Releases of bulk-marked juvenile Chinook, including PIT tagging of sub-yearling Chinook in the fall and yearling Chinook in the spring. It is anticipated that hatchery fish from ODFW hatcheries in the respective sub-basins will be utilized following final coordination and contract modifications with ODFW (in-progress). Due to contracting and deployment timelines, it is anticipated that releases will begin with yearling Chinook in the winter/spring 2023.
- Releases of bulk-marked Chinook fry in the spring, marked with Visual Implement Elastomer (aka VIE and Elastomer tags). It is anticipated that hatchery fish from ODFW hatcheries in the respective sub-basins will be utilized following final coordination and contract modifications (in-progress). Due to contracting and deployment timelines, it is anticipated that releases will begin with Chinook fry in the winter/spring 2023.
- RST sampling will continue to occur above Cougar Reservoir and in the tailrace as shown in Table 24. In addition to collection of the standard biological and environmental data, RST sampling at the Middle Fork McKenzie sites is anticipated to include the metrics identified in Table 24, below.

Table 24. Sampling Planned Above and Below Cougar Dam Beginning in the Fall of 2022

Rotary Screw Trap Sample Site	Sample Period	Juvenile Chinook and Winter Steelhead (*O. mykiss*)					
		Trap Efficiency Trials	PIT Tag >65mm	Elastomer Tag (<65 mm)	Scale Samples	Tissue Sample (DNA)	24-hour Holding (Post Collection)
Cougar Dam Tailrace PH & RO Channels	Year-round	Yes	Yes	No	No	No	Yes
Cougar Head of Reservoir	*01 September to 30 November 2022 *01 February 2023 to 30 November 2023	Yes	Yes	Yes	Yes	Yes	No

Middle Fork Willamette River Injunction Measures

From January 1 – June 30, 2022, multiple injunction measures were implemented in the Middle Fork Willamette subbasin. These included:

- Hills Creek RO Prioritization (IM 8/Interim Measure 20)
- Spring Downstream Fish Passage Operations at Lookout Point/Dexter (IM 17)
- Fall Creek Winter/Spring Delayed Refill and Downstream Fish Passage Operation (IM 20)

The general operational plan for each of these measures can be found in Table 1 and Table 2 above, while more specific details can be found in respective Implementation Plans found on the Corps' website https://www.nwp.usace.army.mil/Locations/Willamette-Valley/Injunction/. Information regarding actual implementation during the January – June 2022 season is described below.

Hills Creek Dam

The Hills Creek nighttime RO downstream fish passage operation (IM8) was implemented from January 1 – March 1, 2022 while the reservoir was at or below El. 1460 ft. The purpose of this operation was to pass fish through a non-turbine outlet at night (with generation during the day) for improved downstream fish passage and survival (Figure 27). During the implementation of this measure, the operation was briefly put on hold during a large rain event that hit the region in early January. Otherwise, this operation was carried out according to plan (Figure 27).

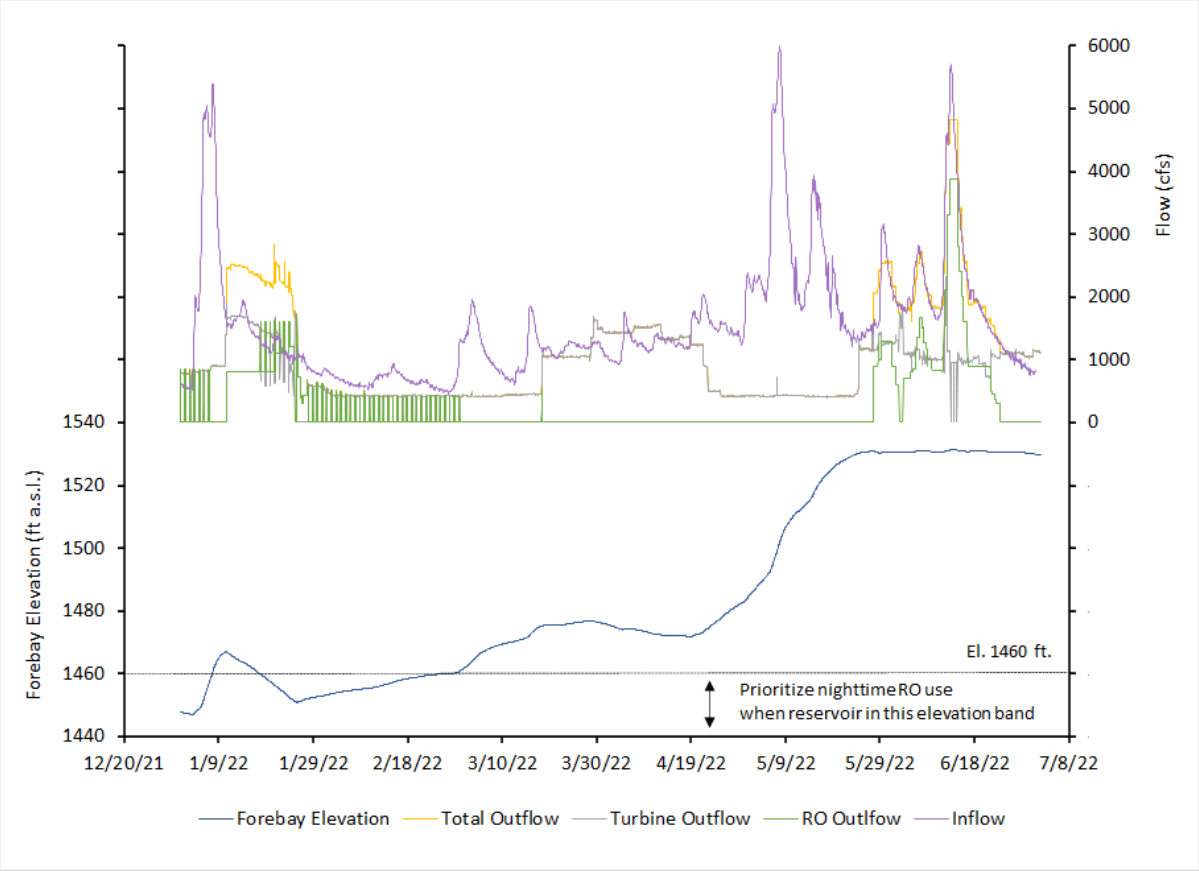

Figure 27. Hills Creek Dam Operations, January 01 - June 30, 2022

TDG conditions were monitored downstream of Hills Creek Dam using a hydrolab for much of the winter and spring. In late May, the USGS installed a real-time TDG instrument downstream of Hills Creek, which will replace the hydrolab and be used to monitor TDG conditions in real-time moving forward.

As shown in Figure 28, from January 1 – June 30, TDG conditions downstream of Hills Creek Dam generally remained below the State of Oregon water quality standard of 110% saturation, except for in mid-June when a very late season category 5 atmospheric river hit the region. Due to the full reservoir, the high flows generated by the weather system were evacuated rather than stored; Hills Creek project outflows peaked to just under 6,000 cfs while RO releases peaked to ~3,800 cfs. Resultant downstream TDG increased to 112% during this event.

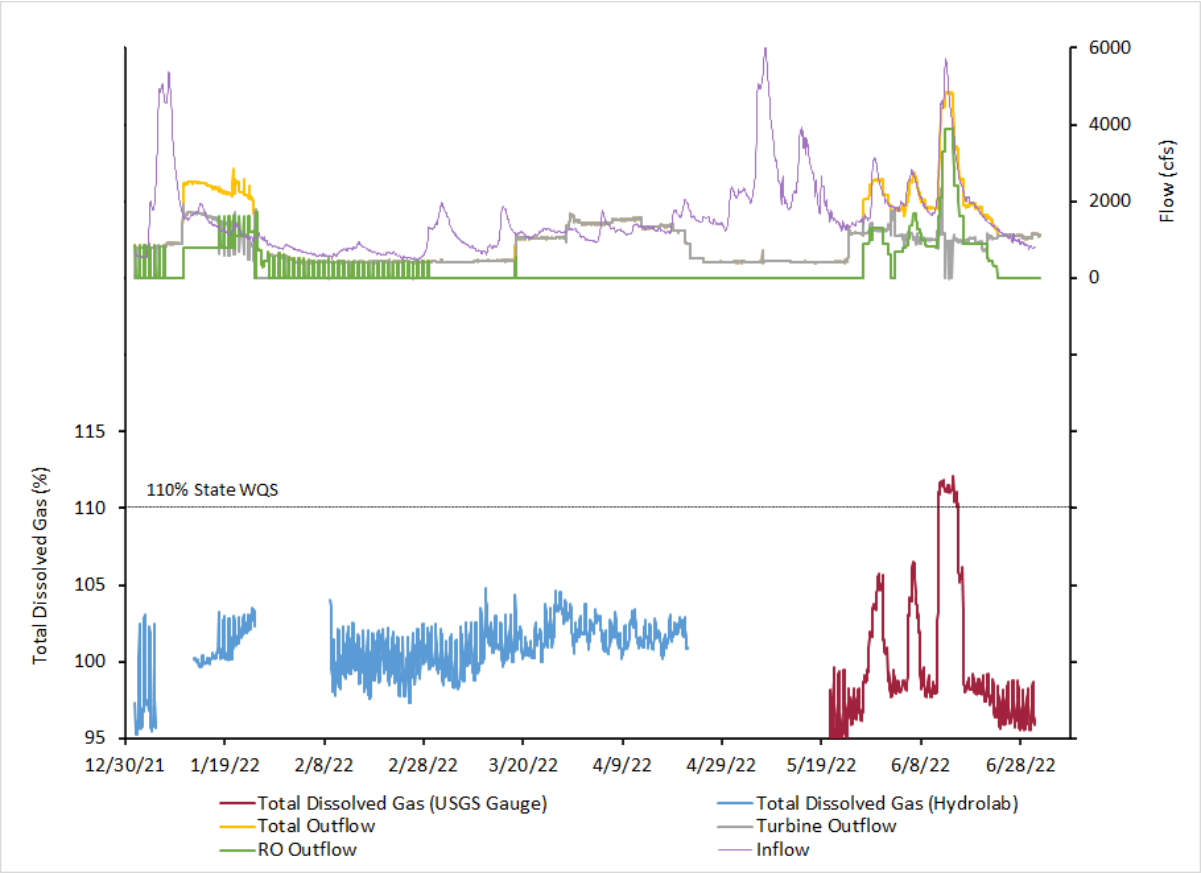

Figure 28. Hills Creek Dam Operations and Downstream Total Dissolved Gas, January 01 - June 30, 2022

Lessons Learned

With the installation of a real-time TDG gauge downstream of Hills Creek Dam, the relationship between project operations and TDG production will continue to be monitored. As information is collected, updates to the Corps' TDG Calculator will be made.

Operations Planned for July – December 2022

Hills Creek Reservoir refilled to above El. 1460 ft. on March 1, and the nighttime RO operation for downstream fish passage concluded. Over the next six months, routine operations will be implemented at Hills Creek Dam until the reservoir is once again drawn down to below El. 1460 ft. At that time, IM 8 will be reinitiated for downstream fish passage.

RM&E

Of note for purposes of interpreting RST results, no adult spring Chinook were outplanted above Hills Creek in calendar year 2021 due to low returns of adults to the Middle Fork Willamette River. While 100,000 juvenile hatchery spring Chinook are typically released annually above Hills Creek Dam, juvenile Chinook were not outplanted above Hills Creek Dam in 2021 due to the low adult returns in 2020 and prioritization of hatchery juvenile Chinook releases in the Middle Fork Willamette River below Hills Creek Dam. For additional information, see the W-FPOM MFR, Title - 21DEX02 MFR Middle Fork Willamette Adult Chinook Outplanting, Subject - W9127N19C0030, Middle Fork Willamette Adult Chinook Outplanting and Juvenile Fingerling Release(s) (http://pweb.crohms.org/tmt/documents/FPOM/2010/Willamette_Coordination/2021_WFPOM/2021_SEP/).

Two RSTs were operated below Hills Creek Dam during the nighttime RO operation with installation completed on October 12, 2021 and sampling occurring from October 15, 2021 to March 1, 2022. Due to channel bathymetry and logistical and safety constraints associated with deployment of a RST below the RO, a five-foot diameter RST was deployed in the RO channel below the confluence with the powerhouse channel (i.e., in the combined channel below the RO and powerhouse). Therefore, for comparison purposes, a second RST was placed and operated in the powerhouse channel. This powerhouse RST was an eight-foot diameter RST located where there is sufficient depth for a large RST. Raw unadjusted catch numbers presented herein do not reflect the differences in trap capture efficiencies between the two different traps.

The Corps had intended to operate these RSTs through mid-March 2022; however, due to lack of available screw traps, the screw traps at Hills Creek were removed on March 1, 2022 upon completion of nighttime spill for use at other upcoming sample sites while new RSTs were procured for future sampling efforts. The RSTs were able to be operated for the full duration of the nighttime RO spill period without interruption. Sampling at these sites included the information found in Table 25, below.

