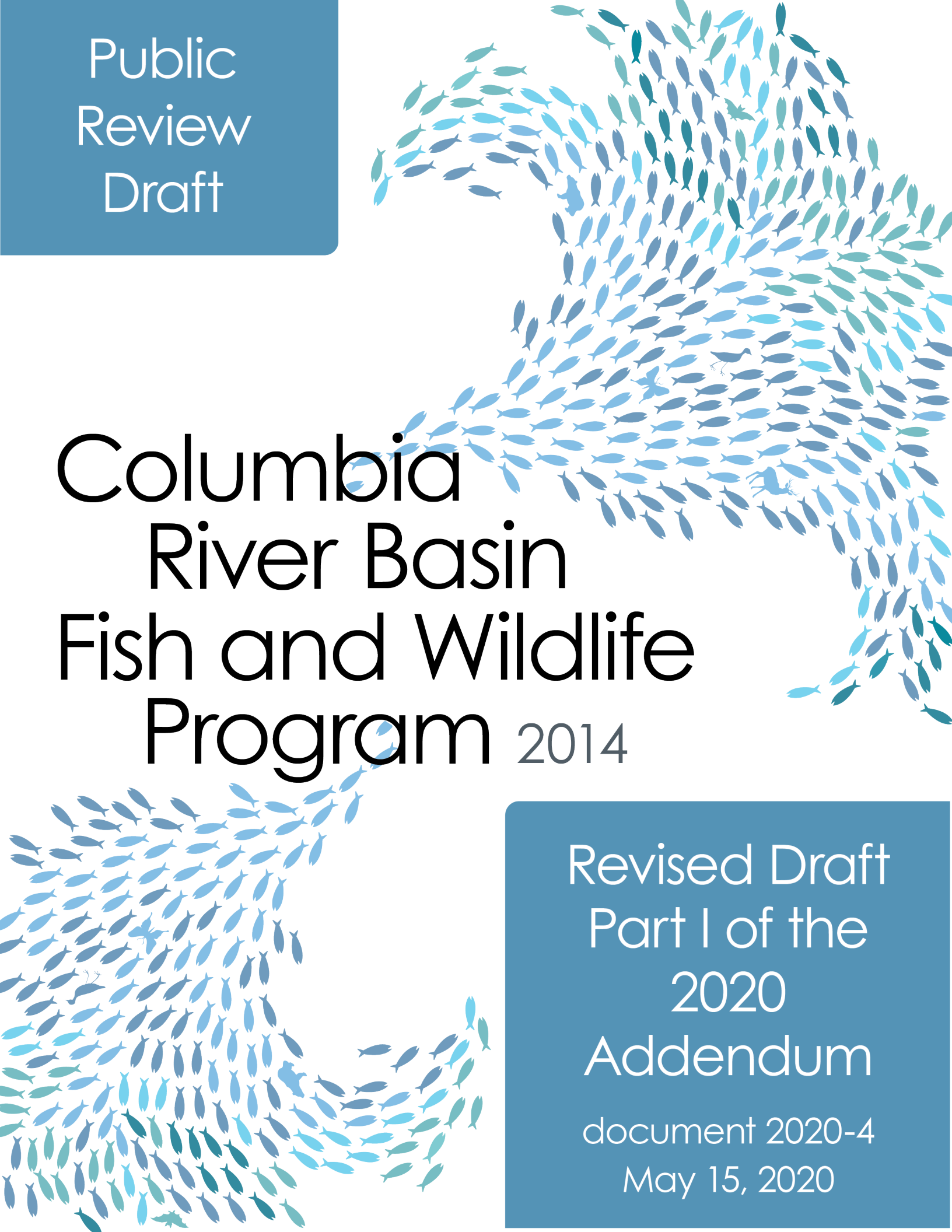


Public
Review
Draft



Columbia River Basin Fish and Wildlife Program 2014

Revised Draft
Part I of the
2020
Addendum
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2020 Addendum to the 2014 Columbia River Basin Fish and Wildlife Program

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2020 Addendum Introduction

The Northwest Power and Conservation Council is amending its 2014 Columbia River Basin Fish and Wildlife Program by adopting and adding this 2020 Addendum. The 2020 Addendum is part of the fish and wildlife program while the 2014 Fish and Wildlife Program also remains in effect. The two documents should be read together to understand the full details of the program's strategies and other provisions. Nothing in the 2020 Addendum replaces or supersedes the provisions of the 2014 Program, although in some situations the addendum supplements or reorganizes material in the 2014 Program.

This most recent set of program amendment recommendations focus on two aspects of the Council's program: how it is implemented and how we assess and report on program performance. After nearly 40 years of program development and implementation, the Council has in place a large protection and mitigation program that is being implemented by Bonneville and the other federal agencies in partnership with the state and federal fish and wildlife agencies and the region's Indian tribes. Much has been accomplished to protect and mitigate the harmful effects of the hydrosystem, even as significant challenges remain. Near-term program requirements are mostly about refining how the program is implemented; defining near-term and evolving priorities for implementation; evaluating program performance; and using what we learn about performance to improve implementation in a cost-effective manner. That is the purpose of this addendum.

Part I of the addendum describes how the Council, with the assistance of others involved in the program, will assess the program's performance and improve program implementation using an adaptive management approach. Part I includes a reorganization and elaboration of the program's goals and objectives to assist in this task. Part I also includes a preliminary set of strategy performance indicators to track and report on as part of program performance; the indicators are not formally adopted as part of the program. Part II identifies near-term priorities for implementation and funding, as well as program guidance on project implementation.

Accompanying the addendum is the "findings" document that describes how the Council used the program amendment recommendations in developing the addendum but not amending the program text. This document also responds to the comments submitted to the Council throughout the amendment process.

Accomplishments from implementation of the 2014 Fish and Wildlife Program include the following:

Habitat¹

- Improved 309,281 acres of habitat from 2014-2018 through stream restoration, planting, removing invasive species, restoring wetlands and floodplains, and

other habitat restoration actions. Of the total, 8,221 acres are in the lower Columbia and estuary.

- Protected 387 miles of riparian habitat with land purchases or leases from 2014-2018.
- Provided access to 1,553 miles of habitat by improving instream passage for fish from 2014-2018.
- Protected fish through screening 93,534 acre-feet of diverted water from 2014-2018.
- Protected 841,665-acre feet of water instream through temporary and permanent water transactions from 2014-2018 to help restore flow to flow-limited tributaries.

Hatcheries

- Supported conservation hatchery activities that are protecting endangered sockeye in the Snake River, including a new sockeye hatchery built by the Idaho Department of Fish and Game at Springfield, Idaho, to boost production of this endangered species; spring Chinook in the Upper Grande Ronde, the Lostine River, and Catherine Creek; and spring/summer Chinook in Johnson Creek.
- Supported construction of the Melvin Sampson coho production facility to boost production of the species in the Yakima River.
- Supported construction of the Twin Rivers Hatchery by the Kootenai Tribe of Idaho in collaboration with Idaho Department of Fish and Game to raise and release Burbot and White Sturgeon. Success of the Burbot production from the facility provided the basis for a collaborative decision to open a Burbot fishery in Idaho in 2019.

Mainstem Dam Passage

- Improved water management, flow, and passage to protect and increase species survival through the mainstem and in the storage reservoirs. Agencies, tribes, Bonneville, the Fish Passage Center and others developed a regional collaborative agreement on an innovative “flexible-spill” operation² intended to benefit both fish and the power system. The Council was not directly involved in the process but views the agreement as an operational change that will help improve the survival of fish that benefit from actions and projects in our program.
- Achieved consistently high juvenile fish passage survival at Columbia and Snake river dams compared to conditions prior to implementation of the Council’s program.
- Invested in passage improvements for Pacific lamprey at the mainstem dams including installation of specially designed lamprey ladders and other passage structures.

Predator Control

- Supported and engaged in a regional collaborative effort to support federal pinniped legislation to enhance local efforts to protect adult salmon returning to the river.³

- Supported management efforts to reduce avian and Northern Pikeminnow predation on juvenile salmon in the lower Columbia River, as well as Northern Pike predation in the upper Columbia River. Approved a new project that will continue the suppression of Northern Pike in Lake Roosevelt.⁴
- Supported a regional approach to establish a defensive perimeter to keep invasive mussels out of the Columbia River Basin.

Reintroduction Above Blocked Areas

- Initiated the investigation of the feasibility of reintroducing salmon and steelhead above Chief Joseph and Grand Coulee dams through support of a habitat assessment.⁵

Wildlife

- Established new settlement agreements with the State of Idaho for wildlife mitigation and to improve riparian and floodplain habitat.⁶

Protected Areas

- Continued implementation of the Protected Areas strategy to protect high-quality fish and wildlife resources in river reaches throughout the Northwest.

Program Performance and Progress

- Finalized the *Program Performance & Progress* tool on the Council's fish and wildlife webpage for reporting and communicating program performance

Asset management

- Developed and implemented the Asset Management Strategic Plan to ensure the longevity and integrity of the program's past investments – fish hatcheries, fish screens and lands.⁷

Cost Savings

- Realized \$3.36 million in savings through a cost-savings workgroup (FY 2016-2019) sponsored by the Council and Bonneville and utilized \$2.48 million of the savings to fund new or expanded mitigation initiatives, i.e., blocked area habitat assessment; non-recurring maintenance of hatcheries and fish screens; a new Pacific Lamprey project; additional work for White Sturgeon and suppression of Northern Pike.

Program challenges remain as well, highlighted by the continuing longer-term challenges in increasing and sustaining salmon and steelhead adult abundance in the Columbia basin. Also highlighted in the recommendations and in this program addendum is the overarching challenge of implementing a program to improve environmental conditions for fish and wildlife while climate change is redefining those very same environmental characteristics.

Part I: Program Performance and Adaptive Management

A. Program Goals, Objectives, and Performance Indicators

In this part of the addendum, the goals, objectives, and indicators stated in [Part Three, III](#) and [Appendix D](#) of the 2014 Program, and the description of adaptive management in [Part IV](#), have been reorganized, reformulated, and supplemented to enable the Council and others to evaluate program performance in an effective way. Part I of the 2020 Addendum does not replace these provisions of the 2014 Program, but to the extent there is a conflict or explicit difference between the two, Part I of the 2020 Addendum is the controlling document.

