Northwest **Power** and **Conservation** Council

May 31, 2017

MEMORANDUM

TO: Council members

FROM: Karl Weist

SUBJECT: Presentation on Willamette Biological Opinion, High Head Dam Passage and Flow Measures

BACKGROUND:

Presenter: Ian Chane, Columbia River Fish Mitigation Program Manager, US Army Corps of Engineers Portland District

Summary: In 2008, the US Fish and Wildlife Service and the National Marine Fisheries Service issued Biological Opinions to address ESA-listed populations of Oregon chub, bull trout, salmon and steelhead. Those BiOps feature upstream and downstream passage actions and actions designed to address downriver temperature effects from operation of the Willamette Valley Project.

Relevance: Actions taken under the Willamette Biological Opinions address Council strategies articulated in the 2014 Fish and Wildlife Program regarding anadromous fish mitigation in blocked areas and the use of hatcheries for reintroduction of salmon and steelhead stocks. Specifically, the actions taken under the BiOps address Fish and wildlife Program measure for reintroductions above projects in the Willamette River Basin – "The Corps and Bonneville should support and implement anadromous fish passage measures prioritized through the Willamette River Basin Biological Opinion."

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Background: The Willamette Valley Project consists of 13 federal dams developed to provided flood control, hydropower generation (power share purposes run from 23% at Cougar to 100% at Big Cliff), recreation, water quality, and irrigation benefits. Declines in populations of Willamette spring chinook and steelhead, along with resident bull trout and Oregon chub led to Endangered Species Act listings in 1993, 1998 and 1999. The 2008 Biological Opinion for the Willamette Basin Flood Control Project set forth a series of proposed actions with a Reasonable and Prudent Alternative to mitigate for the effects of the Willamette Valley Project upon those listed fish populations. Based upon many of the actions taken under the BiOp, the US Fish and Wildlife Service delisted Oregon chub on February 17, 2015. Oregon chub became the first delisted fish species due to recovery.

RPAs include both adult upstream and juvenile salmonid downstream passage. The BiOps set forth a series of actions to deal with downstream temperature effects, proscribed the development of hatchery genetics management plans for the continued production of hatchery fish in the Willamette basin, called for improved habitat for species below the projects, and established the Willamette Action Team for Ecosystem Restoration (WATER) to help oversee the implementation of the BiOp provisions.

The Corps created the Configuration/Operation Plan (COP) to help analyze and sequence the appropriate passage actions. Currently, most adult upstream passage actions have taken place or are in process. Juvenile passage alternatives are being studied by various WATER teams. Evaluations and designs should be in place in the near future, with construction to begin on certain juvenile passage facilities around 2020 and continuing through the term of the BiOps in 2023.

Ian Chane of the Corps will brief the Council on all these passage efforts and the plans for Willamette BiOp implementation.

More Info: Please see attached excerpt from the Executive Summary of the Configuration and Operations Plan Phase II Report, October 2015.

http://www.nwp.usace.army.mil/Portals/24/docs/environment/biop/WillametteBiOp_Overview_FS.pdf

https://www.salmonrecovery.gov/BiologicalOpinions/WillametteBiOp.aspx

http://www.westcoast.fisheries.noaa.gov/fish_passage/willamette_opinion/

EXECUTIVE SUMMARY

The Configuration/Operation Plan (COP), Phase II Report, for the Willamette Valley system provides recommendations to address the Reasonable and Prudent Alternative (RPA) contained in the National Oceanic and Atmospheric Administration's National Marine Fisheries Service (NOAA Fisheries or NMFS) 2008 Biological Opinion (BiOp) for the Willamette System (WS) operated and maintained by the US Army Corps of Engineers (USACE or Corps). The RPA listed actions to be implemented to avoid jeopardy to Upper Willamette River (UWR) spring Chinook salmon (*Oncorhynchus tshawytscha*) and UWR winter steelhead (*O. mykiss*) from continued operations and maintenance of the WS. This COP Phase II report was guided by the development of alternatives documented in the 2009 COP Phase I Report.

Although this document does not meet the EC 11-2-208 (dated 31 Mar 2015) definition as a "Decision Document", it is being used to document the long-term plan for implementing the 2008 Willamette Biological Opinion.

BACKGROUND

The WS system consists of 13 multipurpose dams and reservoirs, and approximately 92 miles of riverbank protection projects in the Willamette River Basin in Oregon. Each project contributes to the overall water resources management in the basin which is designed to provide flood risk management, hydropower generation, irrigation, navigation, recreation, fish and wildlife, and improved water quality on the Willamette River and many of its tributaries.

The fish species listed under the Endangered Species Act (ESA) affected by operation of the WS[1] include UWR spring Chinook salmon, UWR winter steelhead, and bull trout (*Salvelinus confluentus,* threatened). The WS primarily affects four of seven Chinook salmon populations in the UWR, located in the North and South Santiam, McKenzie, and Middle Fork subbasins, as well as two of four winter steelhead populations located in the North and South Santiam subbasins (see map). Willamette subbasins not influenced by Corps facilities are not addressed in this document, although it should be noted that these subbasins also have an impact on the overall recovery of these fish.

Historically, annual wild adult spring Chinook salmon abundance in the Willamette Basin may have ranged as high as 300,000. Large declines in abundance were noted before construction of the WS dams and revetments. Intense commercial and sport fisheries, hatcheries, pollution (domestic and industrial), and habitat degradation (including logging) are cited as the most important factors contributing to these declines. Prior to the start of any WS dam construction in subbasins where spring Chinook populations occurred, the count of wild spring Chinook at Willamette Falls was about 55,000 in 1946 and 47,000 in 1947. Runs continued to diminish as WS dams were constructed in the Santiam, McKenzie, and Middle Fork subbasins, to less than 20,000 wild Chinook after 1960. WS dams and revetments were constructed mostly in eastside tributaries of the Willamette Basin during the 1950s and 1960s.

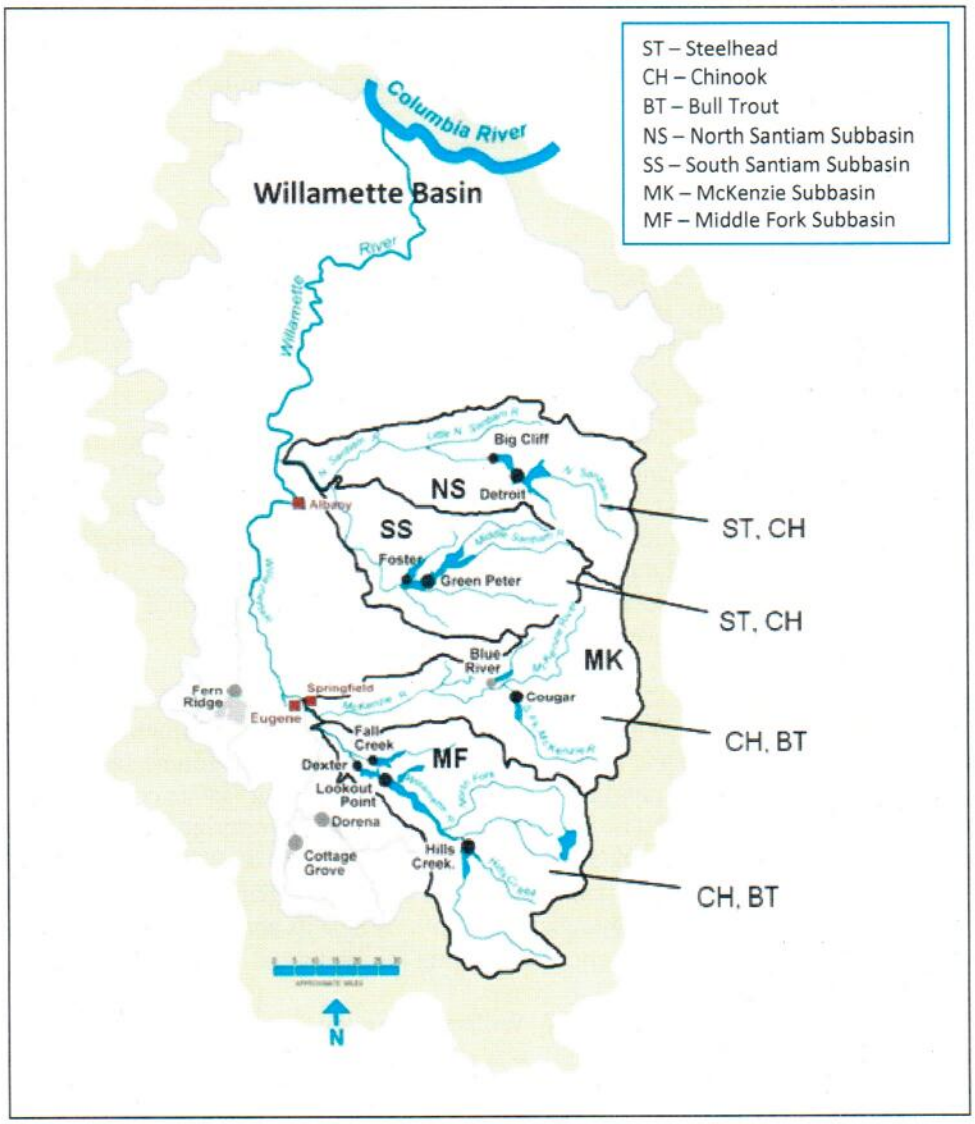
In addition to reducing flooding in the developing Willamette Valley, improving river navigation, and providing hydropower and other benefits, the WS was envisioned to improve water quality by increasing summer flows using WS storage. Water quality in the Willamette River mainstem has since improved; however, dams in the tributaries have blocked access to a majority of spawning habitat for spring Chinook and impacted their production by channelizing the river with revetments, and altering flow,

[1] Oregon chub (*Oregonichthys crameri*) are also affected by the WS but were officially delisted from the ESA in February 2015.

changing sediment dynamics, and impacting water temperature. At the time, state and federal fisheries managers preferred implementation of hatcheries to maintain fish for harvest, as fish passage was deemed infeasible for WS high head dams. Therefore, hatchery production of Chinook salmon, steelhead and trout was increased to mitigate for lost habitat above WS dams. These hatchery practices have impacted the wild productivity and health of spring Chinook in the Willamette Basin.