Table 25. Sampling Conducted in the Hills Creek Dam Tailrace During the 2022 Spring Season

Rotary Screw Trap Sample Site	Sample Period	Juvenile Chinook and Winter Steelhead (*O. mykiss*)					
		Trap Efficiency Trials	PIT Tag >65mm	Elastomer Tag (<65 mm)	Scale Samples	Tissue Sample (DNA)	24-hour Holding (Post Collection)
Hills Creek Dam Tailrace PH & RO	15 October 2021 to 01 March 2022	Yes	No*	No*	No	No	No*
*Sampling at the Hills Creek Dam tailrace concluded for the winter 2021/2022 period before all RM&E activities could be initiated; these additional tasks will be completed in future rotary screw trap sampling periods.							

Detailed results of this RST sampling can be found in preliminary reporting by EAS in their in-season reports available on the Corps' Willamette Valley Injunction RM&E webpage at https://pweb.crohms.org/tmt/documents/FPOM/2010/Willamette_Coordination/Willamette%20RME/InjunctionRME.html. Reporting of RST monitoring results, with detailed comparisons to historical passage data and current operations, will be done once per year, with the final report posted to the Corps' Willamette Valley Injunction RM&E webpage, anticipated to occur in early May annually (e.g., EAS's annual report including this 2022 period will be finalized and posted by May 2023 for sampling period of fall 2021 to fall 2022).

Operational data and preliminary data results for the December 1, 2021 to May 15, 2022 sample period are presented in EAS 2022 and summarized in the tables and figures below (Table 26, Figure 29, Figure 30). These preliminary results are raw unadjusted catch numbers and do not reflect the differences in trap capture efficiencies. Information regarding condition of juvenile salmonids, PIT-tagging efforts, collection of scales and fin-clips for future analysis, non-target fish capture, and other summary statistics caught in RSTs during this period is available in the data reports posted to the Corps' Willamette Valley Injunction RM&E webpage (i.e., EAS 2022 and biweekly in-season reports).

Table 26 - Descriptive statistics for juvenile Chinook captured in the Hills Creek Dam tailrace traps including the regulating outlet channel (RO) and powerhouse channel (PWR) during the 16 November 2021 to 28 February 2022 period.

Site	Route	Species	Life stage	Collected	Length (mm)*			Weight (g)*		
					Min	Max	Mean	Min	Max	Mean
Hills Creek	RO	CHS	Parr	5	90.0	141.0	110.6	7.4	23.4	13.5
		CHS	Smolt	27	201.0	265.0	239.7	77.76	192.3	151.6
Hills Creek	PWR	CHS	Parr	7	69.0	127.0	98.1	3.7	24.5	11.2
		CHS	Smolt	25	128.0	265.0	224.3	26.2	188.7	130.6

*Fish that were missing heads are not included in length and weight calculations. One fish was a head only and could not be assigned a life stage

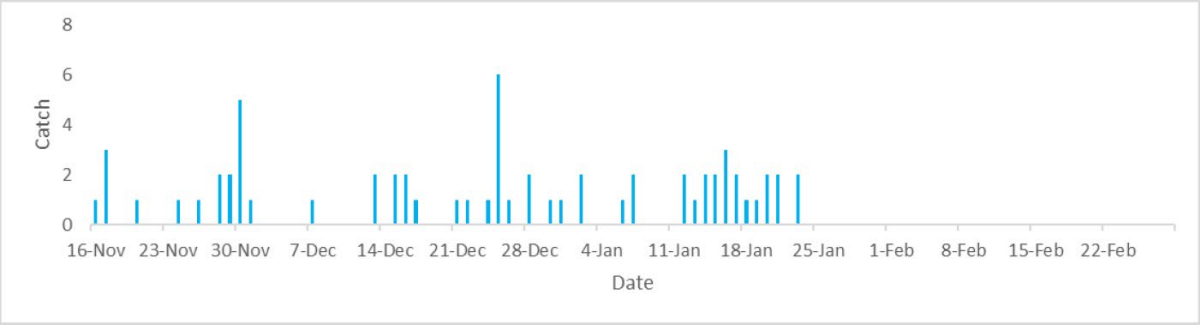

Figure 29 - Capture timing distribution of juvenile Chinook caught in the rotary screw traps in the Hills Creek Dam tailrace. Catch represents juvenile Chinook captured in both regulating outlet and powerhouse channel rotary screw traps for the 16 November 2021 to 28 February 2022 period.

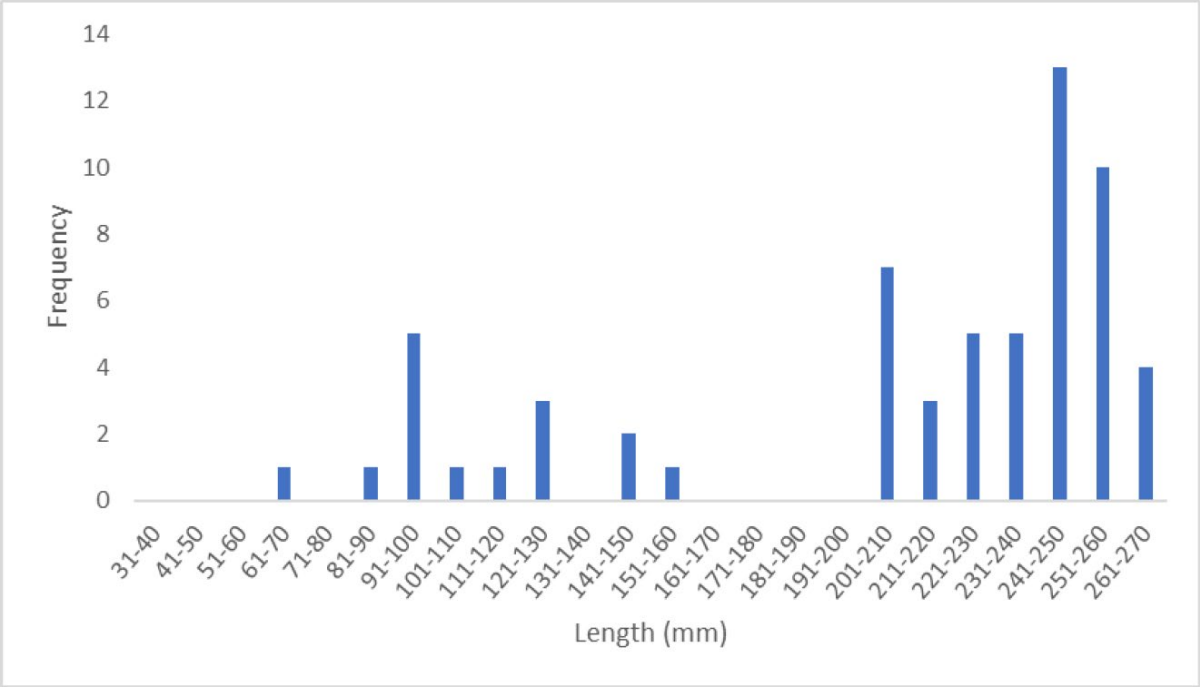

*Figure does not include fish without heads (2)

Figure 30. Size distribution of Chinook collected from the Hills Creek Dam tailrace screwtraps, which operated from 16 November 2021 through 01 March 2022

RM&E Planned for July – December 2022

The Corps has begun the coordination and contracting processes necessary to meet additional RM&E requirements identified in the long-term RM&E plan. This includes development of contract actions for the following activities:

- Releases of bulk-marked juvenile Chinook, including PIT tagging of sub-yearling Chinook in the fall and yearling Chinook in the spring above and below Hills Creek Dam as specified in the long-term RM&E plan. It is anticipated that hatchery fish from ODFW hatcheries in the respective sub-basins will be utilized following final coordination and contract modifications with ODFW (in-progress). However, due to the low returns of adult Chinook to the Middle Fork Willamette Sub-basin in 2021 and the resulting Brood Year (BY) 21 MF Willamette juvenile Chinook shortfall, it is anticipated that ODFW will not make juvenile BY21 Chinook available to the Corps for conducting these bulk releases for the respective late 2022 and early 2023 releases. It is therefore anticipated that releases will generally begin with subyearling Chinook in the fall 2023 and yearling Chinook in the winter/spring 2024 if sufficient BY22 MF Willamette juvenile Chinook are available.
- Releases of bulk-marked Chinook fry in the spring, marked with Visual Implement Elastomer (aka VIE and Elastomer tags) to evaluate passage through Hills Creek Dam and Reservoir. It is anticipated that hatchery fish from ODFW hatcheries in the respective sub-basins will be utilized following final coordination and contract modifications with ODFW (in-progress). Due to contracting and deployment timelines, it is anticipated that releases will begin with Chinook fry in the winter/spring 2023. It is unknown at this time whether sufficient BY22 juvenile Chinook will be available in sufficient quantities for conducting these fry releases.

- EAS, under contract to the Corps, will be conducting RST sampling in the Hills Creek Dam tailrace for the winter 2022/2023 RO spill operation. The Corps is in the process of RST sampling for the Hills Creek Dam head of reservoir site with an anticipated contract award in fall 2022 and sampling start in February 2023. In addition to the standard biological and environmental RST sampling metrics, RST sampling at the Hills Creek sites is included in Table 27, below.

Table 27 - Rotary Screw Trap (RST) Sampling Planned Above and Below Hills Creek Dam Beginning in the Fall of 2022

Rotary Screw Trap Sample Site	Sample Period	Juvenile Chinook and Winter Steelhead (*O. mykiss*)					
		Trap Efficiency Trials	PIT Tag >65mm	Elastomer Tag (<65 mm)	Scale Samples	Tissue Sample (DNA)	24-hour Holding (Post Collection)
Hills Creek Dam Tailrace PH & RO	15 September 2022 to 30 June 2023	Yes	Yes	Yes	No	No	Yes
Hills Creek Dam Head of Reservoir	01 February 2023 to 30 June 2023	Yes	Yes	Yes	Yes	Yes	No

Lookout Point/Dexter Dams

Due to dry conditions observed in the Middle Fork subbasin in late winter/early spring, Lookout Point Reservoir did not refill to above spillway crest (El. 887.5 ft.) until April 22 (Figure 31). Once above spillway crest, the reservoir was held at a flat elevation, and the spillway gates were pulled out of the water for an un-gated and continuous surface spill operation (IM 20) for 30 days. During this time, all flow was released through the spillway at Dexter Dam as well, and the turbines were not used at either project during the operation (April 22 – May 23) with one exception. From May 6 – May 9, the Lookout Point turbines were used to pass high flows caused by a large rain event. This allowed the reservoir elevations at Lookout Point to remain steady and once the event passed, the turbines were discontinued for the remainder of the un-gated spill operation. During this time, Dexter turbines remained offline (Figure 32, left-most red circle).

On May 23, the Lookout Point spillgates were placed back in the water and the reservoir was allowed to refill, at which point the continuous un-gated spill operation concluded and the gated, nighttime surface spill operation began. Nighttime spill operations at Lookout Point and Dexter Dams were carried out through June 30 with the exception of the June rain event when the turbines at Lookout Point were used to pass high inflows continuously for four days (June 10-14) (Figure 32, right-most red circle). Once the rain event subsided, turbine operations were shifted back to daytime only.