Under the Northwest Power Act, the Council is to adopt a program “to protect, mitigate and enhance fish and wildlife, including related spawning grounds and habitat, affected by the development, operation, and management of the hydroelectric facilities located on the Columbia River or its tributaries.” The 2014 Program’s **Vision** describes what the Council expects the Columbia River Basin Fish and Wildlife Program to accomplish, consistent with the Act:

The vision for this program is a Columbia River ecosystem that sustains an abundant, productive, and diverse community of fish and wildlife, supported by mitigation across the basin for the adverse effects to fish and wildlife caused by the development and operation of the hydrosystem. This envisioned ecosystem provides abundant opportunities for tribal trust and treaty-right harvest, non-tribal harvest, and the conditions that allow for restoration of the fish and wildlife affected by the construction and operation of the hydrosystem.

The vision will be accomplished by protecting and restoring the natural ecological functions, habitats, and biological diversity of the Columbia River Basin. Where this is not feasible, other methods that are compatible with self-sustaining fish and wildlife populations will be used, including certain forms of production of hatchery fish. Where impacts have irrevocably changed the ecosystem, the program will protect and enhance habitat and species assemblages compatible with the altered ecosystem.

The program’s goals and objectives are consistent with the Act and with the program’s vision, describing the changes in the environment and the biological performance that are needed to achieve the vision. Where hydrosystem losses have been quantitatively assessed, such as with anadromous salmon and steelhead and certain aspects of the wildlife and resident fish impacts, the program’s goals and objectives are explicitly described in terms of mitigating for those quantified hydrosystem losses. Where hydrosystem losses have not been specifically identified, such as with sturgeon, lamprey, and resident species, this is recognized and accounted for in the statements of the program’s goals and objectives.

Objectives are a means of achieving or contributing to the program's goals. In certain cases that are identified in the text or supporting documentation, objectives may be broader than, or derived from a source other than hydrosystem impacts. Based in part on careful consideration of the program amendment recommendations, the Council has decided to use these targets as objectives when they meet the following criteria: 1) they have been well developed by others in the region; 2) they clearly relate to the program goals; 3) implementing the program's measures will clearly be necessary to contribute to meeting these targets; and 4) the targets are relatively easy to understand and track. Achieving these objectives is not the same as achieving the program's goals, but the program's contribution toward meeting these objectives also demonstrates progress toward achieving the program's goals.

For example, a multi-year collaboration among federal, state, tribal, and non-governmental entities, known as the NOAA Marine Fisheries Advisory Committee's Columbia Basin Partnership Task Force, recently developed a provisional set of rebuilding targets for salmon and steelhead populations in the Columbia River Basin. The collaborative group working to develop these target abundance numbers did not identify responsibility for achieving the targets, but the Columbia River Basin hydrosystem's protection and mitigation program under the Northwest Power Act will contribute significantly toward achieving these targets. At the same time, the work indicated that the program's salmon and steelhead goal, specifically framed within the context of hydrosystem loss assessments, is within the range of expected outcomes in the Columbia River Basin. Based in part on program amendment recommendations urging the Council to make use of this work, the Council identifies some of these numbers as provisional objectives and strategy performance indicators for the purposes of tracking and reporting. Concurrently, the Columbia Basin Partnership Task Force has begun phase II discussions, which may include refining their provisional rebuilding targets.

All the program's substantive strategies in [Part Three, IV](#) of the program contribute to achieving the program's goals and objectives (See Figure 2, Fish and Wildlife Program Framework, in the 2014 Fish and Wildlife Program at 11). This includes the Ecosystem Function Strategy and its various sub-strategies (most notably the Habitat and Mainstem Hydrosystem sub-strategies), and the Wild Fish and Artificial Propagation strategies. The wildlife goal is an exception; a more limited set of strategies is relied upon to achieve that goal. The Council needs an effective way to measure progress in implementing these strategies.

In addition to defining the goals and objectives, this addendum identifies a set of strategy performance indicators that can be used to assess progress in implementing the program strategies and improve the ecological and population conditions of the focal species. While a set of strategy performance indicators are identified in this addendum, the Council does not intend these to be formally part of the addendum. The Council, in collaboration with others, will develop and use the indicators as tracking tools that can be refined and changed outside of an amendment process, as better numbers or better indicators become available. The Council intends to continue working with the state and

federal fish and wildlife agencies, the region's Indian tribes, and others to refine the program's objectives and strategy performance indicators.

The Council drew from numerous sources to develop the strategy performance indicators, working primarily with representatives of the fish and wildlife agencies and tribes to identify a preliminary set of useful indicators. Sources include the recommendations and text of the 2014 Program; all of the objectives and indicators previously compiled by staff (available on the Council's website in its Fish Objectives mapping tool); the recommendations and comments throughout the program amendment process resulting in this addendum; and external sources of information about Columbia River Basin fish and wildlife.

Anadromous Salmon and Steelhead Goal and Objectives

Goal

Increase total adult salmon and steelhead runs of Columbia River origin to a 10-year rolling average of five million annually by 2025, in a manner that emphasizes increases in the abundance of the populations that originate above Bonneville Dam.⁸

For the purposes of this goal, total adult salmon and steelhead abundance numbers should be obtained by combining the number of adult salmon of all species counted at Bonneville Dam, the number of fish spawning below Bonneville Dam, and the estimated number of salmon caught in the ocean and in rivers below Bonneville Dam. Increases in abundance everywhere in the river are important, given that hydropower development and operations affect the entire river and all the salmon and steelhead in the river. But because most of the loss of salmon and steelhead production as a result of hydroelectric development has occurred above Bonneville Dam, increases in abundance to satisfy this goal must come predominantly from the area above Bonneville Dam.

Increasing the total salmon and steelhead runs to five million is an interim program goal that began in the 1987 Program's commitment to "double the runs." This total abundance target is lower than the Council's estimates of the losses of anadromous fish due to the development and operation of the Columbia River hydroelectric facilities. See the program's [Compilation of Information on Salmon and Steelhead Losses in the Columbia River Basin](#) and Numerical Estimates of [Hydropower-Related Losses](#). While the program has always assumed artificial production will be one of the strategies used to achieve this goal, the proportion of naturally spawning fish contributing to this goal should increase as natural production increases.

The program provides a flexible approach to mitigation for loss of anadromous fish in blocked areas that historically had runs of anadromous fish, including passage and habitat improvements, reintroduction of anadromous fish where feasible, and/or the provision of increased harvest opportunities through fish propagation, and by enhancing other species. See the Anadromous Fish Mitigation in Blocked Areas Strategy, Part Four IV(C)(2) of the 2014 Program.

The program's numerical goal for salmon and steelhead is part of an overarching qualitative goal, consistent with the program's vision and the Act, to protect, mitigate and enhance salmon and steelhead adversely affected by the Columbia River hydroelectric power system, including related spawning grounds and habitat. By doing so, contribute to reversing the decline in populations and making progress toward restoring and then maintaining stable healthy populations of salmon and steelhead that support sustainable fisheries and allow for desired expressions of traditional cultural values and practices. Populations that are healthy and support sustainable fisheries are defined as abundant, productive, genetically diverse, and spatially distributed within the Columbia River Basin, and provide ample

opportunities for subsistence, ceremonial, recreational and (where appropriate) commercial fisheries that are of tribal trust, treaty, and non-treaty origin.

Biological Objectives (S)

S1 - Contribute to achieving the targets for salmon and steelhead adult abundance by stock and subregion developed by the NOAA Marine Fisheries Advisory Committee's (MAFAC) Columbia Basin Partnership Task Force.

The tables below display summary information for both natural-spawning and hatchery-origin adult salmon and steelhead. For the complete details on these abundance targets and supporting information go to [citation to be added].¹

The Council adopts this program objective under the following premise: The Council has never distributed the program's total salmon and steelhead abundance goal among stocks and areas of the basin. The Task Force has recently developed abundance targets distributed across stocks and areas but has not allocated responsibility for meeting those targets among the Columbia hydropower system and other mortality sources. For that reason, the Task Force's abundance targets are not to be understood as a division of the Council program's interim hydrosystem goal of an average annual abundance of 5 million total salmon and steelhead adults. Nor does the Council intend these distributed targets to represent, by themselves, the basis for distribution of the program's effort under the Northwest Power Act to protect, mitigate and enhance salmon and steelhead in the different areas of the basin. Instead, the Council expects work implemented under the program will contribute toward achieving these distributed targets along the way to achieving the overarching program goal, and thus the Council will track progress toward these distributed abundance targets as part of program performance.

Natural Origin Adult Returns to the Mouth of the Columbia River

Subregion	Low	Medium	High
Lower Columbia			
Mid-Columbia			
Upper Columbia			
Snake River			
Willamette River			

¹ MAFAC numbers for natural origin adult returns are in the process of being updated from the numbers in the March 2019 Phase 1 report. Expected date of completion is early June 2020. The final MAFAC numbers will be added prior to adoption of the Program addendum.

Hatchery Origin Adult Returns to the Mouth of the Columbia River

Subregion	Current	Future anticipated
Lower Columbia	428,800	440,500
Mid-Columbia	383,600	384,100
Upper Columbia	267,000	615,300
Snake River	362,300	377,800
Willamette River	65,000	70,300

S2 - Contribute to achieving a smolt-to-adult return ratio (SAR) in the 2-6 percent range (minimum 2-percent; average 4-percent) for listed Snake River and upper Columbia salmon and steelhead, as well as for non-listed populations.

S3 - Continue to improve juvenile passage survival through the hydrosystem.