In recent years, the total abundance of wild spring Chinook migration at Willamette Falls was less than 5,000 annually, while total abundance of hatchery spring Chinook migrating passed Willamette Falls was 28,000 to 65,000.

Map of Corps Impacted Subbasins in the Willamette Basin and Distribution of Listed Fish Species



In 2000, the Corps prepared a Biological Assessment (BA) to meet requirements under Section 7 of the ESA with regard to continued operations and maintenance of the WS. In 2007, a supplemental BA was prepared by the Action Agencies (Corps, Bonneville Power Administration and Bureau of Reclamation), providing an update on the biological information for ESA-listed species, the environmental baseline condition, and analysis of the effects of a revision to the proposed action on spring Chinook and winter steelhead. Based on the Supplemental BA, NOAA Fisheries issued a BiOp in 2008 concluding that spring Chinook and winter steelhead would be jeopardized by continued operation and maintenance of the WS as described in the supplemental BA. A USFWS BiOp, also completed in 2008, concluded bull trout would not be jeopardized by continued WS operations as long as the NOAA Fisheries BiOp RPA was implemented.

A major goal of the RPA is to provide effective fish passage for UWR Chinook and steelhead at select WS dams to re-gain access to upstream historic spawning grounds and increase fish production. An effective fish passage program for Chinook and steelhead requires appropriate flows, water temperatures, and fish passage routes at dams to attract and safely pass upstream-migrating adults and downstream-migrating juveniles.

Several actions have been completed as part of the 2007 BA/2008 RPA implementation, which include construction of three new adult fish facilities (Cougar, Minto and Foster) for collection and transport to upstream habitats, interim operations for downstream fish passage and temperature improvement implemented at several dams, improvements to adult fish release sites at spawning grounds above the dams, and research to fill data gaps supporting alternative selection and design.

Improving downstream juvenile fish passage at high-head dams will be challenging, and this action was only generally described in the RPA. As a result of negotiations between NOAA Fisheries and the Action Agencies, the feasibility, performance criteria, biological benefits, and specific locations of these substantive downstream fish actions were to be investigated, and preferred alternatives presented to NOAA Fisheries using the COP process (RPA 4.13). The Action Agencies harbor sole responsibility for implementation of proposed alternatives to meet BiOp requirements that are determined to be feasible and authorized, while the responsibility for assessing the adequacy of alternatives and system-wide scenarios for avoiding jeopardy to ESA-listed species or adverse modification of critical habitat remains solely the responsibility of NOAA Fisheries and USFWS.

The 2007 BA and 2008 RPA included the following specific priority actions for implementation, unless the COP analysis indicated they were infeasible or identified more cost-effective actions:

- Upstream Passage Improvements (complete Cougar adult trap facility, replace/improve Minto, Foster, Dexter, and Fall Creek adult fish collection facilities).
- Provide Downstream Fish Passage (Cougar, Detroit, and Lookout Point).
- Provide Temperature Control (Detroit).

A visual aid to demonstrate the actions outlined in the RPA that have been, or are in the process of being, implemented by the Action Agencies is the table below. The color coding in the table is green for completed actions, blue for ongoing actions, white for actions not yet implemented or else not applicable.

Overview of Action Agency[3] BiOp Implementation Status (Green are completed actions, Blue are ongoing actions, White are not yet implemented or not applicable)

	North Santiam	South Santiam	McKenzie	Middle Fork	
Adult Upstream Passage	Minto	Foster	Cougar[1]	Dexter	Fall Creek
Juvenile Downstream Passage	Detroit	Spill weir at Foster	Cougar (PFFC)[2]	Hills Creek / Lookout Point	Drawdown of Fall Creek
Downstream Temperature	Detroit (operational)	NA (current operations sufficient)	Temperature Tower operation at Cougar[1]	NA	NA
Habitat	Habitat Technical Team work ongoing – land purchases/habitat restoration funded (BPA)				
Streamflow and Ramping Rates	Targets implemented per NOAA Fisheries 2008 RPA, RM&E ongoing				
Hatchery Reforms	Best practices for adult trap and haul, adjust juvenile release timing, hatchery production reprogramming and reductions				
RM&E	Informing implementation of fish passage solutions and other actions				

[1] Cougar adult trap and temperature tower completed separately from the 2008 BiOp.
[2]Cougar PFFC is the Portable Floating Fish Collector.
[3]The Action Agencies are USACE, BPA, and the BOR

COP CRITERIA AND APPROACH TO EVALUATING ALTERNATIVES

The 2008 RPA for the WS stated that the Action Agencies will evaluate a variety of potential actions intended to benefit ESA-listed fish to avoid jeopardy, and that the biological criteria would be defined as a part of the COP process. The RPA further described that the Action Agencies would then present specific implementation plans to NOAA Fisheries based on the COP, and NOAA would evaluate whether the actions proposed were likely to have the biological results that NOAA relied on in their 2008 BiOp to avoid jeopardy. Thus, biological evaluations in the COP incorporate biological criteria and an analysis approach consistent with that used in biological opinions by NOAA Fisheries

Subbasin alternatives and system-wide scenarios were evaluated in several steps as shown below. A science-based decision framework was applied to organize and assess biological, technical and economic data for the wide range of subbasin alternatives under consideration. This framework aimed to clearly present the tradeoffs associated with different implementation strategies to decision makers. The criteria applied by the Action Agencies determined whether or not the action was: (1) biologically feasible, (2) technically feasible; and (3) cost effective (from the NOAA Fisheries 2008 BiOp). Documenting uncertainty and impacts (both positive and negative) were important aspects of this framework. As new information is learned, refined results can be provided to decision makers.

COP Phase II Steps

STEP	Decision Support Process
Step 1	Define project goals, objectives, and constraints
Step 2	Update Phase I results/supplement with current data
Step 3	Determine range of alternatives to be assessed
Step 4	Conduct detailed biological analyses for baseline and alternatives (review with WATER)
Step 5	Establish subbasin alternatives and system-wide scenarios for assessment (review with WATER)
Step 6	Conduct detailed technical and economic assessments
Step 7	Determine benefits and costs, including uncertainty
Step 8	Determine other impacts, including uncertainty
Step 9	Determine significance of impacts (work with WATER)
Step 10	Compile results based on decision-maker input
Step 11	Presentation/discussion with decision makers – Action Agencies select Preferred Plan
Step 12	Repeat decision process (as new data, new measures, etc. are identified)

Note: WATER is the Willamette Action Team for Ecosystem Restoration

The decision framework applied a range of specific screening criteria and assumptions to assess alternative actions in the COP Phase II analysis. These criteria and assumptions are fully described in Section 2.2, but are briefly summarized below:

1) *Actions will meet dam safety requirements, and not result in a reduction to the Corps flood risk management mission.*

2) *Any above-dam fish reintroduction efforts must reach "replacement."* Upstream fish passage, and in some cases downstream fish passage, were expected to be via trap and haul, (i.e., not volitional fish passage). Fish passage improvements must allow sufficient passage survival so that the above dam sub-population is able to replace itself on average over time (i.e., enough adult progeny must successfully return and be transported above the dam to seed production of the next generation).

3) *Drainages with both Chinook and steelhead are a priority.* Actions which provide benefits for both Chinook salmon and steelhead species are understood to be of greater value than actions that address only one species.

4) *Improvements for more than one population per species needed.* Improvements for at least two populations per species (Chinook or steelhead) are necessary to spread risks for the species relating to environmental variability and catastrophic events.

5) *Biological Criteria – System Viable Salmonid Population (VSP) score $\geq$ 1.6 above 95% confidence interval and two subbasin populations above 2.0.* These fish population-level criteria are outlined in detail in Section 2.2.1.1.

6) *Phased Approach is Preferred.* This is to reduce risks and apply information gained during the design and implementation steps.

7) *Middle Fork investments are most risky (technically and biologically).* Of the subbasins within the Willamette system, the Middle Fork Willamette (with the exception of Fall Creek) poses the

most challenges for reintroducing and establishing a stable population of spring Chinook salmon above the dams. Although Fall Creek is a tributary to the Middle Fork, improvements there were also considered since wild Chinook are established above Fall Creek Dam. See Section 2.2.1.9 for more details.