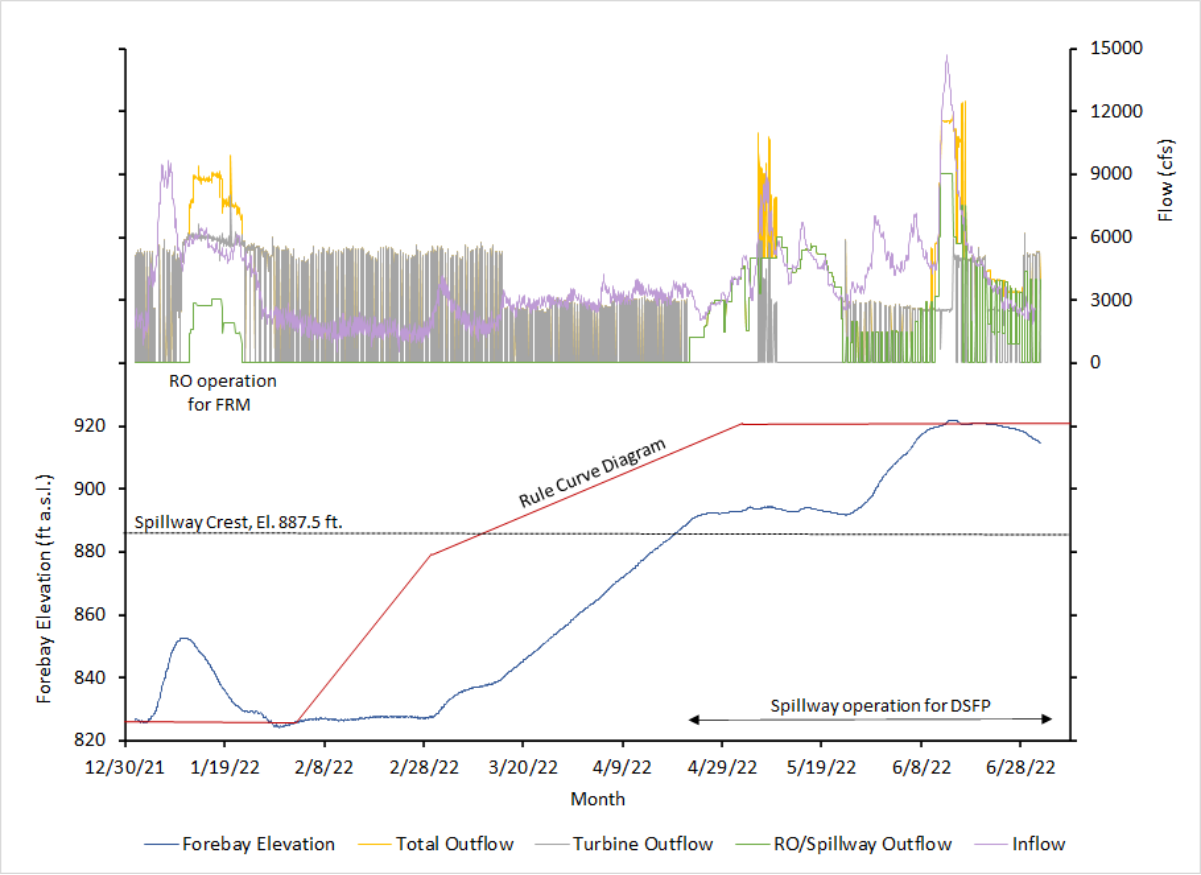

Figure 31. Lookout Point Dam Operations, January 01 - June 30, 2022

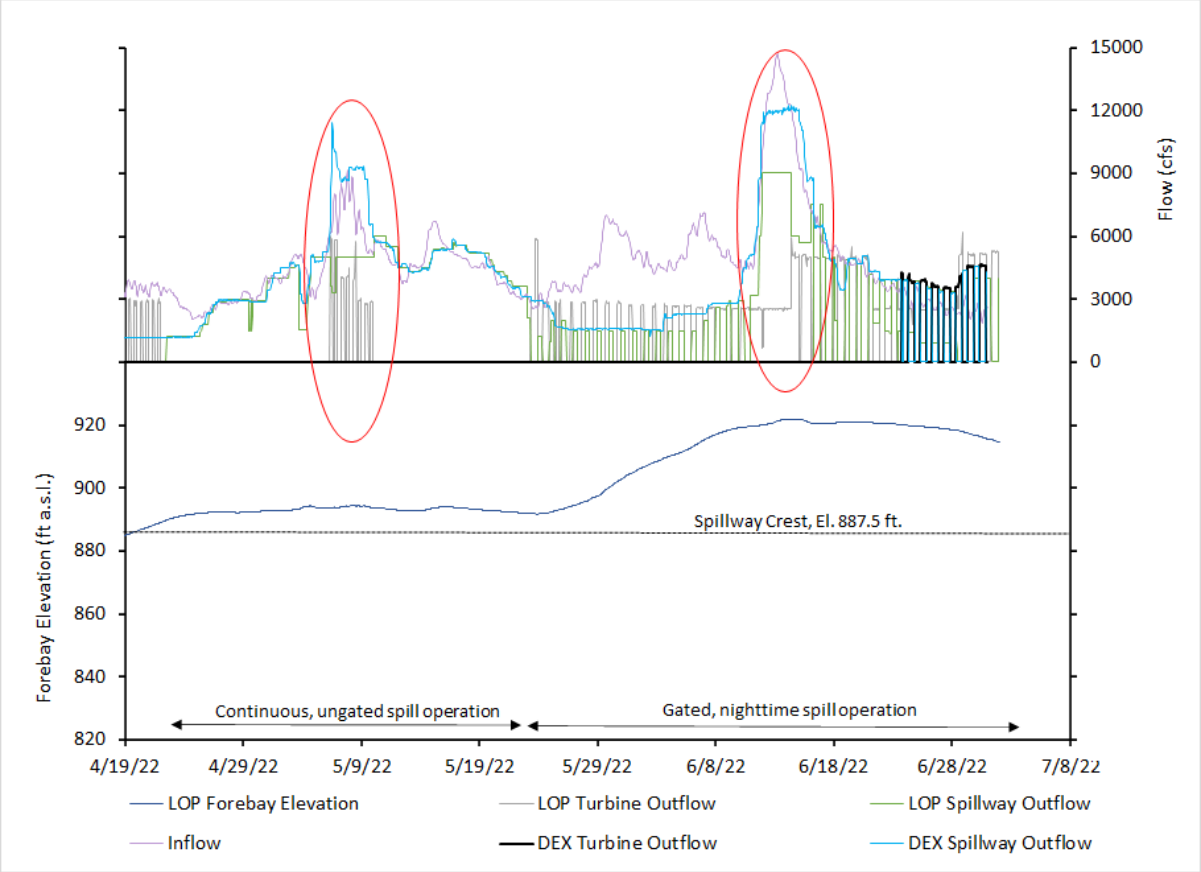

Figure 32. Lookout Point and Dexter Dam Operations During the Implementation of IM 17.

A hydrolab was deployed downstream of Lookout Point Dam to monitor TDG conditions in the tailrace. Additionally, the established USGS TDG gauge located downstream of Dexter Dam was also used to monitor conditions. As shown in Figure 33 below, TDG measurements between the two locations were fairly similar when non-turbine outlets were used to discharge water from Lookout Point and Dexter dams. TDG measured at the Dexter gauge responded to both Lookout Point and Dexter spill operations. When Lookout Point was spilling, TDG conditions in the tailrace were higher than that measured at the Dexter gauge generally. TDG was recorded at its highest levels at both gauges during the June event when a category 5 atmospheric river hit the region. Due to a nearly full reservoir at Lookout Point, much of that water had to be discharged with outflows peaking to ~12,000 cfs from both projects.

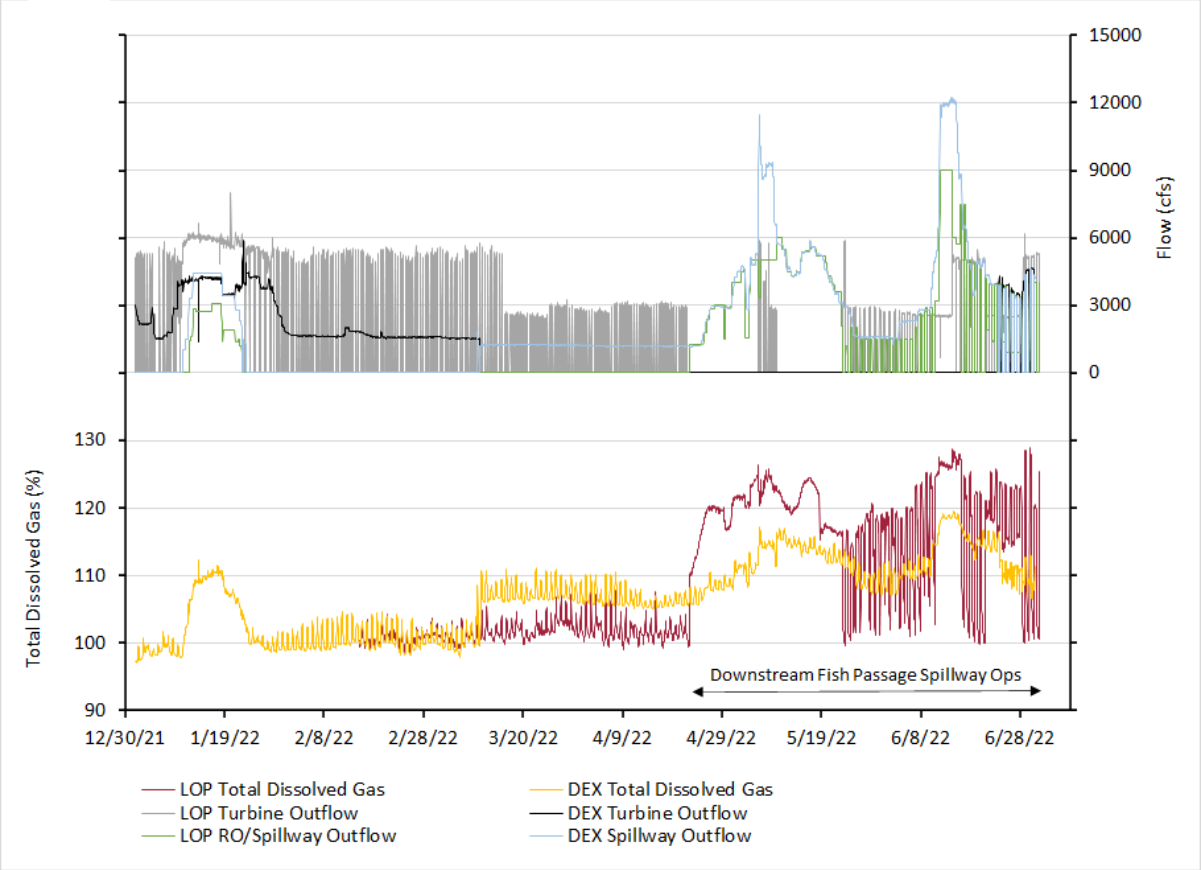

Figure 33. Lookout Point and Dexter Dam Operations and Downstream Total Dissolved Gas Saturations Measured in the Lookout Point Tailrace and at the USGS Gauge Downstream of Dexter Dam, January 01 - June 30, 2022

Lessons Learned

When the non-turbine units are used at Lookout Point Dam to discharge water, TDG conditions in the Lookout Point tailrace often exceed 120% TDG. Furthermore, water temperatures measured in the screwtraps downstream of Lookout Point dam exceeded 68°F during the late spring surface spillway operation. These impacts should be considered while sampling during next year's spring Lookout Point spillway operation for downstream fish passage.

Operations Planned for July – December 2022

On July 15, Lookout Point Reservoir was drawn down to El. 900 ft.[6] to allow for the safe operation of the regulating outlets for downstream water temperature management when water temperatures measured at the USGS gauge downstream of Dexter Dam near 60°F. Summer water temperature management has been carried out mostly through the use of the turbines, but the regulating outlets have recently been operated (as of late August) to cool downstream water temperature conditions.

[6] Originally, Corps guidance directed the reservoir be drawn down to El. 887.5 ft or below prior to use of the Lookout Point ROs. However, after further investigation, it has been determined that the ROs can safely be used at higher reservoir elevations (El. 900 ft. and lower).

Lookout Point Fall Deep Drawdown

The Corps continues to work towards implementation of a deep drawdown operation at Lookout Point Dam in the fall of 2023. In December 2021, the Corps established a technical team to design, procure, and install an alternative water supply for the transformers at Lookout Point Dam and the fire suppression system for the adjacent administrative building for use when the reservoir is drawn down below the water supply intake for those systems during the deep drawdown. The team has subsequently developed a plan for the alternative water supply, which will be procured and installed in time for the deep drawdown to occur in fall 2023.

As required by IM 16, the Corps completed an analysis of the landslide risk associated with the deep drawdown and submitted the landslide risk analysis and its recommendation on the deep drawdown operation to the Court on January 31, 2022. The Corps concluded that there is likely a low probability of landslide activation due to the proposed deep drawdown but that the consequences to Union Pacific Railroad (UPRR) railroad infrastructure and Oregon Department of Transportation (ODOT) highway infrastructure in the unlikely event of slope failure would be significant. As such, the Corps did not recommend proceeding with a deep drawdown operation unless certain mitigation measures—namely the completion of a geotechnical investigation, installation of monitoring instruments, and completion of a monitoring plan and emergency action plan—are in place prior to commencing the drawdown.

The Corps initially proposed conducting the geotechnical investigation and installing monitoring instruments at historical landslide locations within the UPRR railroad right-of-way and made repeated attempts to obtain access from UPRR to its right-of-way to conduct those activities. However, it has since become apparent to the Corps that it is unlikely that the Corps would be able to obtain access from UPRR to conduct the investigation and install the monitoring instruments in time for the deep drawdown operation to occur in fall 2023. Therefore, the Corps reevaluated whether there are any sufficient landslide risk mitigation actions that could be implemented in time for the drawdown to occur in fall 2023 that do not require access to UPRR's right-of-way.

The Corps recently determined that the locations for the geotechnical investigation and installation of monitoring instruments at historical landslide locations could be moved downslope toward the reservoir onto Corps land and still provide the needed monitoring data with no additional risk. This plan will require the Corps' contractor to access the sites by barge over the reservoir with a drill rig in order to drill the instrument holes rather than accessing sites across UPRR property. The Corps is preparing a task order to have the work performed in spring/early summer 2023, which will allow the deep drawdown operation to begin in fall 2023.