S4 - Achieve the following annual adult salmon and steelhead survival standards for the Bonneville Dam to Lower Granite Dam reach and the Bonneville Dam to McNary Dam reach:⁹

ESU	Adult Performance Standard	Reach
Snake River fall Chinook	81.2%	BON to LGR
Snake River spring-summer Chinook	91.0%	BON to LGR
Snake River sockeye	Use Snake River spring/summer chinook salmon and steelhead as surrogate until a standard is developed	BON to LGR
Snake River steelhead	90.1%	BON to LGR
Upper Columbia River spring Chinook	90.1%	BON to MCN
Upper Columbia River steelhead	84.5%	BON to MCN
Middle Columbia River steelhead	Use Snake River steelhead as surrogate until a standard is developed	Variable
Columbia River chum	None; assume survival is adequate if Snake River chinook BON to LGR standard is met	None
Lower Columbia River Chinook	None; assume survival is adequate if Snake River spring/summer chinook and Snake River fall chinook standards are met	None
Lower Columbia River coho	None; assume survival is adequate if Snake River fall chinook standards are met	None
Lower Columbia River steelhead	None; assume survival is adequate if Snake River steelhead standards are met	None
Upper Willamette River Chinook	None	None

S5 - With the agreement of the relevant co-managing state agencies and tribes, contribute to assessing and, where appropriate, expanding anadromous fish distribution into historical habitat above blocked areas.¹⁰

S6 - Bonneville-funded hatcheries meet hatchery mitigation goals as described in the management plans or Hatchery Genetic Management Plans (HGMPs).

S7 - Maintain genetic diversity over time.

The ecological goal and relevant ecological objectives and related strategy performance indicators apply to the salmon and steelhead goal and biological objectives, as do the communication, assessment, and coordination goal and relevant objectives and related strategy performance indicators. See pages 22-24.

All Other Native Aquatic Focal Species Goal and Objectives

Goal

The program goal, consistent with the program Vision and the Act, is to protect, mitigate and enhance these other native focal aquatic species adversely affected by the development and operation of the Columbia River hydroelectric power system, including related spawning grounds and habitat.

The program does not include quantitative hydropower loss assessments and hydropower-related quantitative mitigation goals for aquatic species other than anadromous salmon and steelhead, with the one exception of the impacts of Hungry Horse and Libby dams on certain resident fish species. By protecting, mitigating and enhancing other native focal species, contribute to reversing the decline in populations and making progress toward restoring and then maintaining stable healthy populations that support sustainable fisheries and allow for desired expressions of traditional cultural values and practices. Populations that are healthy and support sustainable fisheries are defined as abundant, productive, genetically diverse, and spatially distributed in areas of the historic range within the Columbia River Basin, and provide ample opportunities for subsistence, ceremonial, recreational and (where appropriate) commercial fisheries that are of tribal trust, treaty, and non-treaty origin.¹¹

Biological Objectives

White Sturgeon (WS)

In the absence of quantitative goals and objectives based in hydropower loss assessments, contribute to achieving the following White Sturgeon adult abundance targets, as well as other population characteristics, derived from sturgeon management plans across the region:¹²

WS1 - Abundance:

Lower Columbia and Lower Snake:

Lower Columbia: Three-year running mean of wild fish 300,000 Sub-Adults (38-65" fork length (FL) and 6,250 Adults (66"+ FL) by 2026.

Bonneville Reservoir: Three-event sampling mean of wild fish 67,973 Sub-Adults (38-65" FL) and 6,728 Adults (66"+ FL).

The Dalles Reservoir: Three-event sampling mean of wild fish 47,125 Sub-Adults (38-65" FL) and 3,392 Adults (66"+ FL) by 2029.

John Day Reservoir: Three-event sampling mean of wild and hatchery 208,081 Sub-Adults (38-65" FL) and 5,055 Adults (66"+ FL) by 2029.

McNary Reservoir and free-flowing section: Sub-adult and adult abundance targets when available based upon population viability analysis.

Ice Harbor Reservoir: Sub-adult and adult abundance targets when available based upon population viability analysis.

Lower Monumental Reservoir: Sub-adult and adult abundance targets when available based upon population viability analysis.

Little Goose Reservoir: Sub-adult and adult abundance targets when available based upon population viability analysis.

Middle Snake:

Natural, stable age structure population with a minimum of 2,500 adult fish from Lower Granite to Hells Canyon as measured every 5 years.

Upper Snake:

Reach	Abundance
Shoshone Falls downstream to upper Salmon Falls Dam	1,400
Upper Salmon Falls Dam downstream to Lower Salmon Falls Dam	340
Lower Salmon Falls Dam downstream to Bliss Dam	630
Bliss Dam downstream to C.J. Strike Dam	2,900
C. J. Strike downstream to Swan Falls	1,340
Swan Falls downstream to Brownlee Dam	7,100
Brownlee Dam downstream to Oxbow Dam	630
Oxbow Dam downstream to Hells Canyon Dam	1,300

Transboundary Upper Columbia:

Interim adult populations of 2,000 in the Canadian Transboundary Reach and 5,000 in the U.S. Transboundary Reach. Subsistence and recreational fishery harvest of 2,000 fish per year.

Kootenai River:

Stable, self-sustaining, healthy population within all available historical habitats. Adult abundance targets for hatchery-reared and wild fish will be developed over time as understanding of constraints are refined. Those constraints may change over time based on flow management, habitat, and nutrient restoration efforts.

The USFWS recovery goal for Kootenai River White Sturgeon is:

Number of Kootenai sturgeon wild recruits (offspring that survive to sexual maturity at 25 years) added to the adult (25 years or older) population annually averages at least

250 individuals per year over 10 years. In addition, the population includes at least 10,000 wild juveniles, ages 3 to 24 years. The population demonstrates consistent natural production of at least 700 wild age-3 juveniles in at least three of 10 consecutive years.

Offspring of hatchery-reared sturgeon will count towards the recovery criteria, because those offspring will have been naturally spawned and reared in the Kootenai River.

WS2 - Spatial Distribution:

Stable, healthy populations within all available historic habitats. These habitats include the lower Columbia River and its estuary, the Willamette River downstream of Willamette Falls; the Bonneville, The Dalles, John Day, McNary, Priest Rapids, Wanapum, Rock Island, Rocky Reach, Wells, and Rufus Woods reservoirs; and Lake Roosevelt on the Columbia River mainstem; the Kootenai River from Kootenai Falls, Montana, downstream to Corra Linn Dam at the outflow from Kootenay Lake in British Columbia; Ice Harbor, Lower Monumental, Little Goose, and Lower Granite reservoirs in the lower Snake River upstream to Shoshone Falls; and Oregon and Washington coastal rivers, bays, and estuaries.

WS3 - Genetic Diversity:

Columbia River populations:

Maintain or attain genetic diversity within all populations similar to historic levels. Maintain diversity sufficient to respond to future conditions and permit population adaptation and persistence. The average number of alleles for groups of several similar-aged year classes of white sturgeon (minimum number examined = 50) at 14 standardized loci is ≥ 235 .

Snake River populations:

Preserve genetic integrity (including rare alleles) similar to current levels. Number of alleles is 184 alleles at 13 baseline microsatellite loci for Lower Granite Dam to Brownlee Dam; 184 and 121 alleles at 13 baseline microsatellite loci for reaches between Brownlee Dam to Shoshone Falls as measured at 5-year intervals for Shoshone, Upper Salmon, Bliss, CJ Strike, Swan Falls) and ten-year intervals for Hells Canyon. (IPC White Sturgeon Genetics Management Plan, Schreier et al. 2013)

Kootenai River:

Number of alleles is 97 at 14 microsatellite loci.

WS4 - Productivity:

Lower Columbia and Lower Snake:

Annual recruitment and length-frequency distribution of wild White Sturgeon populations in all impounded and non-impounded reaches indicates a balanced, robust, productive, and viable population capable of supporting societal needs. The below population-specific recruitment index objectives are provisional until full sturgeon loss assessments are completed.

- (1) Recruitment Index: Three year running mean of proportion of positive sets (E_p)
 - a. Lower Columbia: $E_p \geq 0.52$
 - b. Bonneville Reservoir: $E_p \geq 0.51$
 - c. The Dalles Reservoir: $E_p \geq 0.53$
 - d. John Day Reservoir: $E_p \geq 0.22$
 - e. McNary Reservoir and Free-flowing section: E_p when available based upon recruitment surveys.
 - f. Ice Harbor Reservoir: E_p when available based on recruitment surveys.
 - g. Lower Monumental Reservoir: E_p when available based on recruitment surveys.
 - h. Little Goose Reservoir: E_p when available based on recruitment surveys.

- (2) Length-Frequency Distribution: (In conjunction with above objectives) ~95% juveniles (21-38" FL), ~4.5% sub-adult (38-65" FL), ~0.5% adult (≥ 66 " FL)

Snake River:

- (1) Recruitment Index: Annual standardized YoY gill net sampling (CPUE) in Core Conservation populations (BLS to CJS and HCD to LGR) when available.

- (2) Length-Frequency Distribution – numbers to be developed.

Kootenai River:

Annual recruitment of Kootenai sturgeon reflects a balanced, self-sustaining, viable population.

The USFWS downlisting criteria is production of wild age-3 juveniles occurring at an annual average of at least 700 individuals over 10 consecutive years. Production of 700 or more wild age-3 juveniles should occur in at least 3 of the 10 years, ensuring the annual average is not the result of an anomalous single-year event.

The USFWS delisting criteria is the number of wild recruits (offspring that survive to sexual maturity at 25 years) added to the adult (25 years or older) population annually averages at least 250 individuals per year over 10 years and includes at least 10,000 wild juveniles aged from 3 to 24 years.

Pacific Lamprey (L)

In the absence of quantitative goals and objectives based in hydropower loss assessments, contribute to achieving the following adult abundance and other population targets for Pacific lamprey:

L1 - Adult Pacific lamprey abundance target of a three-year rolling average of 200,000 at Bonneville Dam by 2025, progressing toward 1,000,000 by 2035.¹³

L2 - Reduce the risk of extirpation and improve adult abundance toward sustainable harvestable levels across the historic distribution and range of Pacific lamprey in the Columbia basin, including across all six Pacific Lamprey Regional Management Units (RMU), measured every five years.¹⁴

L3 - Improve passage efficiency for adult Pacific Lamprey to an interim standard of at least 80 percent at each dam on the mainstem Columbia and Snake rivers.¹⁵

L4 - For juvenile lamprey, improve passage efficiency and survival progressing toward standards used to measure juvenile salmonid survival.¹⁶

Resident Salmonids (R)

Except for assessments of the impacts of Hungry Horse and Libby dams on resident fish, the Fish and Wildlife Program does not include quantitative loss assessments or related goals and objectives for the hydropower system's impacts on resident salmonids. In their absence...