8) *Actions should be cost-effective, including consideration of hydropower impacts.*

The Viable Salmonid Population (VSP) Analysis Framework was used in the COP II process to assess the biological benefit of individual and combinations of measures for achieving population-level goals. The VSP principles help form an explicit science-based framework to evaluate population extinction risk. The VSP assessment approach provides a comparable framework to that used in the NOAA Fisheries 2008 Biological Opinion and 2011 UWR Recovery Plan, and will also be useful for future ESA consultation for the WS and Willamette recovery planners. Two biological tools, the Species Lifecycle Analysis Module (SLAM) and the Fish Benefits Workbook (FBW), were used to prepare the VSP scores. These tools were parameterized with regional input through the Willamette Action Team for Ecosystem Restoration (WATER).

The Species Lifecycle Analysis Module (SLAM) was developed by the Northwest Fisheries Science Center (NWFSC). Several workshops (eight) were conducted with WATER in 2014 to develop model input assumptions and provide guidance on model results. Model documentation products and results authored by NWFSC (Appendix C) were reviewed by WATER and the Independent Scientific Advisory Board[2] (ISAB).

The Fish Benefits Workbook (FBW) methodology and input parameters were developed collaboratively at WATER Fish Passage Team meetings and multiple regional workshops. The workbook documentation was reviewed by the Region and the model framework, parameters and results were reviewed by the ISAB and WATER (Appendix K). Additionally, model parameter assumptions were provided by WATER and used to test the Fish Benefits Workbook tool.

Cost estimates for design; construction, supervisory and administration costs during construction; and operation and maintenance were developed (Appendix H). All costs were derived using corollary data from similar projects completed recently and scaled up or down to the projected design. Cost information was reviewed by the Cost Engineering Mandatory Center of Expertise (Cost MCX) located in the Walla Walla District.

Multiple non-monetized impacts were captured for a range of alternatives through the technical assessments. Each impact category was considered for how it would impact decision making. To simplify the analysis, only the critical components were captured for decision makers. Forgone hydropower was monetized and used for some cost-effectiveness calculations.

Given the longevity of the alternative assumed (50+ years) and potential impact on the alternatives, the COP PDT considered climate change as a future risk factor and incorporated that understanding into the final evaluation of the alternatives. Likely climate trends were identified from studies of the region chosen as being recent, regional and relevant to the COP alternative evaluations.

[2] The executive summary and full report from the ISAB are available at http://www.nwcouncil.org/fw/isab/.

ANALYSIS

Development of alternatives was guided by actions initially identified in the 2007 BA and 2008 RPA, and worked in collaboration with regional partners. RPA 4.13 identified several actions that the COP used to guide development of specific alternatives documented in the COP Phase I Report. This COP Phase I Report from October 2009 was also used for guidance in developing this report.

Using the above criteria and tools, 102 individual actions were assessed that included a range of downstream passage options (operational and structural), temperature improvements (operational and structural), total dissolved gas improvements and upstream passage improvements. Individual subbasin actions were combined into system alternatives (one subbasin alternative from each of the four subbasins equals a system alternative) and their affect on each Chinook and steelhead population was assessed. A total of 16 system alternatives were identified which met all criteria before cost-effectiveness was considered. The most cost-effective COP alternatives were identified from which a recommended plan was selected.

RECOMMENDATION

The COP Phase II recommendation includes the following actions:

- Downstream fish passage at Detroit through the Selective Withdrawal Structure (SWS), Weir Box, and the Floating Screen Structure (FSS)
- Downstream fish passage improvement at Foster with an upgraded fish weir
- Downstream fish passage at Cougar through the Floating Screen Structure (FSS)
- Upgraded adult fish facility (AFF) at Fall Creek
- Continued deep winter drawdown for downstream fish passage at Fall Creek
- Although the RPA indicates downstream fish passage in the Middle Fork is required, the COP determined that the prudent path forward is continued evaluation of feasibility and review of the need for providing fish passage in the Middle Fork, in consultation with NOAA Fisheries.
- Hatchery fish management changes

This recommendation will provide improvements for spring Chinook salmon in the North Santiam, South Santiam, McKenzie and Fall Creek subbasins. Winter steelhead improvements will be made in the North and South Santiam subbasins. Bull trout benefits are provided with proposed passage improvements in the McKenzie subbasin. Authority for completing these actions has been verified. This authority is summarized in Section 1.1.1. This option has a weighted average VSP score for steelhead and Chinook of 2.0. The system Chinook VSP score improves from 1.6 at Baseline to 2.3. The steelhead VSP for the two subbasins increases from 2.4 up to 3.5. A summary of biological benefits (VSP scores) and cost by feature is provided in the next table.

This package of actions includes construction of a selective withdrawal structure and three downstream fish passage improvement structures to provide effective fish passage to above-dam habitat for three populations of UWR Chinook and two populations of UWR steelhead. The recommendation takes advantage of investments for fish already made by the Corps, and in subbasins where natural production of Chinook salmon and steelhead is already occurring. The new actions are proposed at locations also prioritized in the NOAA Fisheries 2008 RPA, and on a feasible time frame accounting for necessary appropriations, design and construction. Details of this package include design/performance criteria for Cougar downstream passage, to be used to assess the effectiveness of the new facility after construction. The Cougar criteria are expected to be used as the framework for development of similar criteria for other proposed downstream passage actions. The package also includes continued implementation of discharge

rates and volumes recommended in the RPA, and hatchery and fisheries management reforms not considered in the RPA outlined below. Although the RPA indicates downstream fish passage in the Middle Fork is required, the COP determined that the prudent path forward is continued evaluation of feasibility and review of the need for providing fish passage in the Middle Fork, in consultation with NOAA Fisheries.

Summary of Biological and Future Cost Information for the Recommended Plan

(Costs do not include the $144.5 MIL From 2008-2014)	VSP Scores (95% confidence)		Total Costs ($MIL)[1] 2015-2033		Forgone Hydropower[4] 2015-2033
	Chinook	Steelhead	Fully Funded Capital Costs[2]	O&M[3]	
NS-DSP-H4-DET Selective Withdrawal Structure with Weir Box and Floating Screen Structure at Detroit	3.9 (3.7)	3.7	$ 314.9	$ 6.8	$ -74
SS-DSP-H2-FOS Upgraded Fish Weir at Foster	1.0 (0.7)	3.3	$ 6.8	$ 0.8	$ 10
MK-DSP-10-CGR Floating Screen Structure at Cougar	3.8 (3.5)	NA	$ 127.5	$ 8.8	$ 2
MF-DSP-01-FAL Deep Winter Drawdown and FAL Adult Collection Facility	0.3 (0.2)[5]	NA	$ 21.1	$ 2.6	$ 0
RM&E Research Monitoring and Evaluation to Support BiOp Implementation	NA	NA	$ 144.9	NA	NA
Willamette System Level	2.3 (2.2)	3.5	$ 615.2	$ 19.0	$ -62

NA = Not applicable

[1] Costs are in 2014 dollars and do not include expended dollars from 2008-2014 ($144.5 MIL). Costs do not include fish passage actions in the Middle Fork subbasin which could be included in the future if determined feasible and necessary. Costs for Middle Fork actions are summarized in Section 3.5.4 (Monetized costs and impacts). Costs shown in this table may differ from the 5-year plan due to further refinements after the cost analyses for the above figures were performed.

[2] Capital costs and RM&E are Columbia River Fish Mitigation (CRFM) appropriated funds from 2015-2033.

[3] O&M costs are Operations and Maintenance appropriated funds estimated over 2015-2033 accounting for inflation assumed at 3.5% with a 50% contingency. Costs shown are for those alternatives comprising Option 1 in Chapter 3.

[4] Forgone Hydropower (2015-2033) is the sum of net energy benefit and net capacity benefit, present valued over 50 years using a 3.75% interest rate. For full derivation of hydropower costs please refer to Appendix G. A negative value represents a gain in hydropower value.