Concurrently with the work on the geotechnical investigation and installation of monitoring instruments, the Corps has made substantial progress on the preparation of the Deep Drawdown – Monitoring and Response Plan (DDMRP). The Corps has continued coordination with ODOT and will invite both ODOT and UPRR to review and comment on the draft DDMRP.

RM&E

A combination of RSTs are deployed above and below the Lookout Point and Dexter Dam complex to monitor juvenile Chinook passage through this reach of the Middle Fork Willamette River. A single

five-foot diameter RST is deployed above Lookout Point Reservoir (below the North Fork Middle Fork Willamette River confluence). Three eight-foot diameter RSTs are deployed in the Lookout Point Dam tailrace. A single five-foot diameter RST is deployed in the Dexter Dam tailrace. The RSTs above Lookout Point Dam reservoir and in the Dexter Dam tailrace were slightly delayed in initial deployment in early 2022 due to RST acquisition delays associated with industry wide shortages of materials (stainless steel perforated plate in this instance). Sampling at these sites for this period is summarized in Table 28 and Table 29, below.

Table 28. Sample Periods for Rotary Screw Trap (RST) Sampling Conducted Above and Below Lookout Point and Dexter Dams During the 2022 Spring Season.

Dexter Dam Tailrace RST	Highline Install	03/02/2022	03/02/2022	1
Dexter Dam Tailrace RST	Trap Install	03/03/2022	03/03/2022	1
Dexter Dam Tailrace RST	Operation	03/09/2022#	12/16/2022	285
Dexter Dam Tailrace RST	Trap Efficiency Release (988 Fish)	03/23/2022	03/23/2022	1
Lookout Dam Tailrace RSTs	Operation	03/15/2022	07/31/2022	139
Lookout Dam Tailrace RSTs	Trap Efficiency Release (1,013 fish, PWR route)	04/13/2022	04/13/2022	1
Lookout Point Head of Reservoir RST	Trap Install	03/06/2022	03/06/2022	1
Lookout Point Head of Reservoir RST	Operation	03/10/2022 #	12/16/2022	285
Lookout Point Head of Reservoir RST	Trap Efficiency Release (993 fish)	04/05/2022	04/05/2022	1
Lookout Point Head of Reservoir RST	Trap Efficiency Release (989 fish)	04/14/2022	04/14/2022	1

Site started sampling later than original monitoring start date due to delay in receiving rotary screw trap from manufacturer.

Table 29 - Sampling Conducted Above and Below Lookout Point and Dexter Dams During the 2022 Spring Season

Rotary Screw Trap Sampling Site	Trap Efficiency Trials	Target Species	Biological and Injury Data	Scale and DNA Samples **	24-hr Holds (Post Collection)**	PIT Tagging** (<65 mm)	Elastomer Tagging** (>65 mm)
Dexter Dam Tailrace	Yes- Hatchery Fish	Spring Chinook	Yes- weight (nearest 0.1 g), FL (mm), Injuries	Scales taken on subset of collected fish	Yes	Yes- on fish not included in 24-hr holds.	No
Lookout Dam Tailrace *	Yes- Hatchery Fish	Spring Chinook	Yes- weight (nearest 0.1 g), FL (mm), Injuries	Scales taken on subset of collected fish	Yes	Yes- on fish not included in 24-hr holds.	No
Lookout Point Head of Reservoir	Yes- Hatchery Fish	Spring Chinook	Yes- weight (nearest 0.1 g), FL (mm), Injuries	Yes	No	Yes	Yes

*The Lookout Point Dam tailrace where the rotary screw traps sample is often impacted by high surface water temperatures; sampling efforts often stop during summer periods when water temperatures are high in order to comply with NMFS and ODFW permit requirements.
**Implementation of certain requirements has been phased in as the requirements have been identified, subsequent contracting actions could be taken, and equipment/materials and permits obtained for implementation.

Detailed results of this RST sampling can be found in preliminary reporting by EAS in the in-season reports available on the Corps' Willamette Valley Injunction RM&E webpage at https://pweb.crohms.org/tmt/documents/FPOM/2010/Willamette_Coordination/Willamette%20RME/InjunctionRME.html. Reporting of RST monitoring results, with detailed comparisons to historical passage data and current operations, will be done once per year, with the final report posted to the Corps' Willamette Valley Injunction RM&E webpage, anticipated to occur in early May annually (e.g., EAS's annual report including this 2022 period will be finalized and posted by May 2023 for sampling period of fall 2021 to fall 2022).

Operational data (Table 30) and preliminary data results for the March 2022 to May 15, 2022 sample period are presented in EAS 2022 and summarized in the tables and figures below. Information regarding condition of juvenile salmonids, PIT-tagging efforts, collection of scales and fin-clips for future analysis, non-target fish capture, and other summary statistics caught in RSTs during this period is available in the data reports posted to the Corps' Willamette Valley Injunction RM&E webpage (i.e., EAS 2022 and biweekly in-season reports).

Table 30 - Rotary Screw Trap sampling outages for the Dexter Dam tailrace, Lookout Point Dam tailrace, and Lookout Point Dam head of reservoir site during the winter/spring 2022 sampling period.

Site	Date(s) of Trap Outage	Reason for Outage
Dexter Dam Tailrace	05/05/2022 to 05/07/2022	Forecasted high flows prompted raising the cone to the non-sampling position. Trap resumed fishing after spill patterns were changed to allow for safe access and sampling
Lookout Point Dam Tailrace	05/05/2022 to 05/10/2022	Flows and debris load increased to levels that made it unsafe to fish or access the trap
Lookout Point Head of Reservoir	03/01/2022 to 03/10/2022	Trap was not available for install until 03/10/2022
Lookout Point Head of Reservoir	05/05/2022 to 05/10/2022	Flows and debris load increased to levels that made it unsafe to fish or access the trap
Lookout Point Head of Reservoir	05/14/2022 to 05/16/2022	Flows and debris load increased to levels that made it unsafe to fish or access the trap

Preliminary data results for fish collected entering Lookout Point Reservoir during the March 10 to May 15, 2022 period are reported in the table and figures below based on sampling at the Lookout Point Head of Reservoir RST (Table 31, Figure 34, Figure 35).

Table 31 - Descriptive statistics for juvenile Chinook captured at the Lookout Point Dam head of reservoir rotary screw trap sampling site during the 10 March to 15 May 2022 sample period.

Site	Route	Species	Life stage	Collected	Length (mm)*			Weight (g)*		
					Min	Max	Mean	Min	Max	Mean
Lookout Point Head of Reservoir	5 ft	CHS	Smolt	0	0	0	0	0	0	0
		CHS	Parr	26	51	115	93.0	1.5	19.8	8.5
		CHS	Fry	31	28	49	35.7	N/A	N/A	N/A

*Some fry are too small to accurately weigh and are omitted from the above tables..

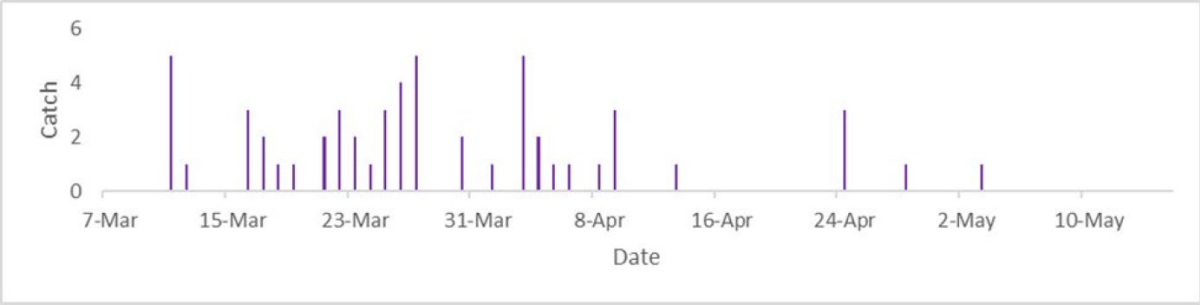

Figure 34 - Rotary Screw Trap (RST) Chinook capture distribution at the Lookout Point head of reservoir rotary screw trap during the 10 March to 15 May 2022 sample period.

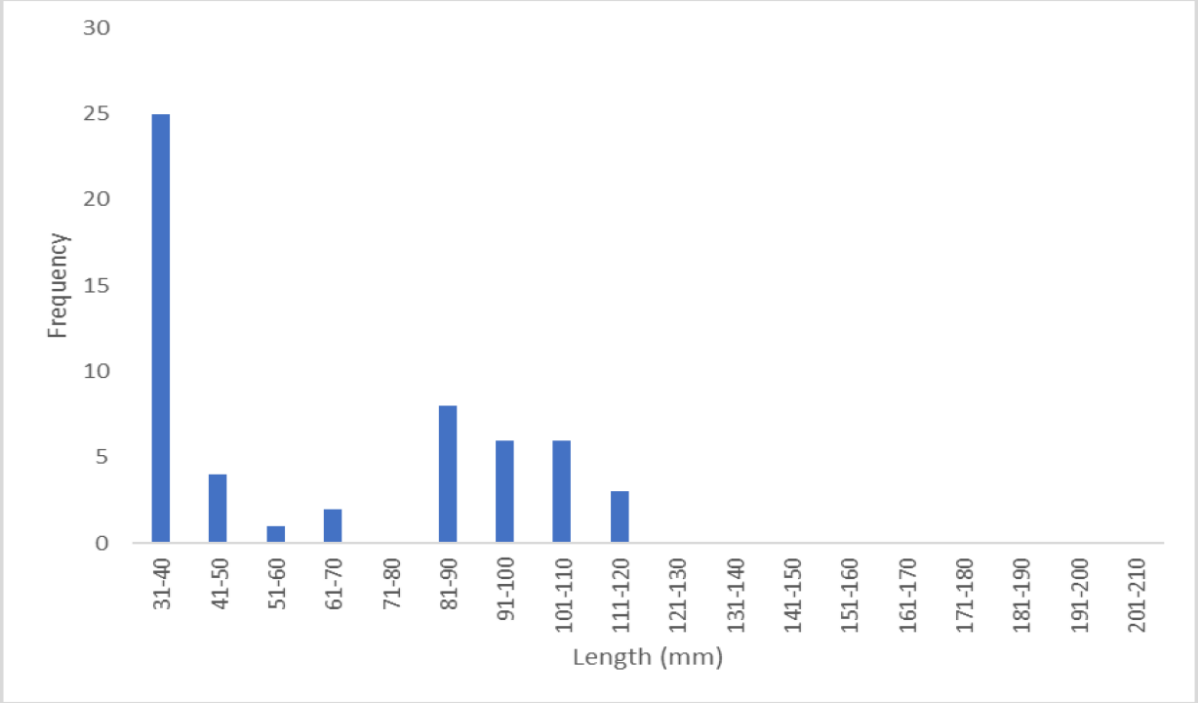

Figure 35 - Rotary Screw Trap (RST) Chinook length frequency distribution at the Lookout Point head of reservoir rotary screw trap during the 10 March to 15 May 2022 sample period.

Of the 57 Chinook captured during March 10 to May 15, 2022, 30 had tissue samples (for DNA) sampled and 28 had scales taken. All other Chinook collected during this time period were under sampling size thresholds.

Preliminary data results for fish collected exiting Lookout Point Dam during the March 10 to May 15, 2022 period are reported in the table and figures below based on sampling at the Lookout Point tailrace RSTs (Table 32, Figure 36, Figure 37).

Table 32 - Summary statistics for juvenile Chinook captured in the Lookout Point Dam tailrace rotary screw traps (RSTs) during the 15 March to 15 May 2022 sample period. Two RSTS sample in the powerhouse channel (PH 1 and PH 2); one RST samples in the spillway channel (Spill).