R1 - For Bull Trout, contribute to achieving self-sustaining populations geographically widespread across their native range, providing for genetic integrity and exchange and with stable and/or increasing fish populations capable of sustaining harvest across that range.¹⁷

R2 - For Cutthroat Trout, contribute to achieving self-sustaining populations of geographically widespread across their native range, providing for genetic integrity and exchange and with stable and/or increasing fish populations capable of sustaining harvest across that range.¹⁸

R3 - For Kokanee, contribute to achieving self-sustaining, broadly distributed populations in the 11 subbasins in which they are present, with stable and/or increasing populations capable of sustaining harvest where they are identified as a focal species.¹⁹

R4 - For Redband Trout, contribute to achieving self-sustaining populations of geographically widespread across their native range, providing for genetic integrity and exchange and with stable and/or increasing fish populations capable of sustaining harvest across that range.²⁰

R5 - Hungry Horse Dam impacts on Westslope Cutthroat and Bull Trout have been assessed and partially mitigated. Mitigation for these losses has been expressed and implemented under the program primarily in terms of operations and habitat protection targets and not species numbers. A current mitigation target for these salmonids is by 2024 to restore and protect 448 miles (721 km) of suitable stream habitat within the Flathead River watershed that is closely equivalent to the habitat blocked and inundated by Hungry Horse Dam.²¹

R6 - Libby Dam impacts on Westslope Cutthroat and Bull Trout have been assessed and partially mitigated. Mitigation for these losses has been expressed and implemented under the program primarily in terms of operations and habitat protection targets and not species numbers. Current mitigation targets for these salmonids is by 2028 to protect or restore 109 miles (175.42 km) of Kootenai River and 40 miles (64.37 km) of tributary stream that were inundated by Libby Dam and make accessible 60 miles or more of previously blocked suitable streams.²²

Other Native Aquatic Focal Species (NF)

The fish and wildlife program does not include quantitative loss assessments or objectives for the hydropower system's impacts on other native aquatic focal species, including Eulachon, Burbot, Oregon Chub and freshwater mussels. At this point, the program's biological objectives for these other native aquatic focal species are expressed in the goal statement.²³

The ecological goal and relevant ecological objectives and related strategy performance indicators also apply to the aquatic species goal and biological objectives, as do the communication, assessment, and coordination goal and relevant objectives and related strategy performance indicators. See pages 22-24.

Wildlife Goal and Objectives

Goal

Mitigate for wildlife losses caused by the development and operation of hydropower dams.²⁴

Mitigation Objectives (W)

Wildlife losses from dam construction and inundation have been assessed and quantified and are displayed in Appendix C, Table C-4 of the 2014 Fish and Wildlife Program. The program expressed wildlife losses caused by dam construction and inundation (C&I) through a measurement of affected and inundated acres and then a calculation of lost habitat area and quality for representative species on those acres, called habitat units (HU), not through species numbers.

Mitigation for the assessed C&I losses is nearly complete, through three decades of the acquisition and protection of properties. The value of properties acquired has been assessed either as an amount of HUs acquired or as properties acquired of a certain acreage with an agreement among the relevant entities that acquisition of these properties sufficed to mitigate for an understood portion of the losses.

Operation losses, though assessed and mitigated in some areas, remain largely unassessed and unaddressed.

Though Appendix C, table C4 remains the expression of C&I mitigation objectives, the Council also wanted to determine mitigation to date. The Wildlife Loss Mitigation table (below) provides the Council's assessment of the degree to which Bonneville has completed its C&I or operation mitigation responsibility. The colors for each dam or dam group signify:

Dark Blue (DB) - The C&I loss has been mitigated through the acquisition of sufficient HUs; in the case of operation losses the loss has been mitigated through acquisition of the appropriate metric.

Light Blue (LB) - The C&I or operation loss has been mitigated through a settlement agreement. In some instances, the parties to the agreement have not completed the acreage or HU amounts, but Bonneville has fulfilled its obligation by dedicating funding to complete mitigation.

Yellow (Y) - C&I mitigation has taken place and might be nearing completion, but issues remain to be addressed or settled; for operation losses the loss has been assessed and some mitigation may have occurred.

Purple (P) - C&I mitigation has been unaddressed or significant issues remain to be addressed or settled; for operations, the loss has not been assessed, therefore no mitigation has occurred to count against the unassessed loss.

W1 - Complete mitigation for construction and inundation losses over the next five-year period by acquiring lands or through settlement to turn the entire C&I portion of the Wildlife Loss Mitigation table (below) to **Dark Blue** or **Light Blue**.²⁵

W2 - Assess and mitigate for losses due to the operation of the hydroelectric facilities. Mitigate for the assessed losses of wildlife associated with the ongoing operations of Hungry Horse and Libby at 26,321 acres for Hungry Horse Dam and 35,571 acres at Libby Dam. The objective for the next five-year period will be to turn the **Purple** portions of the Operation Loss portion of the Wildlife Loss Mitigation Table **Yellow or Light Blue**.²⁶

Wildlife Loss Mitigation (W1 and W2)

Dam or Dam Complex	C&I Loss	Operation Loss
Willamette	LB	LB
Bonneville	DB	P
The Dalles	DB	P
John Day	DB	P
McNary	DB	P
Lower Snake	DB	P
Upper Snake (Idaho MOA, including Deadwood operation)	LB	LB
Anderson Ranch	Y	P
Black Canyon	P	P
Deadwood	P	P
Minidoka	Y	P
Palisades	Y	P
Dworshak	LB	P
Chief Joseph	DB	P
Grand Coulee	Y	P
Albeni Falls (Idaho MOA)	LB	LB
Albeni Falls (Kalispel MOU)	LB	P
Albeni Falls (Other)	Y	P
Libby	LB	Y
Hungry Horse	LB	Y

W3 - All parcels and/or management units operate under an approved management plan.

W4 - Maintain existing habitat mitigation values on the parcels and/or management units as described in their individual management plans.

Ecological Goal and Objectives

Goal

Contribute to providing environmental conditions and processes that support the ecosystem functions necessary to restore healthy, self-sustaining and harvestable populations of native anadromous and resident fish and wildlife adversely affected by the hydroelectric power system, including related spawning grounds and habitat.²⁷

Ecological Objectives (E)²⁸

E1 - Contribute to maintaining and improving habitat quantity, quality, connectivity, and functions while taking into account climate change.

E2 - Contribute to maintaining and improving water quantity and quality.

E3 - Provide flows through the hydrosystem of sufficient quality and quantity to improve production, migration, and survival of fish.²⁹ As described in the 2014 Program and Part II of this 2020 Addendum, the program's objectives include flow objectives and reservoir elevation targets recognized in the program and in most cases embedded in the federal system operating plans and intended to benefit both listed and key unlisted populations of anadromous and resident fish. These objectives include managing water through the hydroelectric system to attempt to achieve the following seasonal flow objectives at specified mainstem Columbia and Snake River dams, with limitations and adjustments on meeting these targets as described by the Action Agencies in the 2018 ESA Section 7 consultation documents and in the 2014 Program's Mainstem strategy.³⁰

Location	Spring		Summer	
	Dates	Objective (kcfs)	Dates	Objective (kcfs)
Snake River at Lower Granite Dam	4/03 to 6/20	85 to 100 ⁽¹⁾	6/21 to 8/31	55 to 55 ⁽¹⁾
Columbia River at McNary Dam	4/10 to 6/30	220 to 260 ⁽¹⁾	7/01 to 8/31	200
Columbia River at Priest Rapids	4/10 to 6/30	135	N/A	N/A
Columbia River at Bonneville Dam	11/1 to emergence	125 to 160 ⁽²⁾	N/A	N/A

(1) the kcfs objective varies according to value forecasts.
(2) the kcfs objective varies based on actual and forecasted water conditions.
Kcfs: thousand cubic feet per second

E4 - Contribute to further reducing avian, pinniped and fish predators that negatively impact the habitat and populations of focal fish species in order to improve abundance and survival of these fish species.

E5 - Contribute to management, prevention or eradication of non-native and invasive species in order to improve abundance and survival of focal fish and wildlife species.

E6 - Contribute to maintaining and improving habitat quality on land purchased or managed to mitigate for hydrosystem impacts on wildlife, resident fish, and/or anadromous fish by developing and using approved land management plans for all parcels purchased under the program.

Communication, Assessment and Coordination Goal and Objectives

Goal

Inform the public about the fish and wildlife program to encourage awareness and involvement, including consideration of the program within an ecological and social context. Track and report on progress in program implementation and performance. Secure improved access to all program-related information and data.³¹

Communication, Assessment, and Coordination Objectives (C)

- C1 - Annually report on progress toward program objectives, program strategy performance indicators, and addressing research critical uncertainties.
- C2 - Review progress toward achieving objectives and strategy performance indicators and refine program objectives and program strategy performance indicators as needed.
- C3 - Improve access to information to inform decisions about program investments, operation and maintenance, and factors that affect program activities and success.
- C4 - Track FERC hydroelectric project applications with respect to the program's protected areas.
- C5 - Advance efforts to complete remaining loss assessments.

Strategy Performance Indicators

The following table contains the strategy performance indicators (indicators), organized by program strategy, that contribute to achieving the objectives. The code in parenthesis at the end of each indicator statement identifies the linkage between the objective and the indicator number; for example, S1-1 refers to objective S1 and indicator number 1. These indicators are not adopted into the program. The order of the strategies reflects the order in the 2014 Program.