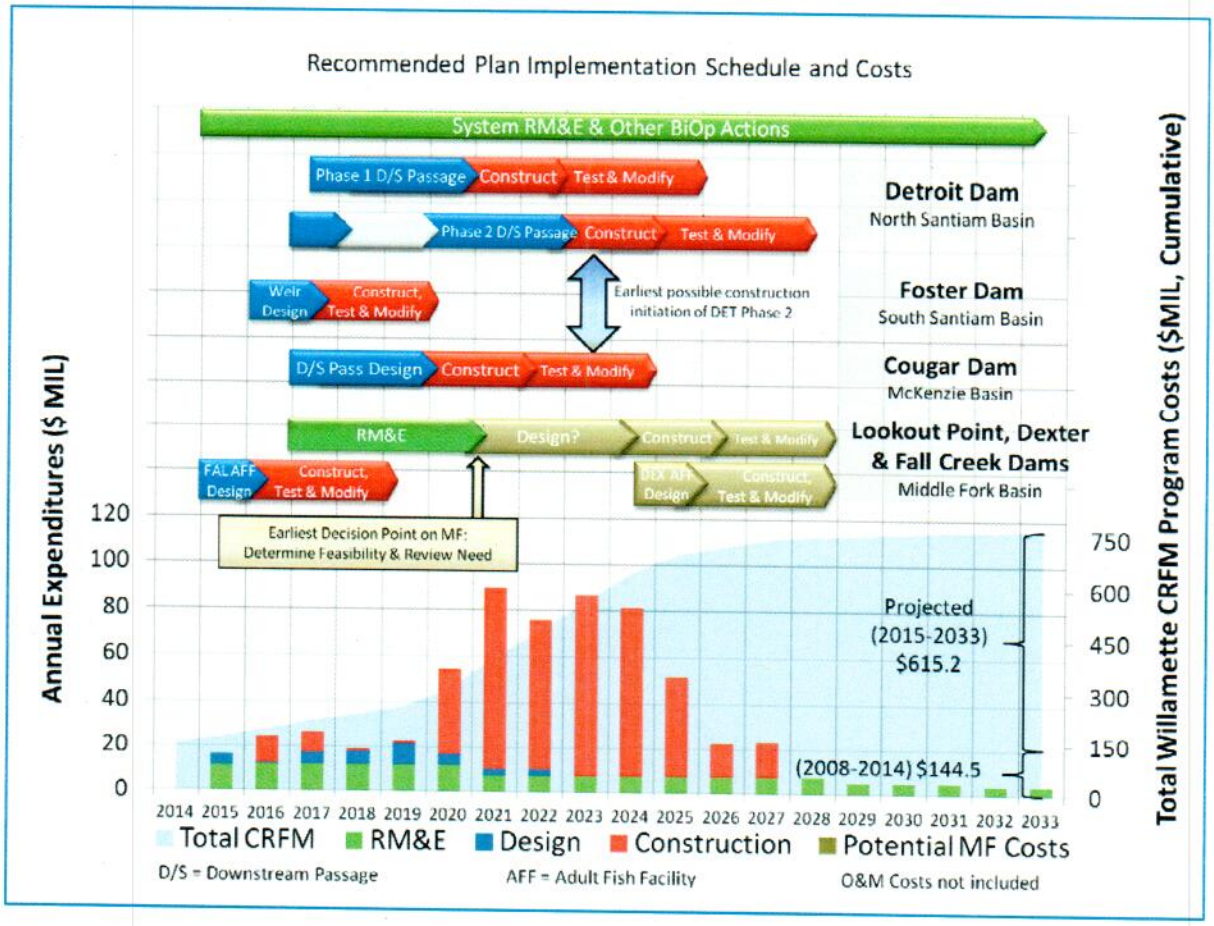
[5] VSP scores are for the entire Middle Fork spring Chinook salmon population (which includes the Fall Creek spring Chinook salmon component population).

Costs associated with BiOp implementation include capital infrastructure, RM&E, O&M and changes to hydropower. From 2008 – 2014, $144.5 MIL has been spent on BiOp implementation using CRFM funds. The table above shows a summary of the remaining fully funded capital costs by project and RM&E for a total of $615.2 MIL through 2033. O&M costs over the same time period equates to $19 MIL, or roughly $1MIL per year. In addition to these costs, changes in dam operations are expected to result in a net increase in hydropower production since the Detroit alternatives result in more water passing through the turbines instead of the spillway.

The fully funded capital costs shown in the table are project estimates as of February 2015. These estimates were based on an assumed timing of project phases between 2015 and 2033. Actual project implementation timing may result in minor cost changes when compared to the COP estimates. These costs reflect the results from the COP analyses developed for this document. A Strategic Implementation Plan (the 5-year plan) for the Willamette summarizing the Corps response to the BiOp was developed after this COP analysis was complete. See the Addendum in Chapter 4 for a detailed description of the minor differences in costs between this report and the 5-Year plan. The annual 5-year planning process will be the venue for budgeting purposes and to document the specific adjustments in costs based on updated design level information.

The next figure graphically displays the proposed implementation schedule for the recommended plan. A rough timeline is shown for each subbasin by structure with representations of design phases shown in blue, and construction with testing and modification phases shown in red. Additionally, the yearly budget assumptions for each phase are plotted, as well as a cumulative total of the CRFM program funds through 2033. This estimate accounts for inflation over time. In addition to the implementation costs, this recommendation will require future funds for O&M in order to keep new features operating properly. The estimated O&M costs associated with the preferred option (as described in Chapter 3) are shown in the table above.

Proposed Implementation Schedule for COP II Recommended Plan



WILLAMETTE BIOLOGICAL OPINION IMPLEMENTATION

Ian Chane, Columbia River Fish Mitigation (CRFM) Program Manager

U.S. Army Corps of Engineers

Portland District

14 June 2017

US Army Corps of Engineers ®
Portland District

U.S.ARMY

AGENDA

Overview of Projects & Biological Opinions

Accomplishments

A Look Ahead (Downstream Fish Passage)

US Army Corps of Engineers ®
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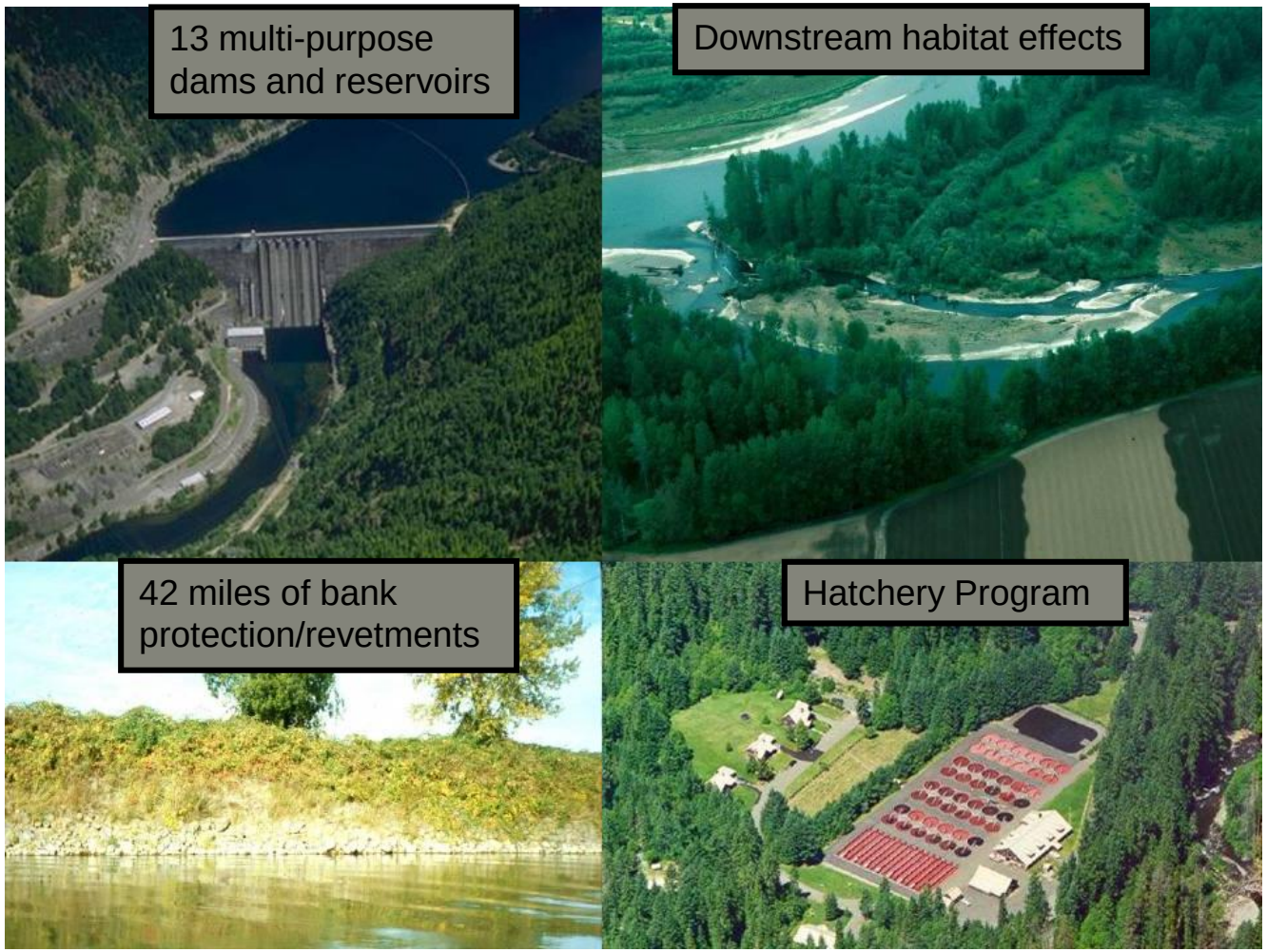
WILLAMETTE PROJECT BIOLOGICAL OPINIONS



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The Willamette Basin

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Anadromous Fish Passage (Four Subbasins)

- Downstream Juvenile Migration
- Spring Chinook and Winter Steelhead
- Downstream Adult Passage
- Bull Trout and Winter Steelhead Kelts