Site	Route	Species	Life	Collected	Length (mm)*			Weight (g)*		
			stage		Min	Max	Mean	Min	Max	Mean
Lookout Point Dam	PH 1	CHS	Smolt	10	154	266	183.4	44.5	108.9	70.6
		CHS	Parr	1	107	107	107	5.3	5.3	5.3
		CHS	Fry	0	0	0	0	0	0	0
	PH 2	CHS	Smolt	0	0	0	0	0	0	0
		CHS	Parr	0	0	0	0	0	0	0
		CHS	Fry	0	0	0	0	0	0	0
	Spill	CHS	Smolt	9	124	194	161.2	19.7	63.0	47.1
		CHS	Parr	1	104	104	104	13.5	13.5	13.5
		CHS	Fry	0	0	0	0	0	0	0

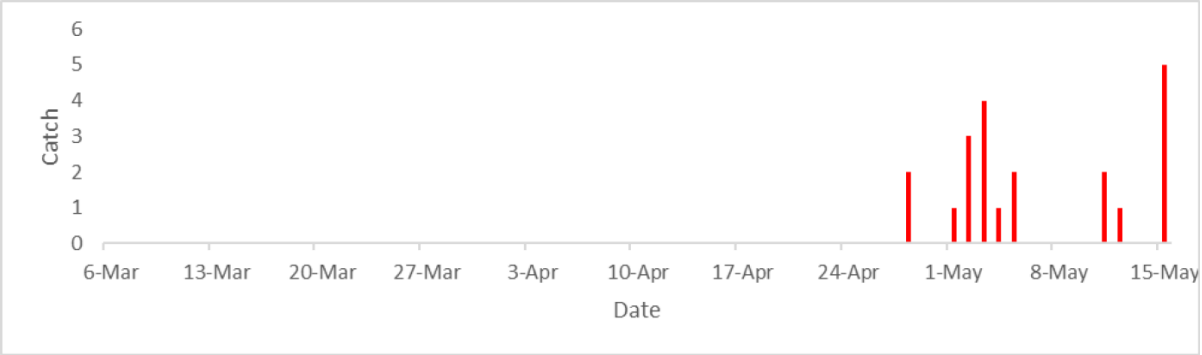

Figure 36 - Rotary Screw Trap (RST) Chinook capture distribution at the Lookout Point Dam tailrace rotary screw traps (all RSTs combined) during the 15 March to 15 May 2022 sample period.

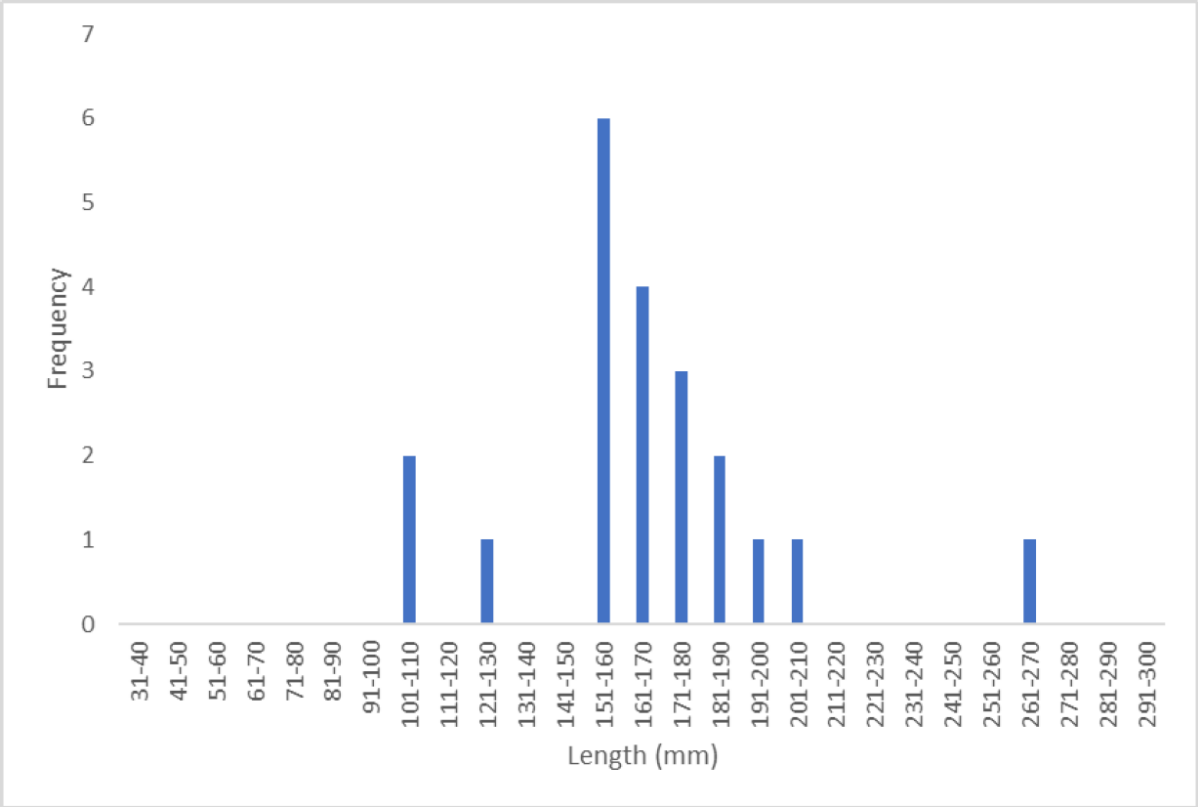

Figure 37 - Rotary Screw Trap (RST) Chinook length frequency distribution at the Lookout Point Dam tailrace rotary screw traps (all RSTs combined) during the 15 March to 15 May 2022 sample period.

Up to 60 live non-immediately moribund juvenile Chinook per week were to be held for 24 hours post-collection (i.e., from time of sampling, typically once per day). A total of 9 Chinook captured in the RSTs were held for 24 hours post-collection during this reporting period. 7 of the 9 juvenile Chinook were released alive (77.8%). One Chinook was captured and held from one of the Powerhouse RSTs. This fish survived the 24-hour holding period. 2 of the 8 Chinook caught in the Spill RST did not survive the 24-hour post collection holding (25.0%).

Preliminary data results for fish collected exiting Dexter Dam during the March 9 to May 15, 2022 period are reported in the table and figures below based on sampling at the Dexter Dam tailrace RST (Table 33, Figure 38, Figure 39).

Table 33 - Descriptive statistics for juvenile Chinook caught in the Dexter Dam tailrace rotary screw trap during the 09 March to 15 May 2022 period.

Site	Trap	Species	Life stage	Collected	Length (mm)*			Weight (g)*		
					Min	Max	Mean	Min	Max	Mean
Dexter Dam	5 ft	CHS	Parr	0	0	0	0	0	0	0
		CHS	Smolt	16	142	224	170.7	27.8	118.4	47.3

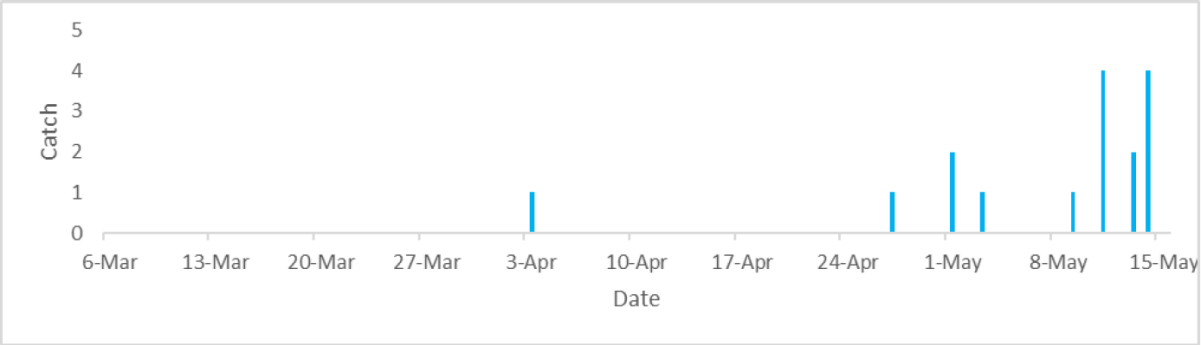

Figure 38 - Rotary Screw Trap (RST) Chinook capture distribution at the Dexter Dam tailrace rotary screw trap during the 09 March to 15 May 2022 sample period.

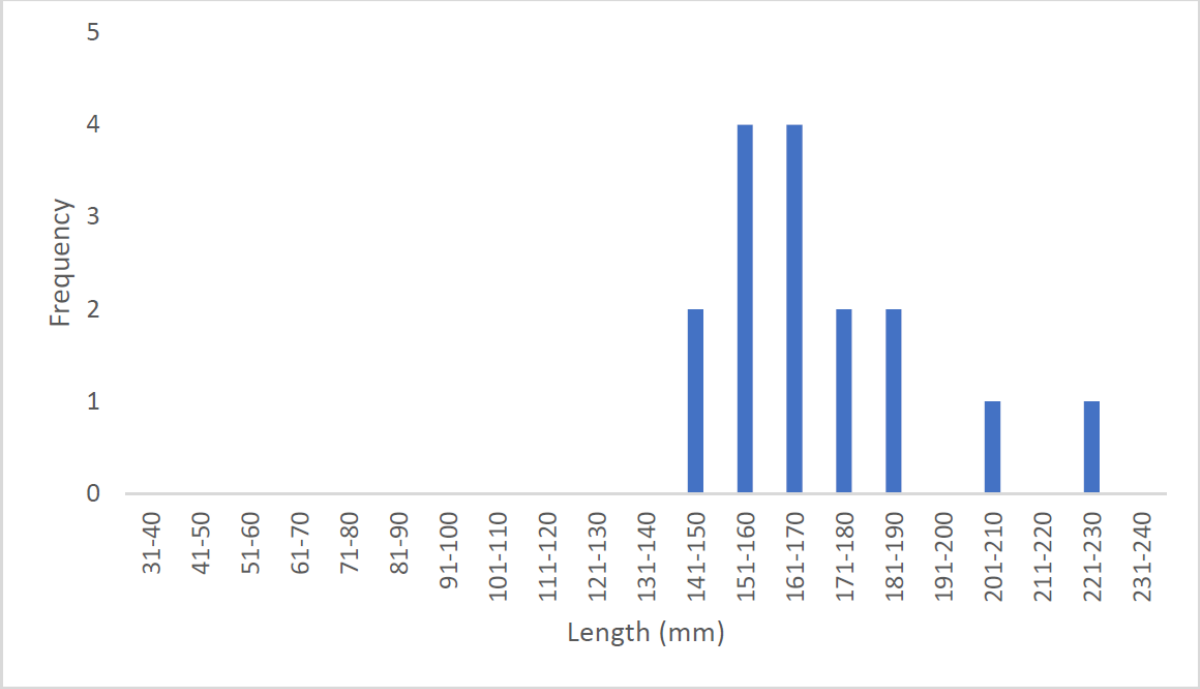

*Figure does not include fish without heads or fish used for trapping efficiency trials.

Figure 39 - Rotary Screw Trap (RST) Chinook length frequency distribution at the Dexter Dam tailrace rotary screw trap during the 09 March to 15 May 2022 sample period.

Up to 60 live non-immediately moribund juvenile Chinook per week were to be held for 24 hours post-collection (i.e., from time of sampling, typically once per day). A total of 16 Chinook captured in the RST were held for 24 hours post-collection during this reporting period. A total of 14 of these Chinook were released alive (87.5%); 2 Chinook did not survive holding (12.5%).

RM&E Planned for July – December 2022

The Corps has begun the coordination and contracting processes necessary to meet additional RM&E requirements for the Lookout Point Dam and Dexter Dam reach as identified in the long-term RM&E plan. This includes development of contract actions for the following activities:

- Releases of bulk-marked juvenile Chinook, including PIT tagging of sub-yearling Chinook in the fall and yearling Chinook in the spring. It is anticipated that hatchery fish from ODFW hatcheries in the respective sub-basins will be utilized following final coordination and contract modifications with ODFW (in-progress). Due to the low returns of adult Chinook in 2021 and the resulting BY21 MF Willamette juvenile Chinook shortfall, it is anticipated that ODFW will not make juvenile BY21 Chinook available to the Corps for conducting these bulk releases for the respective late 2022 and early 2023 releases. It is therefore anticipated that releases will generally begin with subyearling Chinook in the fall 2023 and yearling Chinook in the winter/spring 2024 if sufficient BY22 MF Willamette juvenile Chinook are available.
- Releases of bulk-marked Chinook fry in the spring, marked with Visual Implement Elastomer (aka VIE and Elastomer tags). It is anticipated that hatchery fish from ODFW hatcheries in the respective sub-basins will be utilized following final coordination and contract modifications with ODFW (in-progress). Due to contracting and deployment timelines, it is anticipated that releases will begin with Chinook fry in the winter/spring 2023. It is unknown at this time whether sufficient BY22 juvenile Chinook will be available in sufficient quantities for conducting these fry releases.
- Development of sampling the nearshore distribution of juvenile salmon within Lookout Point Reservoir has been initiated internally within the Corps. Contracting for development and implementation of a 2023 study is underway and is anticipated to be awarded in time for a field study to occur beginning in spring 2023. It is anticipated that this study will follow the timing and location of previous studies to provide a basis for comparing fry and subyearling distribution relative to reservoir conditions.
- EAS will be conducting RST sampling at the Lookout Point head of reservoir site, Lookout Point Dam tailrace, and Dexter Dam tailrace. In addition to the standard biological and environmental RST sampling metrics, RST sampling at these sites is included in Table 34, below.