<p>Habitat Strategy Indicators (Implementation indicators)</p>
Number of habitat acres protected or improved. (E1-1, E6-1)
Miles of stream protected or improved; miles and/or acres of access created. (E1-2)
Instream flow added (acre-feet or cubic feet per second of protected water). (E2-1)
Number of barriers removed. (E1-3)
Miles of road or trail removed or improved. (E1-4, E6-2)
Miles of levee or dike removed or improved. (E1-5)
Number of new fish screens installed, or number of screens improved. (E1-6)
<p>Non-Native and Invasive Species Strategy Indicators</p>
Number of watercraft inspected and decontaminated in the northwest states of the Columbia River Basin for zebra/quagga mussels. (E5-1)
Ratio of positive detections of zebra/quagga mussels to number of inspected watercraft. (E5-2)
<p>Predator Management Strategy Indicators</p>
The number of breeding pairs of Caspian Terns and availability of suitable nesting habitat on East Sand Island. ³² Compare the breeding pairs to the target range of 3,125 to 4,375, and the suitable nesting habitat to the target of one acre. (E4-1)
Cormorant colony size at East Sand Island. Compare to management goal that colony size does not exceed management average of 5600 breeding pairs. ³³ (E4-2)
Predation rate on ESA-listed juvenile salmonids by Caspian Terns in the Columbia Plateau region compares to target of less than 2%. ³⁴ (E4-3)

Exploitation rate on Northern Pikeminnow measuring nine inches or greater in total length (228 mm fork length). ³⁵ Compare the exploitation rate to the 10-20 percent annual target. (E4-4)
Emigration, spatial distribution, and index of abundance of non-native Northern Pike in the Columbia River Basin. ³⁶ Evaluate trend to determine if the numbers and range are reducing over time. (E4-5)
Counts of sea lions observed at Bonneville Dam, the lower Columbia River, estuary and Willamette Falls. Compare trend to determine if the impacts are decreasing over time. (E4-6)
Proportion of the adult salmon and steelhead run consumed by sea lions in the lower Columbia River and estuary, with emphasis on upper Columbia spring Chinook and wild Winter Steelhead. (E4-7)
Number of adult salmon and steelhead, White Sturgeon, and Pacific Lamprey consumed by sea lions at Bonneville Dam, the lower Columbia, estuary and Willamette Falls. ³⁷ (E4-8)
Annual average catch rate of Lake Trout in Upper Priest, Flathead, and Pend Oreille lakes. (R1-1, R3-1)
Protected Areas and Hydroelectric Development and Licensing Strategy Indicators Error! Bookmark not defined.
Number of preliminary permits issued by FERC in protected areas; proposed exclusions from protected areas; and exclusions granted by the Council. (C4-1)
Draft license applications submitted to FERC for hydroelectric projects in protected areas. (C4-2)
Licenses granted by FERC in protected areas. (C4-3)
Proposed exclusions from protected areas and exclusions granted by the Council. (C4-4)
Water Quality Strategy Indicators
Number of days above lethal fish temperatures for each species at fixed monitoring sites in the mainstem. (E2-2)
Number of days of spawning temperatures between 12C and 18C for Columbia River (downstream of McNary Dam) white sturgeon. ³⁸ (E2-3)
Percent exceedance of state and tribal water quality temperature standards at fixed monitoring sites in the mainstem. ³⁹ (E2-4)

Total dissolved gas (TDG) exceedances during spill events at Dworshak, Libby, Grand Coulee, Hungry Horse, Albeni Falls dams, and at other Columbia River and Snake River dams.⁴⁰ Compare to the following standards: (E2-5)

Projects	TDG Standard
Dworshak	110% as set by Idaho State
Libby	110% as set by Montana State
Grand Coulee	Operate to minimize TDG production
Hungry Horse	110% as set by Montana State
Albeni Falls	110% as set by Idaho State
Columbia River and Snake River Dams	TDG Levels set by Oregon and Washington

Climate Change Strategy Indicators (See Mainstem Flow, Water Quality and Plume/Nearshore Ocean Strategy Performance Indicators)

Mainstem Hydrosystem Flow and Passage Strategy Indicators

Annual adult salmon and steelhead survival for the Bonneville Dam to Lower Granite Dam reach and the Bonneville Dam to McNary Dam reach. (S4-1)

Powerhouse encounter rates, Lower Granite to Bonneville Dam and uppermost dam to Bonneville Dam.⁴¹ (S3-1)

Annual juvenile salmon and steelhead system and reach survival. (S3-2)

Seasonal flows at specified Columbia and Snake River dams. (E3-1)

Travel time for salmon and steelhead – Lower Granite to Bonneville Dam and uppermost dam to Bonneville Dam. (E3-2)

SARs for salmon and steelhead, Lower Granite Dam to Lower Granite Dam and uppermost to uppermost dam on the Columbia. (S2-1)

Percent of salmon and steelhead transported in Snake River (S3-3)

Number of direct mortalities of salmon and steelhead juveniles and adults at projects. (S4-2, S3-4)

Flows from Libby Dam for Kootenai River White sturgeon. (WS1-1; WS4-1)

Percent of days with flow equal to or greater than 250 KCFS from McNary Dam May through July for sturgeon recruitment. (E3-4; WS1-2; WS4-2)

Reservoir elevation and retention times at storage reservoirs. (E3-5)

Estuary Strategy Indicator

Acres of estuary floodplain protected or restored per hydrogeomorphic reach. Compare to target of no net loss of native habitats and recovery of 40 percent of historic extent for priority habitats.⁴² (E1-7)

Plume and Nearshore Ocean Strategy Indicator

NOAA's stop light indicator chart of ocean conditions.⁴³ (S1-1, S2-2)

Wildlife Mitigation Strategy Indicators

Amount of construction and inundation mitigation acquired at each hydro-facility or number of settlement agreements covering C&I losses. (W1-1)

Number of operational loss assessments or settlement agreements covering operational losses completed for each hydro-facility. (W2-1)

Number of parcels and/or management units being managed through an approved management plan. (W3-1)

Number of parcels or management units that report concerns related to meeting their habitat mitigation values. (W4-1)

Fish Propagation and Hatchery Indicators

Progress toward the following regionally agreed-upon targets for salmon and steelhead hatchery production. These targets were developed by the NOAA Marine Fisheries Advisory Committee's (MAFAC) Columbia Basin Partnership Task Force. For the complete details on these targets and supporting information go to [citation to be added]. See Objective S1 above for the relationship of these targets to the program. (S1-2)

Group	Current Hatchery Juvenile Production	Future Total Hatchery Juvenile Production
Lower Columbia Chum	770,000	770,000
Lower Columbia Coho	12,108,600	12,230,000
Lower Columbia Fall Chinook (tules)	19,366,500	19,366,500
Lower Columbia Fall Chinook (brights)	0	0
Lower Columbia Fall Chinook (brights) Select Area	2,100,000	2,100,000
Lower Columbia Spring Chinook	4,120,000	6,340,000
Lower Columbia Winter Steelhead	1,381,000	1,381,000
SW Washington Winter Steelhead	223,000	223,000

Lower Columbia Summer Steelhead	1,307,000	1,307,000
Mid-Columbia (upriver) Coho	5,200,000	5,200,000
Mid-Columbia Sockeye (Deschutes)	7,000	80,000
Mid-Columbia Spring Chinook	6,380,000	6,930,000
Mid-Columbia Fall Chinook (tules) Bonn Pool	10,700,000	10,700,000
Mid-Columbia Fall Chinook (brights)	11,000,000	12,000,000
Mid-Columbia Summer Steelhead	960,000	710,000
Snake River Fall Chinook	5,650,000	5,650,000
Snake River Sockeye	980,000	1,000,000
Snake River Spring Chinook	15,340,500	18,115,500
Snake River Summer Steelhead	10,328,000	10,328,000
Snake River Coho	1,550,000	1,550,000
Upper Columbia Fall Chinook	14,450,000	24,140,000
Upper Columbia Sockeye	4,500,000	14,100,000
Upper Columbia Spring Chinook	3,094,000	10,200,000
Upper Columbia Summer Chinook	4,286,000	14,400,000
Upper Columbia Summer Steelhead	935,300	2,750,000
Upper Columbia Coho	2,000,000	2,250,000
Willamette River Spring Chinook	5,241,000	5,817,000
Upper Willamette River Summer Steelhead	600,000	600,000
Upper Willamette River Winter Steelhead	0	0

All program-funded hatcheries have a final management plan and a reviewed and approved master plan, with specific objectives to track performance. (S6-1)

Salmon and steelhead indicators for Bonneville-funded hatcheries tracked and compared to management goals as described in hatchery management plans and HGMPs. (S6-2)

Sturgeon hatchery objectives are tracked and compared to the hatchery management plan and a reviewed and approved master plan. (S6-3, WS1-3)

Cutthroat Trout hatchery objectives are tracked and compared to the management plan and a reviewed and approved master plan. (S6-4, R2-1)

Kokanee hatchery objectives are tracked and compared to the management plan and a reviewed and approved master plan. (S6-5, R3-1)

Redband Trout populations' genetic integrity is protected from non-native hatchery trout by program-funded hatchery actions. (R4-1)

Pacific lamprey hatchery objectives are tracked and compared to a reviewed and approved master plan. (L1-1, L2-1)

Burbot hatchery objectives are tracked and compared to the management plan and a reviewed and approved master plan. (S6-6, NF-1)

Wild Fish Strategy Indicators

Progress toward the following regionally agreed-upon adult abundance escapement targets for natural-origin salmon and steelhead. These targets were developed by the NOAA Marine Fisheries Advisory Committee's (MAFAC) Columbia Basin Partnership Task Force. For the complete details on these targets and supporting information go to [citation to be added]². See Objective S1 above for the relationship of these targets to the program. (S1-3, S5-1)

Group	Low, 10-year geometric mean	Med, 10-year geometric mean	High, 10-year geometric mean
Lower Columbia Spring Chinook	9,800	21,550	33,300
Lower Columbia Chum	16,500	33,000	49,500
Lower Columbia Coho	67,900	129,500	191,400
Lower Columbia Fall Chinook (tules)	28,000	54,100	82,000
Lower Columbia Fall Chinook (late brights)	11,100	16,700	22,200
Lower Columbia Fall (brights)	11,000	11,000	11,000
Lower Columbia Summer Steelhead	4,600	5,850	6,950
SW Washington Winter Steelhead	19,000	27,900	36,400
Lower Columbia Winter Steelhead	21,100	29,800	38,100
Mid-Columbia Coho	6,500	14,000	23,500
Mid-Columbia Sockeye	7,500	45,000	107,500
Mid-Columbia Spring Chinook	17,750	40,425	114,500
Deschutes Summer/Fall	4,000	13,000	16,000
Mid-Columbia Summer Steelhead	21,500	43,850	69,150
Snake River Fall Chinook	4,200	10,780	23,360
Snake River Sockeye	3,000	6,750	11,500
Snake River Spring/Summer Chinook	31,750	91,875	148,500
Snake River Summer Steelhead	21,000	70,500	124,000
Snake River Coho	10,000	28,800	47,400
Upper Columbia Fall Chinook	9,200	62,200	87,800
Upper Columbia Sockeye	31,500	580,000	1,235,000

² MAFAC numbers for natural origin escapement are in the process of being updated from the numbers in the March 2019 Phase 1 report. Additional revisions to these numbers may occur and are expected to be available in early June 2020. The final MAFAC numbers will be added prior to adoption of the Program addendum.