North Santiam (Detroit and Big Cliff)
spring Chinook & winter steelhead
South Santiam (Green Peter and Foster)
spring Chinook & winter steelhead
SF McKenzie (Cougar)
spring Chinook & bull trout
MF Willamette (Hills Creek, Dexter and Lookout Point) *spring Chinook*

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AUTHORIZED PURPOSES/SYSTEM BENEFITS

- **Flood damage reduction**
- Hydropower
- Navigation
- Irrigation
- Fish & wildlife
- Recreation
- Water quality
- Municipal & industrial water supply

Salem 1943

Corvallis 1996

Portland 1894

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ACCOMPLISHMENTS TO DATE

- **CRFM**
  - Instream Flows/Ramp Rates
  - Interim Temperature Control Operations
  - Interim Fish Passage Operations
  - Adult Fish Collection Facilities
  - Trap and Haul / Out plant Sites
  - Annual Fall Creek Drawdown
  - RM&E (MF RM&E Plan)
  - Foster Dam Spillway Weir (FY18)

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ACCOMPLISHMENTS TO DATE

- **O&M**
  - Bull Trout / Oregon Chub
  - Revetment Assessments
  - Hatchery Genetic Management Plans
  - McKenzie Hatchery Adult Collection Efficiency Improvements
  - Willamette Fish Operations Plan
  - Environmental Flows (HQ Funded Development)
- **BPA Funded**
  - 2,580 Acres Purchased for Conservation

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WILLAMETTE BIOLOGICAL OPINIONS

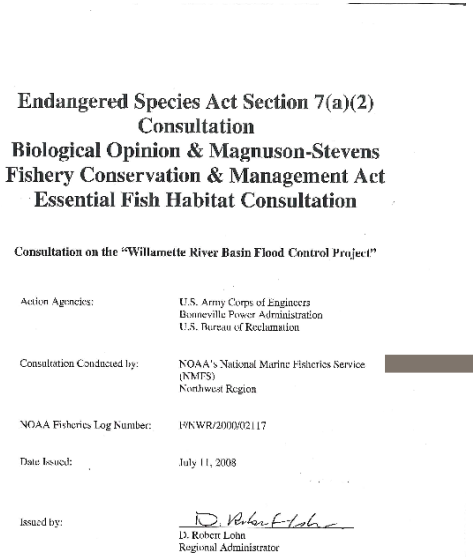
Initial Budget Estimate (2008) $300M

Implementation Costs FY08-FY16 = $193M

Revised Budget Estimate (2015) $757M

- Includes downstream passage at Cougar and Detroit Dams (Phase 1 & 2)
- Continued RM&E to refine understanding of biology related to passage

Increase CRFM TPC to $2.8B ($449M increase for Willamette)



Endangered Species Act Section 7(a)(2) Consultation
Biological Opinion & Magnuson-Stevens Fishery Conservation & Management Act Essential Fish Habitat Consultation

Consultation on the "Willamette River Basin Flood Control Project"

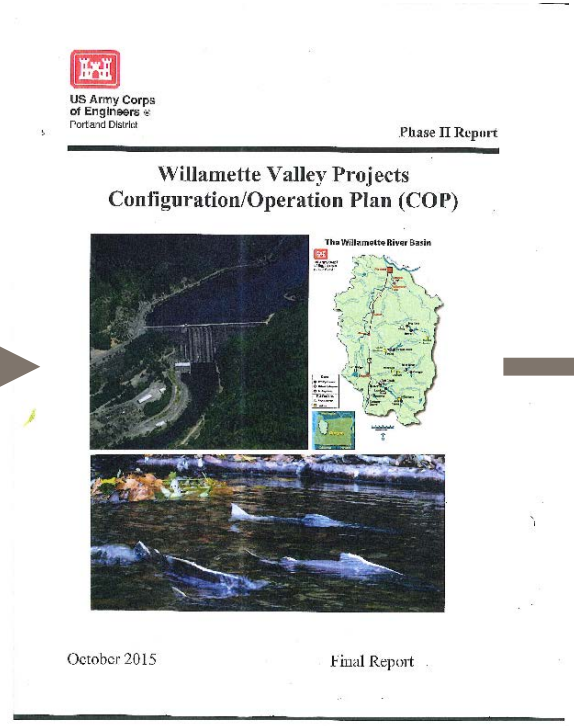
Action Agencies: U.S. Army Corps of Engineers, Bonneville Power Administration, U.S. Bureau of Reclamation

Consultation Conducted by: NOAA's National Marine Fisheries Service (NMFS) Northwest Region

NOAA Fisheries Log Number: 19NWR/2000/02117

Date Issued: July 11, 2008

Issued by: D. Robert Lohn, Regional Administrator



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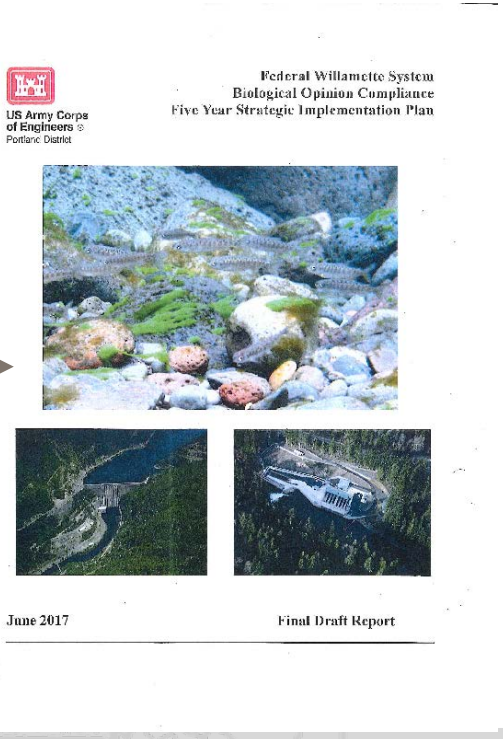
Phase II Report

Willamette Valley Projects Configuration/Operation Plan (COP)

The Willamette River Basin

October 2015 Final Report



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Federal Willamette System
Biological Opinion Compliance
Five Year Strategic Implementation Plan

June 2017 Final Draft Report

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WILLAMETTE DAMS – FLOOD OPERATIONS

Flood Control

- Seasonal Operations (Rule Curve)
  - Reservoir elevation changes/drafting/refill
- Columbia River (FCRPS) not operated for flood control
  - Relatively stable reservoir elevations (no drafting and refill)
- Real-time Management (Forecast/Monitoring)
  - Outcome – Rapid changes in reservoir elevations/inflow and outflow possible
- Project Configuration
  - Regulating Outlets and Spillway Gates designed for flood damage reduction operations (not designed with juvenile fish passage in mind)

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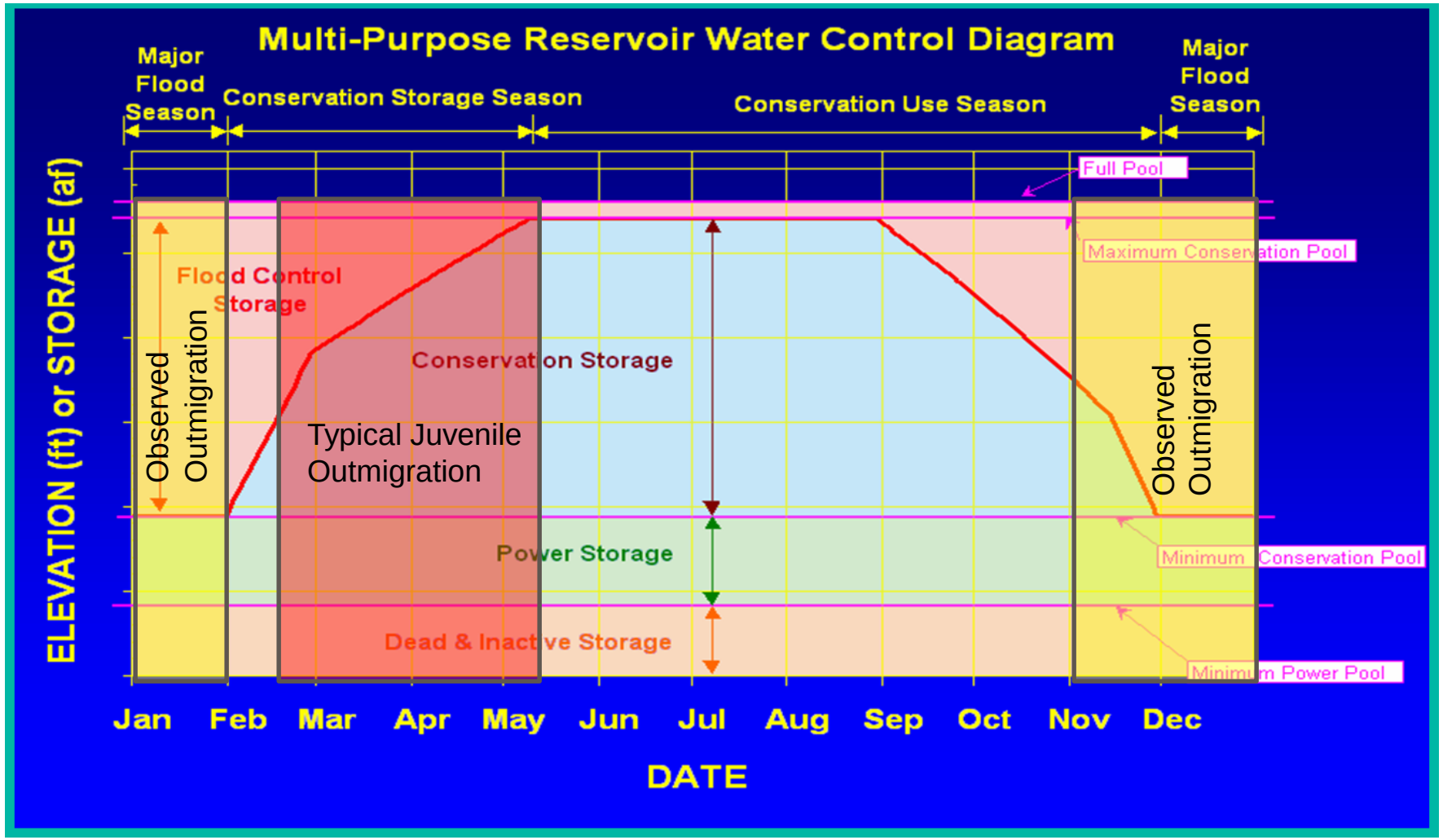
WILLAMETTE DAMS – RULE CURVE