Table 34. Sampling Planned Above and Below Lookout Point Dam Beginning in 2022

Rotary Screw Trap Sample Site	Sample Period	Juvenile Chinook					
		Trap Efficiency Trials**	PIT Tag >65mm	Elastomer Tag (<65 mm)	Scale Samples	Tissue Sample (DNA)	24-hour Holding (Post Collection)
Lookout Point Dam Head of Reservoir	Year-round	Yes	Yes	Yes	Yes	Yes	No
Lookout Point Dam Tailrace*	Year-round	Yes	Yes	Yes	No	No	Yes
Dexter Dam Tailrace	Year-round	Yes	Yes	No	No	No	Yes

*The Lookout Point Dam tailrace where the RSTs sample is often impacted by high surface water temperatures; sampling efforts often stop during summer periods when water temperatures are high in order to comply with NMFS and ODFW permit requirements.
**Trap Efficiency Trials are contingent on sufficient numbers of hatchery fish available from the respective in-basin hatcheries being available for conducting the respective trap efficiency trials at each location.

Middle Fork Willamette Trap Efficiency Tests

In 2021, while drafting the current ODFW hatchery production contract, the Corps included anticipated juvenile hatchery Chinook needs for conducting RST capture efficiency trials planned by the Corps at that time. Following issuance of the interim injunction and development of the RM&E Plan, additional juvenile hatchery Chinook needs for RST capture efficiency trials have been identified, primarily due to additional RST sampling sites than originally planned by the Corps. As a result, the Corps approached ODFW with a proposed contract modification in January 2022 to supply the additional juvenile hatchery Chinook needed to conduct RST capture efficiency trials contemplated by the interim injunction. In responding to this January 2022 contract modification proposal, ODFW stated that juvenile BY21 MF Willamette Chinook are not available for RST capture efficiency estimates due to juvenile fish production shortages associated with low adult returns of this stock in 2021. Following further discussions, ODFW has agreed to provide the approximately 18,000 BY21 MF Willamette juvenile hatchery Chinook already agreed to in the existing hatchery production contract. However, ODFW have indicated that they will not agree to a contract modification to provide additional juvenile BY21 MF Willamette hatchery Chinook for purposes of conducting additional RST capture efficiency trials.

The Corps had planned for its RST contractor to utilize BY21 MF Willamette juvenile hatchery Chinook to conduct trap efficiency trials for the RSTs located below Dexter Dam, above and below Lookout Point Dam, and above and below Hills Creek Dam in 2022-2023 associated with monitoring the implementation of Injunction Measures 17 and 8. As a result of the limited availability of those fish, the Corps has modified planned use of BY21 MF Willamette juvenile Chinook to account for only the approximately 18,000 fish ODFW will make available for the purposes of calculating RST capture efficiencies and abundance estimates. In order to reduce impacts to the overall RST capture efficiency trials associated with this change, the Corps has directed its RST contractor to not perform future planned BY21 MF Willamette RST capture efficiency trials at the Lookout Point Dam tailrace in 2022-2023. This decision is based on the following factors:

- Capture rates at Lookout Point Dam are historically low and generally well under 1%. For example, during a capture efficiency trial on April 13, 2022, 2 of 1,013 juvenile Chinook released were recaptured in the RSTs (0.2%). As a result, the Corps originally planned to use a relatively large number of juvenile hatchery Chinook to evaluate RST capture efficiencies by the three RSTs located in the Lookout Point Dam tailrace (i.e., 1,000-2,000 juvenile Chinook per release; approximately 10,000 BY21 MF Willamette juvenile Chinook in total).
- Eliminating the Lookout Point Dam tailrace BY21 capture efficiency minimizes impacts to other RST sample sites.
    - This will allow RST capture efficiency trials to be done at Dexter Dam tailrace, Lookout Point head of reservoir, and Hills Creek Dam tailrace in 2022 and early 2023 generally as originally planned. However, some changes may need to be made to overall release numbers at these sites to remain within the total ~18,000 BY21 MF Willamette hatchery fish being provided by ODFW.
    - There may be additional impact(s) to RST monitoring and capture efficiency estimates above Hills Creek Dam in early 2023 depending on the scope of this future monitoring.
- Other sources of fish for RST capture efficiency estimates are not available.
    - Chinook at the OSU Surrogate Program are limited in number and are being prioritized for other injunction-related RM&E studies.
    - Fish released for purposes of RST capture efficiency trials must be juvenile Chinook from within sub-basin sources (i.e., MF Willamette stock) in order to provide biologically meaningful RST capture efficiency estimates.
- Out-of-sub-basin stocks are not suitable for release due to various permitting and HGMP concerns.

Fall Creek Dam

A deep drawdown and delayed refill operation were implemented at Fall Creek Reservoir for much of the winter and spring season of 2021-2022 to improve downstream fish passage and survival (IMs 19 and 20). The winter deep drawdown/run-of-river operation ran November 2021 through January 16, 2022 when the reservoir was allowed to refill to El. 700 ft. This elevation was held from January 16 – March 15 then the reservoir was refilled to minimum conservation pool (El. 720 ft.) and held at this level until April 15. On April 16, a joint decision between the Corps and NMFS was made to conclude the delayed refill operation for the season in order to improve the likelihood that the reservoir would refill sufficiently to permit the operation of the Fall Creek Adult Fish Facility throughout the summer. Due to late rains, Fall Creek was able to reach maximum conservation pool elevation even though refill was delayed until mid-April (Figure 40).

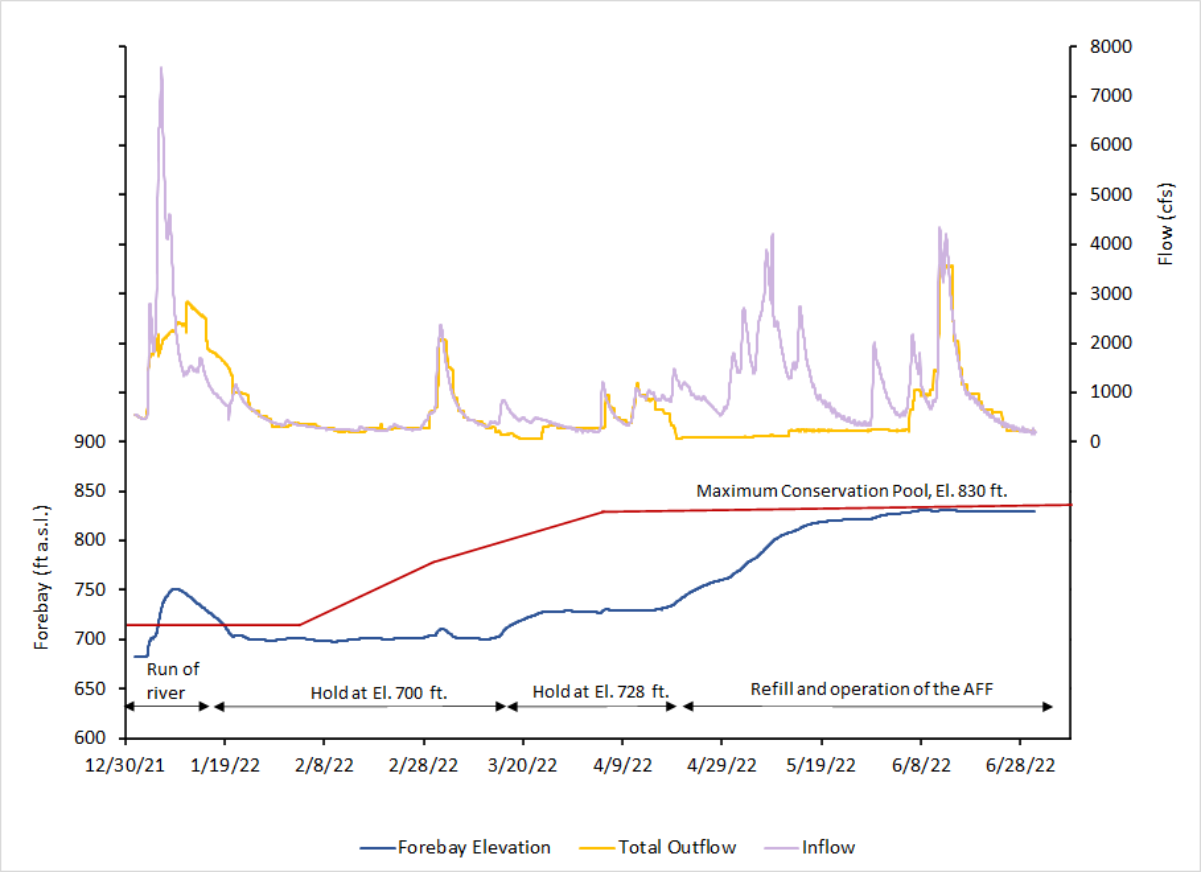

Figure 40. Fall Creek Dam Operations, January 01 - June 30, 2022

Turbidity and total dissolved oxygen were monitored downstream of Fall Creek Reservoir throughout the duration of the delayed refill and downstream fish passage operations (Figure 41 and Figure 42). Turbidity levels ranged from 0-1250 NTUs and tracked closely with inflows, peaking when inflows peaked and leveling off as inflows subsided. Dissolved oxygen remained at healthy levels for aquatic biota, and no anoxic conditions were measured throughout the duration of the operation.

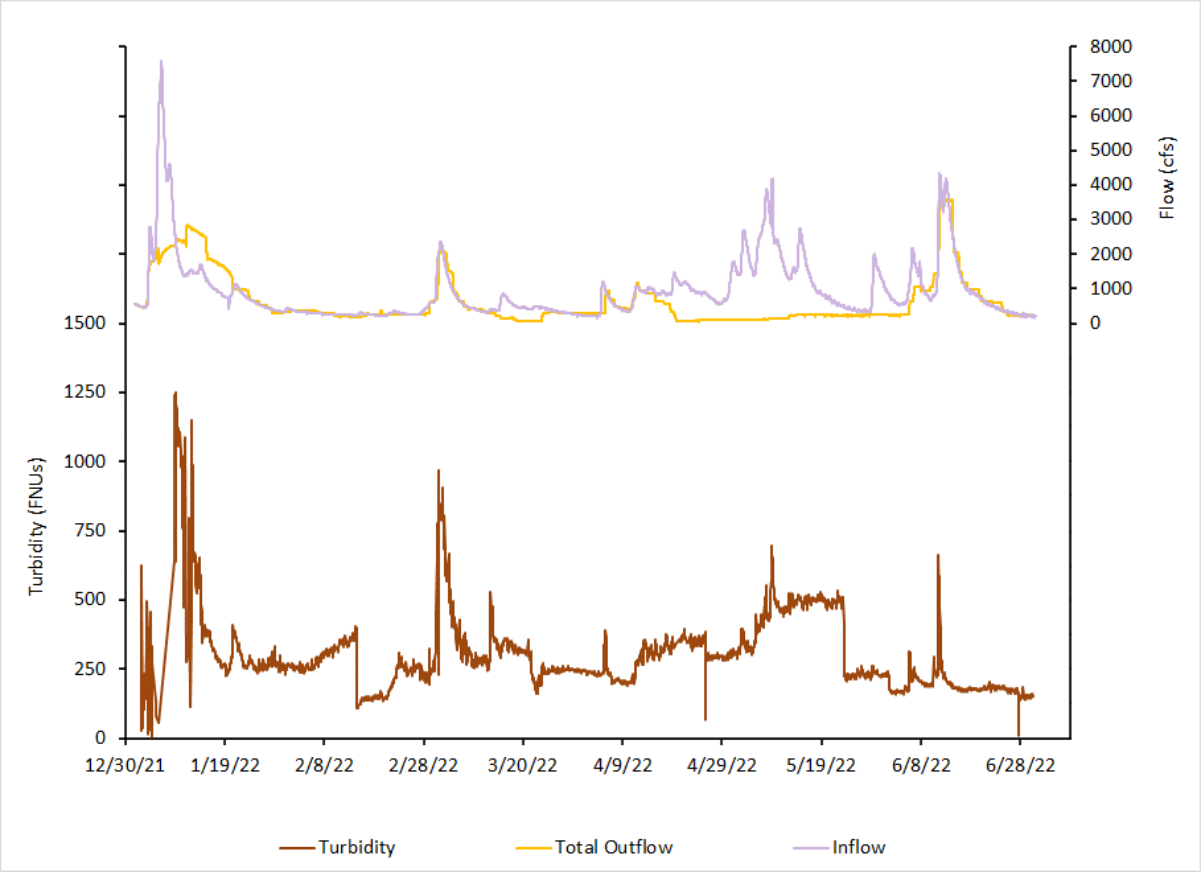

Figure 41. Fall Creek Dam Operations and Downstream Turbidity, January 01 – June 30, 2022