Upper Columbia Spring Chinook	11,500	19,800	30,100
Upper Columbia Summer Chinook	9,000	78,350	131,300
Upper Columbia Summer Steelhead	7,500	31,000	47,000
Upper Columbia Coho	7,500	15,000	26,000
Upper Willamette Spring Chinook	28,900	47,800	66,800
Upper Willamette Winter Steelhead	16,300	27,800	39,300
Abundance of populations tracked as identified through coordinated assessments. (S1-4)			
Total Bonneville Dam, Lower Granite Dam and Willamette Falls counts. (S1-5)			
Trends in genetic diversity measures (heterozygosity, allelic diversity, private alleles, etc.)			
Anadromous Fish Mitigation in Blocked Areas Strategy Indicators			
Studies completed regarding fish passage, experimental pilot releases and testing interim fish passage facilities, fish reintroduction approaches, upstream/downstream passage options and costs, and habitat suitability. (S5-2)			
The blocked-area reintroduction implementation plans are completed. (S5-3)			
In blocked areas where the program has committed to any or all of these anadromous fish reintroduction activities, track the following: <ul style="list-style-type: none"> • Increase in habitat access for anadromous fish in the blocked waters above the blockage including, but not limited to, miles of fish habitat made accessible and high-head dam interim fish passage facilities in operation. (S5-4) • Number of salmon passed above and below the blockage through interim fish passage facilities and trap and haul. (S5-5) • Number of salmon released in reintroduction pilot projects and selective releases. (S5-6) 			
Resident Fish Mitigation Strategy Indicators			
Bull Trout population abundance by subbasin. (R1-1)			
Amount of protected or expanded habitat for Cutthroat Trout to provide for genetic integrity. (R2-2)			
Number of core and conservation populations of Cutthroat Trout. (R2-3)			
Redband Trout stream length (miles) and lake area (hectares) occupancy within each of the five geographic management units (GMUs). (R4-2)			
Percent of currently occupied habitat that contains genetically unaltered Redband Trout for the five GMUs. (R4-3)			
Redband Trout patch sizes at the population level. (R4-4)			

Percent of Redband Trout population that is hybridized for the five GMUs. ⁴⁴ (R4-5)
Number of miles or kilometers of suitable stream habitat in the Flathead River. (R5-1)
Number of acres of suitable stream or reservoir habitat in the Kootenai River Basin. (R6-1)
Number of accessible miles of previously blocked suitable streams in the Kootenai River Basin. (R6-2)
Status and trend of Kokanee. (R3-2)
Status and trend of Burbot. (NF-2)
Status, trend and distribution of native freshwater mussels. (NF-3)
Discussions with fish managers are undertaken to evaluate and identify the best approach to assess remaining native focal fish losses. (C5-1)
White Sturgeon Strategy Indicators
White Sturgeon population abundance:
<u>Lower Columbia and Lower Snake (WS1-4):</u> Lower Columbia: Three-year running mean of Sub-Adults and Adults. Bonneville Reservoir: Three-event sampling mean of Sub-Adults and Adults. The Dalles Reservoir: Three-event sampling mean of Sub-Adults and Adults. John Day Reservoir: Three-event sampling mean of Sub-Adults and Adults. McNary Reservoir and Free-flowing section: Sub-adult and adult abundance when available. Ice Harbor Reservoir: Sub-adult and adult abundance when available. Lower Monumental Reservoir: Sub-adult and adult abundance when available. Little Goose Reservoir: Sub-adult and adult abundance when available.
<u>Middle Snake:</u> Juvenile and adult abundance. (WS1-5)
<u>Upper Snake:</u> Population abundance (> 60 cm FL) and stock structure (juvenile, subadult, adult) compared at five-year sampling intervals for all Upper Snake reaches between Shoshone Falls and Brownlee Dam and 10-year intervals for Hells Canyon Dam to Lower Granite Dam. (WS1-6)
<u>Transboundary Upper Columbia:</u> Adult populations in the Canadian Transboundary Reach and the U.S. Transboundary Reach. Subsistence and recreational fishery harvest per year. (WS1-7)
<u>Kootenai River:</u> 10-year average of number of Kootenai sturgeon wild recruits (offspring that survive to sexual maturity at 25 years) that are added to the adult (25 years or older)

population annually. Number of wild juveniles, ages 3 to 24 years. Production of wild age-3 juveniles in three of 10 consecutive years. (WS1-8).

Offspring of hatchery-reared sturgeon will count towards the criteria, because those offspring will have been naturally spawned and reared in the Kootenai River.

Genetic Diversity:

The average number of alleles. (WS3-1)

Productivity:

Annual recruitment and length frequency distribution of wild White Sturgeon populations in all impounded and non-impounded reaches.

Lower Columbia and Lower Snake:

- Recruitment Index: Three-year running mean of proportion of positive sets (E_p). (WS4-3)
- Length-Frequency Distribution: juveniles, sub-adult, adult. (WS4-4)

Snake River:

- Recruitment Index: Annual standardized YoY gill net sampling (CPUE) in Core Conservation populations (Bliss Dam to C. J. Strike Dam and Hells Canyon Dam to Lower Granite Dam). (WS4-5)
- Length-Frequency Distribution. (WS4-6)

Kootenai River:

10-year average of number of Kootenai sturgeon wild recruits (offspring that survive to sexual maturity at 25 years) that are added to the adult (25 years or older) population annually. Number of wild juveniles, ages 3 to 24 years. Production of wild age-3 juveniles in three of 10 consecutive years. (WS1-9).

Offspring of hatchery-reared sturgeon will count toward the criteria, because those offspring will have been naturally spawned and reared in the Kootenai River.

Pacific Lamprey Strategy Indicators

Total end-of-year dam count at Bonneville Dam. (L1-2)

Geographic distribution as indicated by total end-of-year counts at Willamette Falls, Columbia and Snake River dams. (L1-3)

Abundance of juvenile and larval outmigration tracked at John Day Dam and Bonneville Dam. (L1-4)

PLCI Risk category as reported by RMU every five years. (L2-2)

RMU abundance and distribution indicators as reported every five years. (L2-3)

Adult passage efficiency for each Columbia and Snake mainstem dam. (L3-1)

Annual weighted average mortality rate for Pacific Lamprey macrophthalmia at Bonneville, McNary and John Day dams. (L4-1)
Annual weighted average injury rates for Pacific Lamprey macrophthalmia at Bonneville, McNary and John Day dams. (L4-2)
Juvenile and larval passage efficiency for each Columbia and Snake mainstem dam. (L4-3)
Eulachon Strategy Indicator
Spawning stock biomass of lower Columbia River eulachon. Evaluate to determine if biomass is stable and/or increasing. ⁴⁵ (NF-4)
Public Engagement Strategy Indicators
Status and summary reports on strategy performance indicators and progress toward objectives and goals. (C1-1)
Periodic review and refinement of strategy performance indicators with managers and the Regional Coordination Forum (RCF). (C2-1)
Review meeting(s) with managers and RCF on program objectives and strategy performance indicators prior to next program amendment. (C2-2)
Updates to and review of the Council's Program Tracker and Program Performance & Progress sites. (C3-1)
Annual updates to the Council's tracking document for Operation and Maintenance (O&M) needs for hatcheries, fish screens and lands and fish objectives and associated mappers. (C3-2)
Publication of the Columbia River Basin Fish and Wildlife Program Cost Report to the Northwest Governors. (C3-3)
Update on Columbia River Fish Mitigation annual capital investments. (C3-4)
Support of existing collaborative regional information exchange groups and databases, especially program-supported efforts. Examples are: The Coordinated Assessment effort, StreamNet, Fish Passage Center, CRITFC Inter-Tribal Monitoring Data, Columbia Basin Fish and Wildlife Library, Pacific Northwest Aquatic Monitoring Partnership, the Intermountain Province Subbasin Data Management Project and YNStar. (C3-5)
Financial and/or in-kind support to existing regional forums contributing to the program's progress, such as the RCF, Fish Screen Oversight Committee, Lamprey Technical Work Group and Conservation Team, collaborative White Sturgeon workshop, Lake Roosevelt Forum, Washington Salmon Recovery Conference, American Fisheries Society local meetings, The Columbia Basin Transboundary Conference, and Council science-policy exchanges. (C3-6)

B. Assessing, Monitoring and Reporting

The goals, objectives and strategy performance indicators described in Part I provide the key components for assessing program performance. The Council will use its Program Tracker and Program Performance & Progress tools to track how the program strategies are contributing to achieving the objectives and program goals, and to report on program performance. The Council will update the Tracker to report detailed information on the objectives and strategy performance indicators, along with relevant contextual information, such as climatic or ocean conditions. The Council will use the detailed information from the Tracker to update the infographics on the Program Performance and Progress tool. The Tracker will be updated to align with the reorganization of the program's goals, objectives, and strategy performance indicators.