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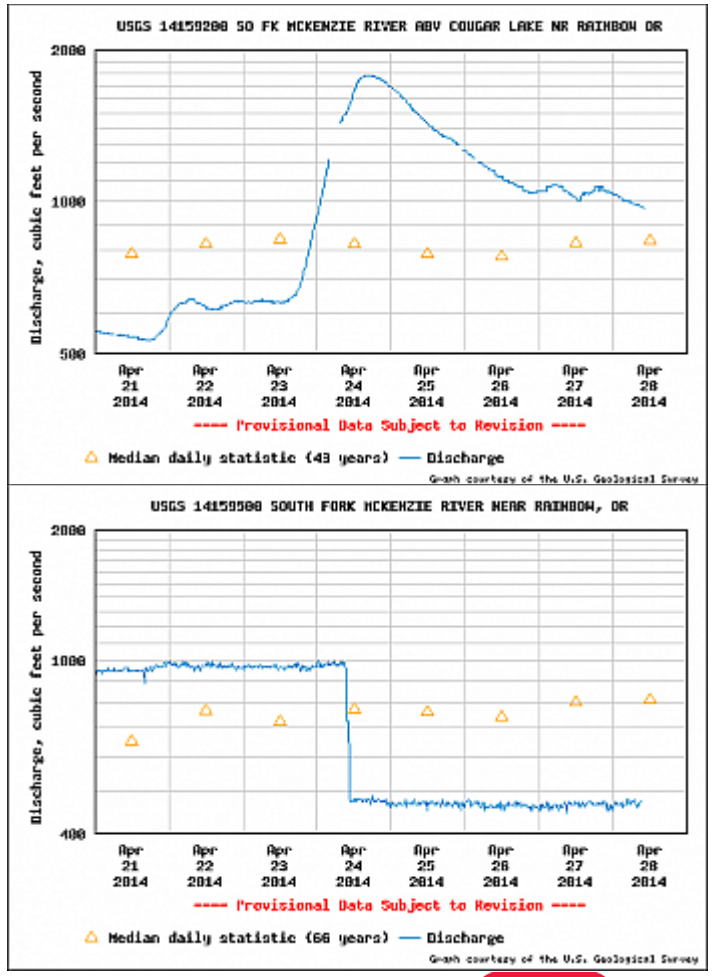
WILLAMETTE DAMS – PROBLEM OUTMIGRATION PERIOD

- Flow
  - Refill occurring, outflow reduced
    - less cue
    - Smaller gate openings
- Reservoir Condition
  - Refill occurring = increasing reservoir area
    - More “milling”
  - Orifice depth = increase sounding distance
    - Lowered efficiency
    - Injury / mortality



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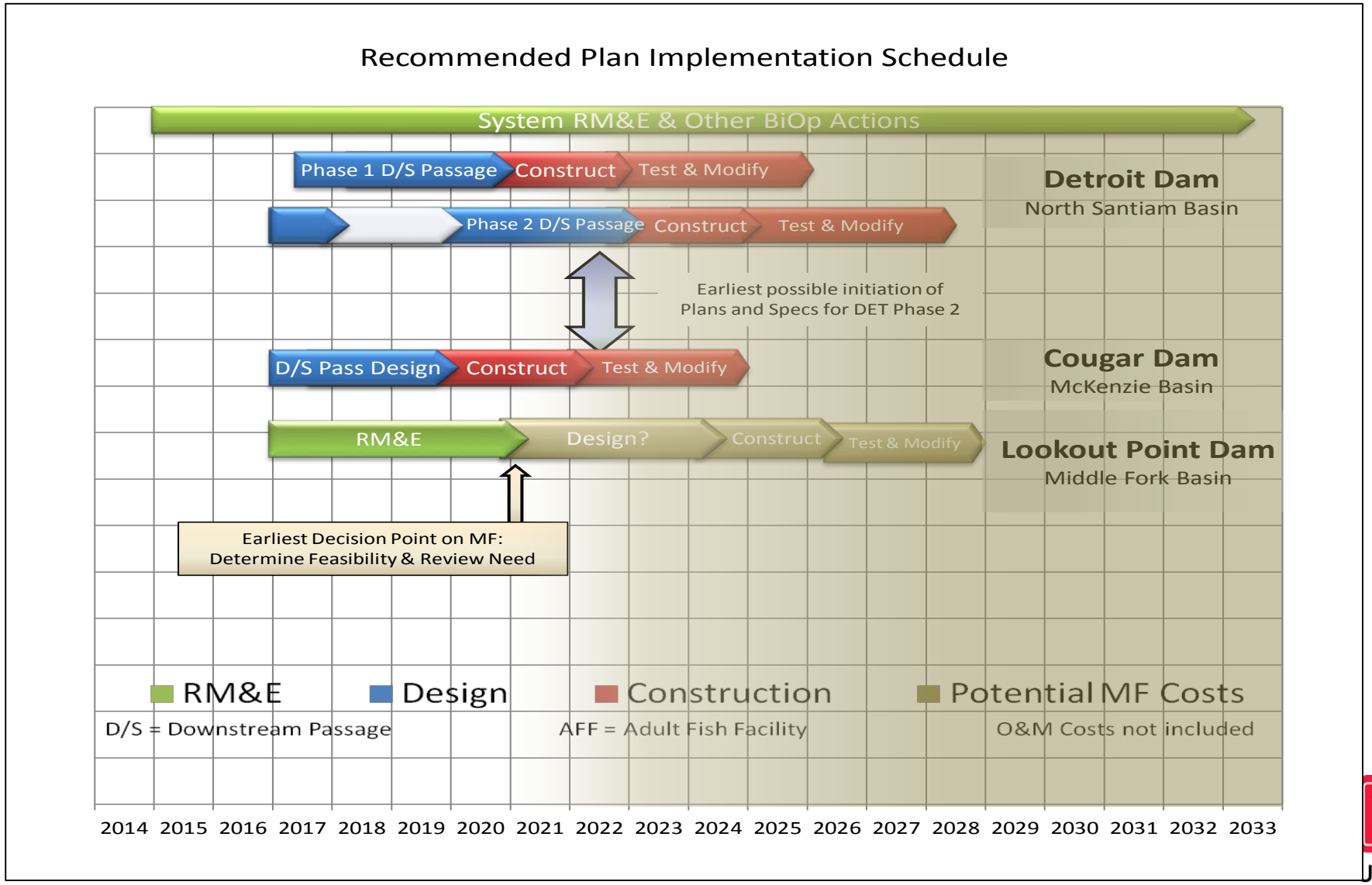
WILLAMETTE BIOLOGICAL OPINIONS – IMPLEMENTATION



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WILLAMETTE BIOLOGICAL OPINIONS – DOWNSTREAM PASSAGE

Fall Creek Dam (Fall Creek – MF Willamette)

Foster Dam (South Santiam River) FY2018

Cougar Dam (South Fork McKenzie River) FY2020

Detroit Dam/Temperature Control (North Santiam River) FY2021

Lookout Point Dam (MF Willamette River) – pending research

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WILLAMETTE DAMS – OPERATIONAL OPPORTUNITIES (FALL CREEK DAM)

- Operation occurs during flood damage reduction
- No hydropower
- Limited spawning habitat downstream (turbidity)
- RO positioned low (run of river)
- Limited winter recreation interest