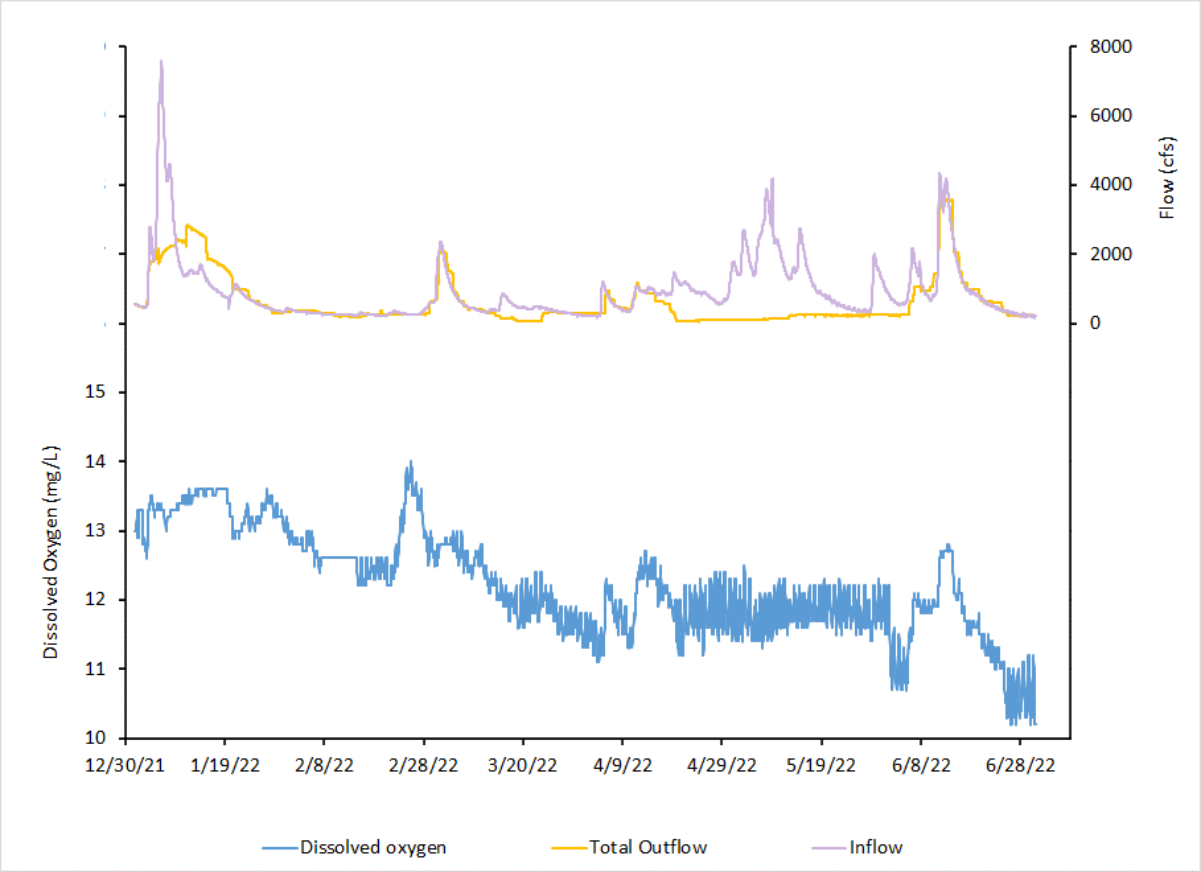

Figure 42. Fall Creek Dam Operations and Downstream Dissolved Oxygen, January 01 – June 30, 2022

Lessons Learned

The Corps will continue to monitor results of operations and research efforts and incorporate lessons learned in future plans and actions.

The refill date of Fall Creek Reservoir will continue to be determined on an annual basis. Close coordination between the Corps and NMFS regarding this date is imperative and should be determined through review and discussion of water conditions, weather forecasts, and (limited, but informative) screwtrapping information.

Operations Planned for July – December 2022

Fall Creek Dam will be operated to support the adult fish facility throughout the remainder of the summer season. Water temperature management, while limited, will be implemented as well through the strategic use of the fish horns. Reservoir drawdown will follow the rule curve, and the initiation of the deep drawdown will be aligned with the rule curve and typical drawdown rate and timing. This deep drawdown is likely to occur in November. After that, the reservoir will be refilled to El. 700 ft. and then gradually drawn back down for the second drawdown required by the

injunction from December 1 through January 15. Turbidity and total dissolved oxygen will be monitored during the winter drawdowns.

RM&E

Two RSTs were operated in Fall Creek during the reporting period. A single eight-foot diameter RST was operated above Fall Creek Reservoir from January 14 to May 31, 2022. A single RST has been operated in the Fall Creek Dam RO channel tailrace since fall 2021 through July 15, 2022. The Corps operated the tailrace RST through March 15, 2022; EAS took over operation of the tailrace RST on March 15, 2022 and will continue as the operator of this trap moving forward. For the purposes of this report, preliminary data results are provided for the January to May 15, 2022 sample period.

Detailed results of the RST sampling, as performed by EAS, can be found in preliminary reporting by EAS in the in-season reports available on the Corps' Willamette Valley Injunction RM&E webpage at https://pweb.crohms.org/tmt/documents/FPOM/2010/Willamette_Coordination/Willamette%20RME/InjunctionRME.html. Reporting of EAS's RST monitoring results, with detailed comparisons to historical passage data and current operations, will be done once per year, with the final report posted to the Corps' Willamette Valley Injunction webpage, anticipated to occur in early May annually (e.g., EAS's annual report including this 2022 period will be finalized and posted by May 2023 for sampling period of fall 2021 to fall 2022).

Operational data and preliminary data results for the (1) head of reservoir RST during the January to May 15, 2022 sampling period and (2) Regulating Outlet (RO) RST during the March 15 to May 15, 2022 sampling period are presented in EAS 2022 and summarized in the tables and figures below. Information regarding condition of juvenile salmonids, PIT-tagging efforts, collection of scales and fin-clips for future analysis, non-target fish capture, and other summary statistics caught in RSTs during this period is available in the data reports posted to the Corps' Willamette Valley Injunction RM&E webpage (i.e., EAS 2022 and biweekly in-season reports). Sampling at these sites for this period is included in Table 19, below.

Table 35. Sampling Conducted Above and Below Fall Creek Dam During Fall to May 2022 Spring Season

Rotary Screw Trap Sample Site	Sample Period	Juvenile Chinook					
		Trap Efficiency Trials	**PIT Tag >65mm	Elastomer Tag (<65 mm)	**Scale Samples	**Tissue Sample (DNA)	**24-hour Holding (Post Collection)
Fall Creek Dam Head of Reservoir	14 January to 15 May 2022	Yes	Yes	No	Yes	Yes	No
Fall Creek Dam Tailrace - RO Channel	01 January to 15 July 2022	Yes*	Yes	No	No	No	Yes

*Trap Efficiency trials above Fall Creek were limited to use of run-of-river fish. Trap efficiency trials were conducted by EAS following assumption of trap operations.
**Implementation of certain requirements has been phased in as the requirements have been identified, subsequent contracting actions could be taken, and equipment/materials and permits obtained for implementation.

Fall Creek Dam Tailrace RO Channel

The Corps operated the RST in the Fall Creek Dam RO Channel through March 15, 2022. During this period, a total of 4 juvenile Chinook were captured with lengths of 110 mm (January 24, 2022), 120 mm (January 27, 2022), 116 mm (January 29, 2022), and 114 mm (February 1, 2022).

EAS operated the RST in the Fall Creek Dam RO Channel for the March 15 to May 15, 2022 reporting period. No Chinook were captured during period. Therefore, there is no information on juvenile Chinook passage to report for this period (EAS 2022).

Fall Creek Dam Head of Reservoir

Operational information (Table 36) and preliminary data results (Table 37, Figure 43, Figure 44) for fish collected entering the Fall Creek Reservoir during the January 14 to May 15, 2022 period are reported in the tables and figures below based on sampling at the Fall Creek head of reservoir RST.

Table 36 - Sampling Outage Summary For Fall Creek Head of Reservoir Rotary Screw Trap during 02 January to 15 May 2022 period

Site	Date(s) of Trap Outage	Reason for Outage
Fall Creek Head of Reservoir	01/02/2022 to 01/14/2022	Trap installation was postponed until 01/11/2022 due to high flows access issues. Trap was unable to sample until 01/14/2022 when flows and debris level decreased to a safe level for sampling.
Fall Creek Head of Reservoir	03/02/2022 to 03/04/2022	Flows and debris load increased to levels that made it unsafe to fish or access the trap.
Fall Creek Head of Reservoir	05/05/2022 to 05/09/2022	Flows and debris load increased to levels that made it unsafe to fish or access the trap.

Table 37 - Descriptive statistics for juvenile Chinook salmon captured in the Fall Creek Head of Reservoir rotary screw trap during the 14 January to 15 May 2022 period.

Site	Route	Species	Life stage	Collected	Length (mm)*			Weight (g)*		
					Min	Max	Mean	Min	Max	Mean
Fall Creek Head of Reservoir	8 ft	CHS	Smolt	5	127	255	157.2	21.5	108.5	214.3
		CHS	Parr	2	119	120	119.5	16.1	19.8	18.0

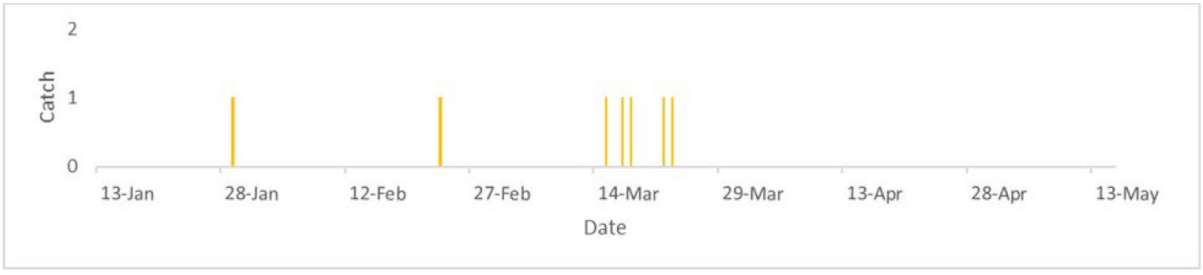

Figure 43 - Juvenile Chinook salmon catch in the rotary screw trap operated above Fall Creek reservoir during the 14 January 2022 to 15 May 2022 period.

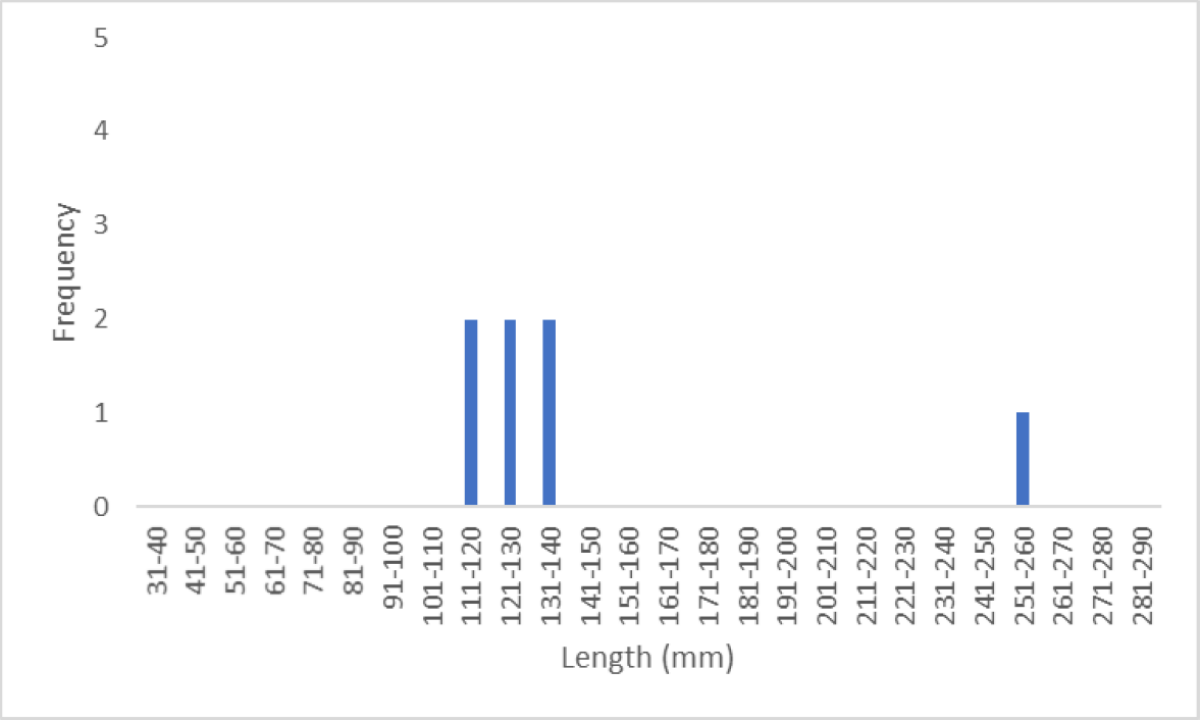

Figure 44- Length frequency distribution of juvenile Chinook salmon caught in the Fall Creek head of reservoir rotary screw trap during the 14 January to 15 May 2022 sample period.