The Council will convene a standing workgroup to provide advice and guidance to the Council on assessing and reporting on the program goals, objectives and strategy performance indicators. This workgroup will also continue to identify, evaluate and refine strategy performance indicators over time. The Council will begin reporting annually on the status of strategy performance indicators and progress toward objectives and goals. Prior to beginning the next Program amendment process the Council will produce a comprehensive program performance report that assesses and summarizes the status of strategy performance indicators and progress toward the objectives and goals. The report will also identify information gaps that limit the Council's ability to assess strategy performance indicators and will describe the data and information required to address the gaps.

Research, monitoring and evaluation are essential for assessing program performance and implementing adaptive management. The Council is committed to working with partners to develop basinwide research, monitoring, and evaluation (RM&E) strategies that demonstrate the effectiveness of actions at multiple scales. The strategies will create a coordinated approach to research, monitoring and evaluation, but will be flexible enough to accommodate the biological and ecological variation across the basin. The focus of these strategies will be to address key management questions, provide data for evaluating project and program performance, and inform future actions. The data compiled through program performance and RM&E provide information to help address the critical uncertainties in the Council's 2017 Research Plan and can serve as a basis for updating the plan over time.

Project implementation is an important component of Program performance. Projects address the Program's strategies and measures, track and assess changes in biological and ecological conditions and provide data and information to inform and resolve critical uncertainties. The objectives and strategy performance indicators described in this addendum will inform project reviews and help identify needed changes in program priorities or strategy implementation.

To adequately assess the program, it is critical that current information-gathering and data-management capabilities are retained and that there is strong coordination among

data collection, management, assessment, and reporting efforts across the basin. At a minimum, the following activities must continue to be adequately supported:

- Public access to Bonneville-funded project implementation information through an interactive website that uses standardized fields to facilitate data access and data downloads (e.g., database queries). Adjustments are needed to the existing Bonneville database (cbfish.org) to improve the delivery of information that the Council uses to assess and report on program performance. These adjustments include: (a) adding a standardized list of the program goals, objectives, and strategy performance indicators; (b) connecting these elements to projects/contracts as appropriate; and (c) providing Excel reports with data in the required format for Council staff.
- Public access through centralized databases of compiled and analyzed data required for reporting on program goals, objectives, strategy performance indicators, and other supporting information. Proper documentation and metadata are an important component of this effort. Needed improvements include collaborative development and use of data exchange standards for additional fish species and topics to improve access to analyzed data (for example, hatchery metrics and cutthroat trout indicators); and delivery of these data to the appropriate centralized database.
- Maintenance of historical and current program data and products (e.g., tools, GIS-layers, documents) in a structured manner that facilitates public access in a searchable format (e.g. through libraries and databases). This includes the program's Protected Areas database, mapper and files; habitat evaluation procedures (HEP) data and documentation; Council documents; ISG/ISAB/ISRP documents; past and current subbasin plans; "grey" literature such as technical reports, consultants' reports, and state government/non-profit organizations' reports; tribal data and products; Bonneville annual project reports; program investments such as hatcheries, fish screens, and analytical models; and data documentation.

References

¹ The values for these implementation accomplishments are based on the summation of values provided from Bonneville's project implementation database www.cbfish.org.

² www.bpa.gov/efw/FishWildlife/SpillOperationAgreement/doc/ECF-2298_Spill-Notice-and-Agreement.pdf

³ www.govinfo.gov/content/pkg/PLAW-115publ329/html/PLAW-115publ329.htm

⁴ nwcouncil.box.com/s/m0j3w1vibhq7fpve43rdpctdvkiq30vmnwcouncil.box.com/s/07tp410h8ww8xx0u5fzac762lvy24540

⁵ ucut.org/wp-content/uploads/2019/05/Fish-Passage-and-Reintroduction-Phase-1-Report.pdf

⁶ Northern Idaho Memorandum of Agreement between the State of Idaho and the Bonneville Power Administration for Wildlife Habitat and Stewardship, August 2018, See [Northern Idaho MOA](#)

Bonneville Power Administration, Administrators' Record of Decision and Response to Comments Southern Idaho Wildlife Mitigation Memorandum of Agreement, September 2014, See [Southern Idaho MOA](#)

⁷ nwcouncil.box.com/s/tv8ct47vzz58v8smuuzi53z7u5fanx9l

⁸ The Anadromous Salmon and Steelhead Goal is based on the following sources of information: (a) 1987 Fish and Wildlife Program, section 203; (b) 1994/1995 Fish and Wildlife Program section 4.1; (c) 2000 Fish and Wildlife Program section on Objectives for Biological Performance; (d) 2014 Fish and Wildlife Program section III. Goals and Objectives – the changes we want to achieve; and, (e) 2014 Fish and Wildlife Program Appendix D, Theme 2, objective 2.a.

⁹ Objective S4 is based on 2014 Fish and Wildlife Program Appendix D, Theme 2, objective 5b. It originates from the 2009 NOAA Fisheries FCRPS Biological Opinion the Reasonable and Prudent Alternative No. 52 - Hydrosystem Research, Monitoring and Evaluation Strategy 2 of the NOAA Fisheries 2008 FCRPS Biological Opinion, including Table 7 (see details: nwcouncil.box.com/s/j5jpgzb1hpp64w0zb12z91ydc724p73y), and is included in the Council's HLIs.

¹⁰ This objective is related to the Anadromous Mitigation in Blocked Areas strategy in the 2014 Fish and Wildlife Program and the provision on Blocked Areas Mitigation implementation in Part II of the 2020 Addendum. Reintroduction possibilities of various kinds are being investigated or discussed for most blocked areas; all are at different levels of progress. This objective is intended to reflect and track agreements that exist to investigate reintroduction, and not be a mechanism to drive implementation of

reintroduction proposals. Differences in policy (e.g. Idaho's Blocked Areas Policy as Approved by the Governor's Office, 24 Feb 2020 and Upper Snake River Tribes' Hells Canyon Complex Fish Management Program, April 27, 2018) need to be worked out in other fora and then brought to the Council's program.

¹¹ The qualitative native aquatic species goal is based on the 2014 Fish and Wildlife Program Appendix D, Theme Two.

¹² The values for the White Sturgeon objectives are based on the following sources of information: (a) Lower Columbia: ODFW Lower Columbia River and Oregon Coast White Sturgeon Conservation Plan, 2011; (b) Bonneville, The Dalles and John Day Reservoir: Draft (unpublished) ODFW Zone 6 management plans based on the same PVA methodology as the ODFW, 2011 plan; (c) Middle Snake: 2005 White Sturgeon Management Plan in the Snake River between Lower Granite and Hells Canyon dams; (d) Upper Snake: 2004 Middle Snake Subbasin Management Plan; (e) A.D. Schreier et al. Aquaculture 416–417 (2013) 141–145; Idaho Power Company. 2015. Snake River White Sturgeon Conservation Plan, 2015-2020 Planning and Implementation. Unpublished Report to Idaho Power Company, Boise ID. p. 132. (f) Transboundary Upper Columbia: Upper Columbia White Sturgeon Recovery Initiative Operational Plan 2013-2017, Upper Columbia White Sturgeon Recovery Plan - 2012 Revision, and, 2013 Columbia Basin White Sturgeon Planning Framework; (g) Kootenai USFWS Revised Recovery Plan for the Kootenai River Distinct Population segment of White Sturgeon, 2019.

¹³ Objective L1 is based on the 2011 Tribal Pacific Lamprey Restoration Plan for the Columbia River Basin.

¹⁴ Objective L2 is based on U.S. Fish and Wildlife Service (2012). Pacific Lamprey Conservation Agreement. U.S. Fish and Wildlife Service, Portland, Oregon. 57 pp.

¹⁵ Objective L3 is based on the 2011 Tribal Pacific Lamprey Restoration Plan for the Columbia River Basin.

¹⁶ The Objective L4 is based on (a) 2011 Tribal Pacific Lamprey Restoration Plan for the Columbia River Basin; and, (b) recommendations submitted for the 2014 Program amendment process by BPT, CRITFC, CTGR, CTUIR, Cowlitz, NPT, USRTF, USFWS.

¹⁷ The Objective R1 is based on the 2014 Fish and Wildlife Program Appendix D, Theme 2, and documents compiled in the Fish Objectives mapping tool including the 2002 USFWS Bull Trout Draft Recovery Plan.

¹⁸ The Objective R2 is based on the 2014 Fish and Wildlife Program Appendix D, Theme 2.

¹⁹ The Objective R3 is based on (a) the 2014 Fish and Wildlife Program Appendix D, Theme 2, and (b) documents compiled in the Fish Objectives mapping tool including: Montana Statewide Fish Management Plan 2013-2018, IDFG Fisheries Management

Plan 2013-2018, 2012 Coeur d'Alene Tribe Integrated Resource Management Plan, 2000 Draft Pend Oreille Subbasin Summary, 2000 Draft San Poil River Subbasin Summary, 2004 Spokane Subbasin Plan, 2000 Kootenai River Subbasin Management Plan, and MFWP/CSKT Flathead Lake and River Fisheries Co-Management Plan 2001-2010.

²⁰ The Objective R4 is based on (a) the 2014 Fish and Wildlife Program Appendix D, Theme 2, and, (b) documents compiled in the Fish Objectives mapping tool including: 2016 Conservation Strategy for Interior Redband (*Oncorhynchus mykiss* subsp.) in the states of California, Idaho, Montana, Nevada, Oregon and Washington, 2000 Fifteenmile Subbasin Summary, 2009 Lake Roosevelt Fisheries Guiding Document, IDFG Fisheries Management Plan 2013-2018, 2014 Rangeland Conservation Agreement for the Conservation and Management of Interior Redband Trout, Montana Statewide Fisheries Management Plan 2013-2018, and 2004 Intermountain Province Subbasin Plan.