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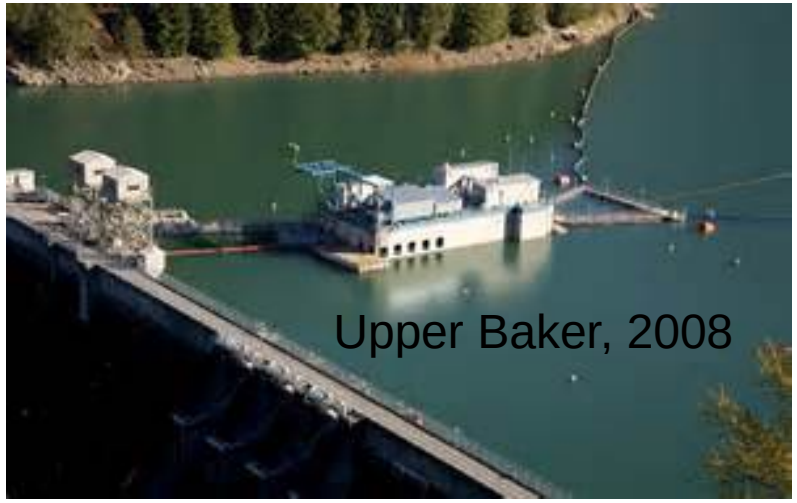
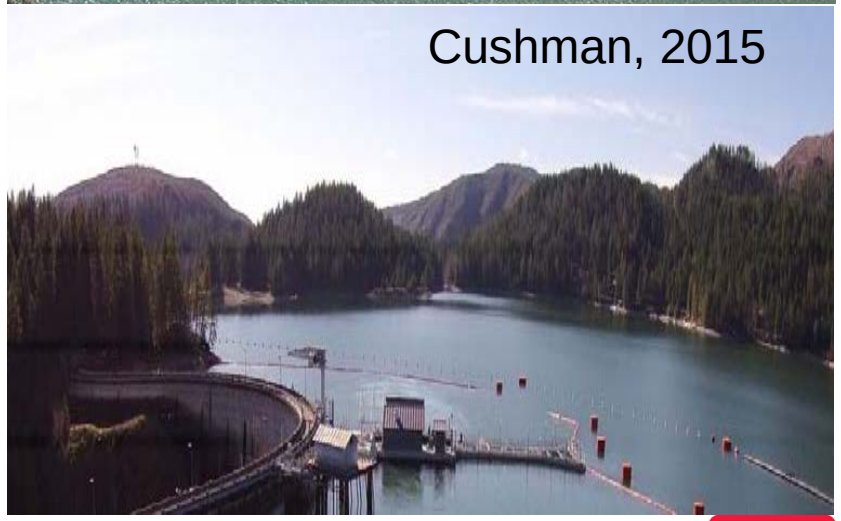
HIGH HEAD DOWNSTREAM FISH PASSAGE FACILITIES IN THE PACIFIC NORTHWEST





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WILLAMETTE BIOLOGICAL OPINION IMPLEMENTATION – COUGAR DAM

- Downstream Fish Passage (FY20-FY22)
  - Temperature Control Structure Completed (Separate Appropriation)

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WILLAMETTE BIOLOGICAL OPINION IMPLEMENTATION – DETROIT DAM

- Phase 1 Temperature Control (FY21-FY23)
- Incorporate long term passage design needs (FY23-FY25)

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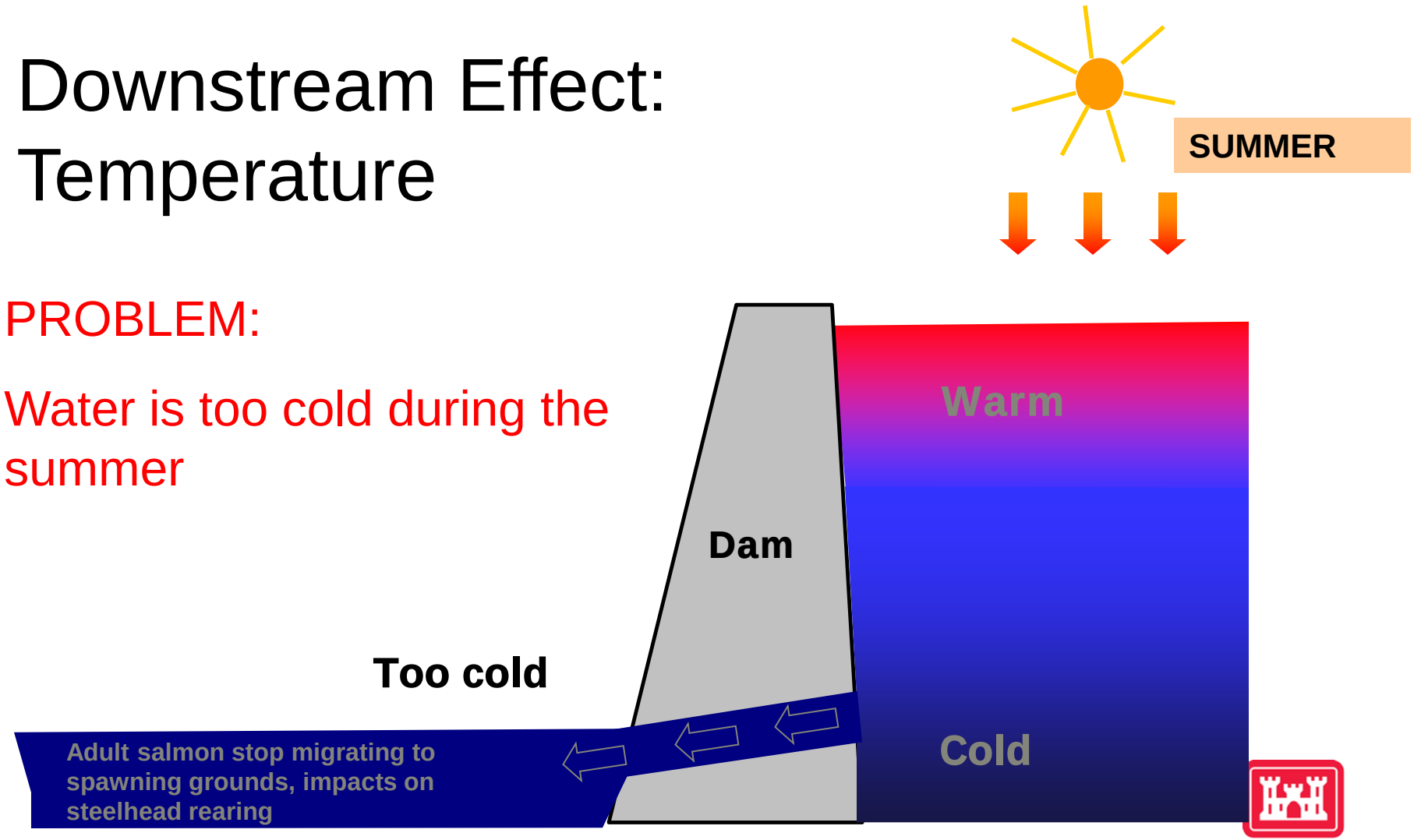
WILLAMETTE BIOLOGICAL OPINION IMPLEMENTATION – DETROIT DAM

Downstream Effect: Temperature



PROBLEM:

Water is too cold during the summer

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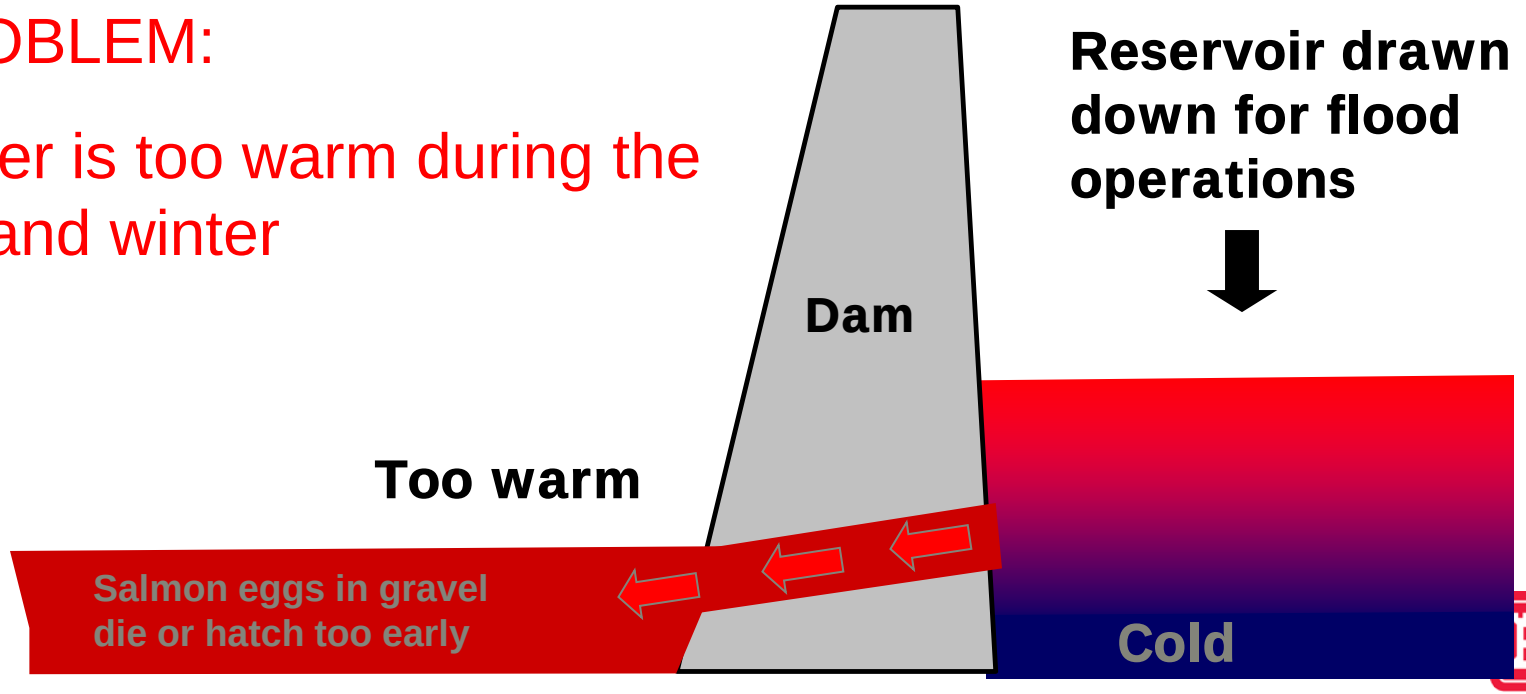
WILLAMETTE BIOLOGICAL OPINION IMPLEMENTATION – DETROIT DAM