Fin clips (for DNA) and scales were taken from 5 of the 7 Chinook captured during the reporting period.

RM&E Planned for July – December 2022

The Corps has begun the coordination and contracting processes necessary to meet additional RM&E requirements identified in the long-term RM&E plan. This includes development of contract actions for the following activities:

- Releases of bulk-marked juvenile Chinook, including PIT tagging of sub-yearling Chinook in the fall and yearling Chinook in the spring. It is anticipated that hatchery fish from ODFW hatcheries in the respective sub-basins will be utilized following final coordination and contract modifications with ODFW (in-progress). Due to the low returns of adult Chinook in 2021 and the resulting BY21 MF Willamette Middle Fork Willamette juvenile Chinook shortfall, it is anticipated that ODFW will not make juvenile BY21 Chinook available to the Corps for conducting these bulk releases for the respective late 2022 and early 2023 releases in the Middle Fork Willamette River subbasin including Fall Creek. It is therefore anticipated that releases will generally begin with subyearling Chinook in the fall 2023 and yearling Chinook in the winter/spring 2024 if sufficient BY22 MF Willamette juvenile Chinook are available.
- Releases of bulk-marked Chinook fry in the spring, marked with Visual Implement Elastomer (aka VIE and Elastomer tags). It is anticipated that hatchery fish from ODFW hatcheries in the respective sub-basins will be utilized following final coordination and contract modifications

with ODFW (in-progress). Due to contracting and deployment timelines, it is anticipated that releases will begin with Chinook fry in the winter/spring 2023. It is unknown at this time whether sufficient BY22 juvenile Chinook will be available in sufficient quantities for conducting these fry releases in Fall Creek.

- EAS will be conducting RST sampling at the Fall Creek head of reservoir and Fall Creek Dam tailrace RO Channel sites consistent with RM&E plan. The tailrace RO channel RST will be sampled October 15, 2022 through July 15, 2023. The Fall Creek Dam head of reservoir site will be sampled January 2, 2023 through May 31, 2023. In addition to the standard biological and environmental RST sampling metrics, RST sampling in the Fall Creek sub-basin is included in Table 38, below.

Table 38. Sampling Planned Above and Below Fall Creek Dam Beginning in the Fall of 2022

Rotary Screw Trap Sample Site	Sample Period	Juvenile Chinook					
		Trap Efficiency Trials	PIT Tag >65mm	Elastomer Tag (<65 mm)	Scale Samples	Tissue Sample (DNA)	24-hour Holding (Post Collection)
Fall Creek Dam Head of Reservoir	02 January to 31 May 2023	Yes	Yes	Yes	Yes	Yes	No
Fall Creek Dam Tailrace - RO Channel	15 October 2022 to 15 July 2023	Yes*	Yes	No	No	No	Yes
*Trap Efficiency trials above Fall Creek were limited to use of run-of-river fish. If sufficient numbers of hatchery fish become available from ODFW, hatchery fish will be utilized for conducting trap capture efficiency trials in the future.							

Willamette Fish Operations Plan Deviations (unit outages, ramp rates, minimum flows)

Injunction Measure 5 requires the Corps to follow its established maintenance outage schedules and emergency protocols, and Injunction Measure 6 requires that the Corps include information on any deviation from outage schedules in these biannual status reports.

In accordance with Reasonable and Prudent Alternative Action 4.3 set forth in NMFS's 2008 BiOp for the WVP, the Corps annually develops the Willamette Fish Operations Plan (WFOP) in coordination with the Willamette Fish Passage Operations and Maintenance (W-FPOM) team (comprised of the Corps, Bonneville Power Administration, NMFS, U.S. Fish and Wildlife Service, Oregon Department of Fish and Wildlife, and other regional federal, state, and tribal agencies). The WFOP describes year-round operations and maintenance activities at WVP dams to protect and enhance anadromous and resident fish species listed as endangered or threatened under the ESA, as well as non-listed species of concern. The WFOP guides Corps actions related to fish protection and passage at the WVP dams. Among other items, the WFOP sets forth outage periods for the WVP

dams during which any turbine unit outages necessary for maintenance should be scheduled. The WFOP also sets forth processes for coordinating revisions to the WFOP, both annually and throughout the year, and deviations from WFOP criteria, including notification and reporting protocols for unplanned and emergency deviations. The published WFOP is available at https://pweb.crohms.org/tmt/documents/FPOM/2010/Willamette_Coordination/WFOP/.

During the period covered by this status report, there were some outages that occurred that deviated from the outage periods specified in the WFOP, as follows:

(1) Foster Dam Outages:

a) There was an outage at Foster Dam on February 8, 2022, outside outage time periods listed in the WFOP. Turbine units were taken offline to install research equipment to evaluate the nighttime spill operations required by the injunction. The Foster Fish Facility ladder was also offline at this time.

b) Regarding the other outage, debris removal was required to prevent a pressure differential across the trashracks that would take units offline, which could have negatively impacted flood risk management capabilities. The outage was scheduled for February 1, 2022 when a fish passage operation through the spillway was already planned. Thus, during the outage, the spillway was merely utilized for a longer period of time.

(2) Cougar Dam Outages:

a) On June 28, 2022, at 06:49 hours, both units went offline due to a line fault. Cougar project staff responded, with the unit reducing to 'Speed No Load' as expected and the RO opening to about one foot to maintain river flow. Flows increased from 313 cfs to 571 cfs then decreased to where they had been over a period of 3 hours. There was a ramp rate deviation from BiOp criteria (-0.2 ft/hr.) due to this event with a stage change of -0.43 feet. The trip was caused by a momentary ground, suspected to be a tree or bird on the line. Units were returned to service on June 28, 2022, at 09:46 hours.

b) Units at Cougar Dam were offline March 11-12, 2022, for installation and commissioning of a Generic Data Acquisition and Control System (GDACS), which is used to operate the turbine units.

c) On March 15, 2022, Cougar Units 1 and 2 tripped offline. The RO gate was opened to match scheduled outflows. It was reported that the units tripped on reverse power while the units were generating 20 MW. There was a ramp rate deviation from BiOp criteria (-0.2 ft/hr.) due to this event with a stage change of -0.38 feet.

Other deviations from the WFOP during the period covered by this status report are listed below in Table 39. Additional information about these deviations can be found on the W-FPOM website at https://pweb.crohms.org/tmt/documents/FPOM/2010/Willamette_Coordination/.

Table 39. Reportable Exceedances from criteria listed in the 2008 Biological Opinion issued by the National Marine Fisheries Service (NMFS)

Project	Exceedance	Date/Month	BiOp Criteria/Exceedance Value
Blue River	ramp rate	May 11	-0.2 ft/hr. / -0.25 ft/hr.
Cottage Grove	minimum flow	Feb 14-15	75 cfs / 62 cfs
Cougar	ramp rate	Feb 2	-0.2 ft/hr. / -0.32 ft/hr.
Cougar	minimum flow	Jun	400 cfs / 300 cfs
Dorena	minimum flow/ramp rate	Feb	ramp rate: -0.2 ft/hr. / various minimum flow: 190 cfs/ 166 cfs
Fern Ridge	minimum flow	Feb 1-17	50 cfs / 28 cfs
Hills Creek	ramp rate	Feb 8	-0.2 ft/hr. / -0.24 ft/hr.

Structural Measures

Dexter Adult Fish Facility Upgrades (IM 18)

Final design work is ongoing, with the Agency Technical Review nearly complete. Briefings and meetings have been held with W-FPOM and ODFW staff. Commentary from those entities has been considered, and some resultant changes that do not impact the construction schedule have been incorporated. The Environmental Assessment (EA) is scheduled to be released for public review and comment in September 2022, and stakeholders have been notified of its pending release. The solicitation for the construction contract is anticipated to be issued in fall 2022. There are currently no factors that would impact completion of the upgrades by May 31, 2026.

Big Cliff TDG Abatement Structural Improvement (IM 10b)

The Corps developed proposed timelines for designing and constructing a structural solution at Big Cliff Dam for mitigating excess TDG levels during spill operations and submitted the timeline to the Court on August 5, 2022. The Corps has identified two alternatives that warrant further consideration: installing spillway flow deflectors and placing boulders in the tailrace. Additional modeling and evaluation is necessary before selecting a preferred alternative for completion of design and construction, and the Corps is currently moving forward with such modeling and evaluation. This includes numerical modeling and a targeted risk assessment for dam safety to inform selection of the preferred alternative, which the Corps anticipates it will complete by April 2023. The selected alternative will also require additional modeling during the next design phase in order to inform final design, including physical modeling for the spillway flow deflector alternative. The Corps team is coordinating with the Engineering Research and Design Center (ERDC) on their capabilities and the scope of physical modeling. The Corps anticipates it will complete physical modeling by October 2023. The Corps has identified milestones for completion of engineering and design, environmental compliance activities (e.g., National Environmental Policy Act, Clean Water Act, etc.), procurement, and construction, and estimates that construction of the spillway flow

deflectors can be completed by October 2027 and the boulders in the tailrace alternative by October 2028.

Cougar Regulating Outlet Modifications (IM 15b)

Cougar RO Chute Resurfacing

The Corps has started preparation of the Plans and Specifications for the contract to recoat the Cougar RO chute with a fish-friendly coating by September 1, 2023. Initial investigations into the site conditions have determined that temporary modifications will need to be made to the RO system to route leakage water around the chute during construction. The bulkheads that block flow to the ROs leak enough water such that the chute is never dry, and the surface needs to be dry for any coating or smoothing effort to be viable. This will be a challenge but appears to be feasible at this time. Otherwise, the timing of the outage to perform the recoating will need to be carefully coordinated so as to not negatively impact other injunction requirements or the operational safety of the system. The Corps currently anticipates that the recoating will be completed by September 1, 2023 and will identify its recoating plan in Federal Defendants' status report due on February 28, 2023.

Cougar RO System Improvements

The Corps has established a Product Delivery Team (PDT) to examine alternatives for improvements to the Cougar RO system to provide safer fish passage and to increase the allowable rate of discharge without generating excess TDG, and to develop an estimated cost and schedule associated with design and construction of each alternative carried forward. The PDT held a kick-off meeting in August to begin scoping. The Corps currently anticipates providing estimated costs and schedules for the alternatives carried forward by June 30, 2023.

Lebanon Dam PIT Tag Detection Arrays (Antennas) (IM 13a)

The Corps initiated discussion with the City of Albany, owner and operator of Lebanon Dam on the South Santiam River downstream of Foster Dam, in August 2021 and requested approval to install a Passive Interrogation Transponder (PIT) tag detection system (antennas) on Lebanon Dam to detect PIT tagged study fish migrating downstream from Foster Dam. The City of Albany approved the Corps' request in September 2021 and granted the Corps a license to install the PIT tag detection system on Lebanon Dam on April 29, 2022 for a period of three years. The Corps also issued a contract for the design, fabrication, and installation of the PIT detection system on Lebanon Dam. The PIT antennas will be installed at the two adult fish ladders, across the entire overflow spillway that spans the river, and at the juvenile fish bypass. The contractor is currently designing and fabricating the antennas and associated equipment. The PIT detection system is scheduled to be installed at Lebanon Dam during September 2022, when the river flows are low because the spillway will have to be raised to accommodate the antenna installation. Furthermore, only half of the spillway and one adult fish ladder may be taken out of service (closed) at any given time because flows and fish must be able to be passed over the other half of the spillway and fish ladder at all times. The Corps is coordinating the antenna installation with the City of Albany. After installation, the contractor will have to conduct a series of detection efficiency tests of each antenna and tune the antennas before the PIT detection system is fully operational and functional and ready for data

collection. The time for detection efficiency tests and antenna tuning will be dependent on river flows and antenna functionality. It is anticipated the PIT detection system will be operational and functional by this fall 2022, although potentially not until October or November. Electrical power for the south fish ladder and juvenile bypass PIT antennas will be provided by Lebanon Dam. However, there is currently no electrical power on the north side of the dam for the north fish ladder and spillway antennas. The Corps attempted to obtain power to the north side of the dam from the local power utility company (not the City of Albany), but it was ultimately determined that it would not be workable to do so. The Corps subsequently worked with its contractor to determine the feasibility of running power from the south side of the dam to the north side of the dam, and the contractor then provided a proposed design to do so, which the Corps has reviewed and approved. The Corps currently anticipates issuing a contract modification by September 1, 2022 to have power routed from the south side of the dam to the north side of the dam so that the system is functional in fall 2022.

References

Environmental Assessment Services (EAS). 2022. *2021/2022 Willamette Rotary Screwtrap Bi-Annual Report, 11/16/2021 to 05/15/2022.*

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