²¹ Objective R5 is based on the Hungry Horse Mitigation Plan; Fisheries Mitigation Plan for Losses Attributable to the Construction and Operation of Hungry Horse Dam, Bonneville Project No. 1990-2003, Technical Report, Project No. 199301904, available nwcouncil.box.com/s/fqjl4sdegg6i9mad6bu8j2hfo4wa25pr

²² Objective R6 is based on the Fisheries Mitigation and Implementation Plan for Losses Attributable to the Construction and Operation of Libby Dam, Bonneville Project No. 1995-00400, available nwcouncil.box.com/s/aye1lypekqusy550bnuxf7yn9k7ij6bq

²³ Information relevant to goals and objectives for other native aquatic species can be found in (a) 2014 Fish and Wildlife Program Appendix D, Theme 2; (b) 2016 Draft Eulachon Recovery Plan October 2016 Endangered Species Act Recovery Plan for the Southern Distinct Population Segment of Eulachon (*Thaleichthys pacificus*); (c) the 2017 Endangered Species Act Recovery Plan for the Southern Distinct Population Segment of Eulachon (*Thaleichthys pacificus*); (d) 2013 Federal Recovery Outline Pacific Eulachon Southern Distinct Population Segment ; (e) WDFW/ODFW 2001 . Washington and Oregon Eulachon Management Plan; (f) 2004 Lower Columbia Salmon Recovery And Fish & Wildlife Subbasin Plan Volume II – Subbasin Plan Chapter A – Lower Columbia Mainstem and Estuary; (g) 2015 Eulachon: State of the Science and Science to Policy Forum available nwcouncil.box.com/s/9smx3zqt6y8ym5ipw45g10fihillpsme.

²⁴ The Wildlife Goal (W) is based on the 2014 Fish and Wildlife Program Appendix C and Appendix D, Theme 1. For a quantification of losses from construction and inundation of the hydrosystem, see Appendix C, Table C-4.

²⁵ These values are described in the Wildlife Strategy Program Mitigation and Remaining Loss Ledger presentation to the Fish and Wildlife Committee February 2019. See [Loss Ledger Power Point](#)

Supporting documents include: (a) Wildlife Mitigation Agreement for Dworshak Dam. Bonneville Power Administration, State of Idaho and Nez Perce Tribe, See [Dworshak Dam Agreement](#) (b) Northern Idaho Memorandum of Agreement between the State of Idaho and the Bonneville Power Administration for Wildlife Habitat and Stewardship, August 2018, See [Northern Idaho MOA](#); (c) Wildlife Mitigation Agreement for Libby and Hungry Horse Dams between the Bonneville Power Administration and the State of Montana (1992). See [Montana Agreement](#) (d) Willamette River Basin Memorandum of Agreement Regarding Wildlife Habitat Protection and Enhancement between the State of Oregon and the Bonneville Power Administration, October 22, 2010, See [Willamette MOA](#); and, (e) Bonneville Power Administration, Administrators' Record of Decision and Response to Comments Southern Idaho Wildlife Mitigation Memorandum of Agreement, September 2014, See [Southern Idaho MOA](#)

²⁶ The values for Objective W2 are described in the Wildlife Strategy Program Mitigation and Remaining Loss Ledger presentation to the Fish and Wildlife Committee February 2019. See [Loss Ledger Power Point](#)

Supporting documents include 2018 recommendations and comments on the 2014 F&W Program received from Montana Fish, Wildlife & Parks, Confederated Salish & Kootenai Tribes, and Kootenai Tribe of Idaho.

²⁷ The Ecological Goal is based on the 2014 Fish and Wildlife Program Appendix D, Theme 1, Goal 1.

²⁸ The ecological objectives are based on the 2014 Fish and Wildlife Program Appendix D, Theme 1 and consultation during program amendment goals and objectives workshop.

²⁹ The Objective E3 is based on (a) the 2019 CRS Biological Opinion, (b) 2018 Consultation Package related to the 2019 CRS Biological Opinion (c) the 2008 FCRPS BiOP, and (d) 2007 Biological Assessment for Effects of Federal Columbia River Power System and Mainstem Effects of Other Tributary Actions on Anadromous Salmonid Species Listed Under the Endangered Species Act.

³⁰ The table of values in Objective E3 is from the ESA Section 7(a)(2) Initiation of Formal Consultation for the Operations and Maintenance of the Columbia River System on NOAA Fisheries Listed Species and Designated Critical Habitat. Bonneville Power Administration, Bureau of Reclamation, U.S. Army Corps of Engineers, November 2, 2018, available www.salmonrecovery.gov/doc/default-source/default-document-library/proposedaction2019crs.pdf?status=Temp&sfvrsn=0.29652687684318046. These values are also included in Appendix B.2. - Operations to Benefit Listed Fish (Table B.2.1-1) in the Biological Assessment for Effects of Federal Columbia River Power System and Mainstem Effects of Other Tributary Actions on Anadromous Salmonid Species Listed Under the Endangered Species Act. Bonneville Power Administration, Bureau of Reclamation, U.S. Army Corps of Engineers, August 2007, available www.salmonrecovery.gov/Files/BiologicalOpinions/Appendix.pdf

³¹ The Communication goals and objectives are based on the Public Engagement goals in 2014 Program App D and consultation during the program amendment goals and objectives workshop.

³² The Performance Indicator E4-1 is based on (a) the 2014 Fish and Wildlife Program Predator Management Strategy; (b) USFWS 2005 Caspian Tern Management to Reduce Predation of Juvenile Salmonids in the Columbia River Estuary, Final Environmental Impact Statement; (c) USACE 2014 Inland Avian Predation Management Plan Environmental Assessment; and, (d) Roby D.D. et al. 2015 Avian Predation on Juvenile Salmonids: Evaluation of the Caspian Tern Management Plan in the Columbia River Estuary. 2015 Bonneville Annual Project Report, Project No. 1997-024-00.

³³ The Performance Indicator E4-2 is based on Double-Crested Cormorant Management Plan to Reduce Predation of Juvenile Salmonids in the Columbia River Estuary Final Environmental Impact Statement (FEIS).

³⁴ The Performance Indicator E4-3 is based on Avian Predation in the Columbia Plateau Region: Management, Monitoring and Evaluation, 2019 Final Annual Report

³⁵ The Performance Indicator E4-4 is based on (a) the 2014 Fish and Wildlife Program Predator Management Strategy; and, (b) Williams, S.E. et al. 2017 Report on the predation index, predator control fisheries, and program evaluation for the Columbia River Basin Northern pikeminnow sport reward program, 2017 Bonneville Annual Project Report, Project No. 1990-077-00.

³⁶ The Performance Indicator E4-5 is based on (a) from the 2014 Fish and Wildlife Program Predator Management Strategy; and, (b) Northern Pike Suppression and Monitoring, Bonneville Project No. 2017-004-00, implemented by the Colville Confederated Tribes, Spokane Tribes, and WDFW.

³⁷ The Performance Indicators E4-6, E4-7 and E4-8 are based on (a) the 2014 Fish and Wildlife Program Predator Management Strategy; (b) 2011 Tribal Pacific Lamprey Restoration Plan for the Columbia River Basin; (c) Hatch D.R. et al. 2018. Sea Lion Monitoring and Non-Lethal Hazing. 1/1/2017 – 12/31/2017 Bonneville Annual Project Report, Project No. 2008-004-00; and, (d) Tidwell K.S. et al. 2018. Evaluation of Pinniped Predation on Adult Salmonids and other Fish in the Bonneville Dam Tailrace, 2018. USACE Portland District, Fisheries Field Unit. Cascade Locks, Oregon, available pweb.crohms.org/tmt/documents/FPOM/2010/Task%20Groups/Task%20Group%20Pinnipeds/2018%20Pinniped%20Annual%20Report.pdf

³⁸ The performance indicator E2-3 is based on Parsley, Michael J., Lance G. Beckman and George T. McCabe JR. Spawning and Rearing Habitat Use by White Sturgeons in the Columbia River Downstream from McNary Dam. Transactions of the American Fisheries Society 122:217-227, 1993
citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.522.5160&rep=rep1&type=pdf

³⁹ The Performance Indicator E2-4 consists of the standards promulgated or adopted by the five governments with jurisdictions over the Columbia, Lower Columbia, and Lower Snake Rivers listed in the February 5, 2018 [draft document](#) for Temperature Water Quality Standards for the Columbia, Lower Columbia, and Lower Snake Rivers prepared by U.S. EPA Region 10. This performance indicator relates to the general measures to address temperature under the 2014 Program's Water Quality sub-strategy.

⁴⁰ The Performance Indicator E2-5 is based on the 2014 Fish and Wildlife Program Appendix D, Theme 1 and the Kalispel Tribe of Indians 2018/2019 program amendment recommendation to add the Albeni Falls Dam total dissolved gas standard of 110%.

⁴¹ The Performance Indicator S3-1 is based on the recommendations submitted by ODFW, WDFW, and Nez Perce Tribe, for the 2018-2019 Fish and Wildlife Program amendment process and the 2019-2021 Spill Operation Agreement.

⁴² The Performance Indicator E1-7 is based on the 2014 Fish and Wildlife Program Appendix D, Theme 1, and Corbett, C. et al. in preparation (Lower Columbia Estuary Partnership) that contains the specific percentage stated in E1-4.

⁴³ The Performance Indicators S1-1 and S2-2 are from Northwest Fisheries Science Center Ocean Ecosystem Indicators
www.nwfsc.noaa.gov/research/divisions/fe/estuarine/oeip/index.cfm

⁴⁴ The Performance Indicators R4-2, R4-3, R4-4, R4-5 are based on Interior Redband Conservation Team. 2016. A Conservation Strategy for Interior Redband (*Oncorhynchus mykiss* subsp.) in the states of California, Idaho, Montana, Nevada, Oregon, and Washington.

⁴⁵ The Performance Indicators NF-4 is based on 2019 Briefing on Columbia River Eulachon by Laura Heironimus (Washington Department of Fish and Wildlife) presented to NPCC Fish and Wildlife Committee on 11 May 2019, available
www.nwcouncil.org/sites/default/files/2019_0409_4.pdf