Downstream Effect: Temperature

PROBLEM:

Water is too warm during the fall and winter



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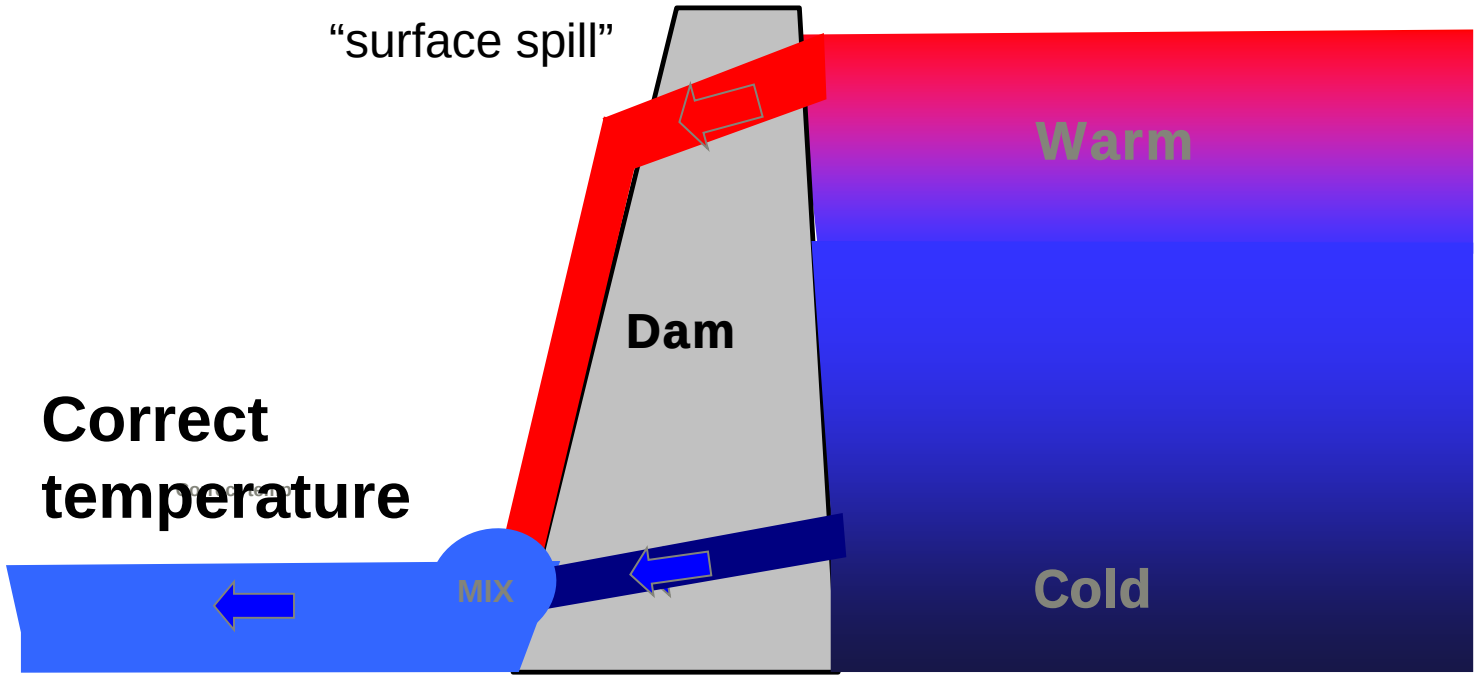
WILLAMETTE BIOLOGICAL OPINION IMPLEMENTATION – DETROIT DAM

Downstream Effect: Temperature

Detroit Dam 2007 – 8

Detroit Dam 2009?

SOLUTION:
Temperature Control Operation



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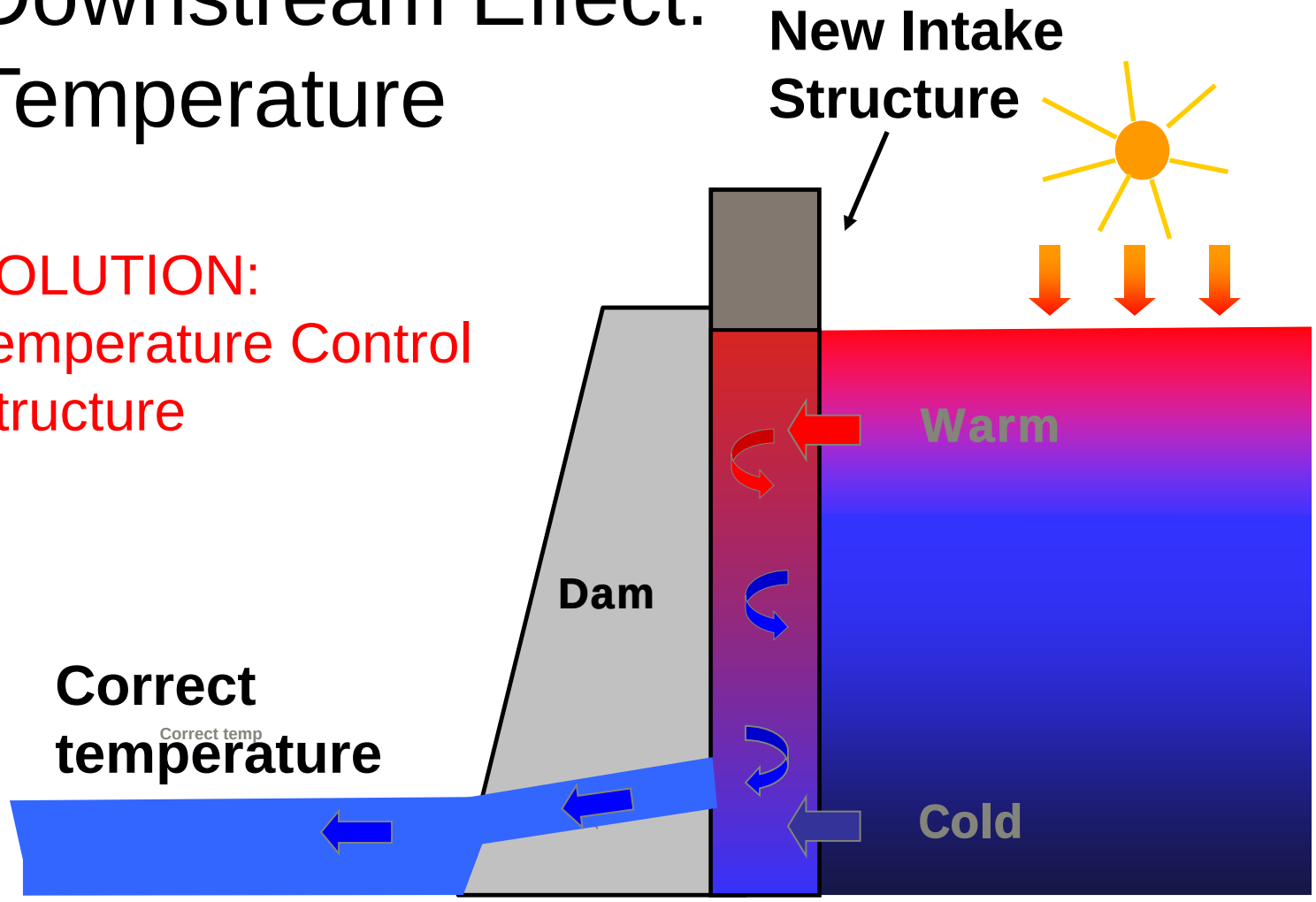
WILLAMETTE BIOLOGICAL OPINION IMPLEMENTATION – DETROIT DAM

Downstream Effect: Temperature

SOLUTION:
Temperature Control Structure



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WILLAMETTE 5 YEAR PLAN (FY17 AND FY18)

CRFM FY 2017: $18.68M (Capability)

- Develop Middle Fork Willamette RM&E plan to inform future passage actions
- Foster Fish Weir modifications for downstream passage
- Design work for Detroit phase 1 downstream fish passage
- Design work for Cougar downstream fish passage
- Contract for Fall Creek Adult Fish Collection Facility water supply system improvements
- High head bypass engineering evaluations for volitional juvenile fish passage
- Evaluate interim operations for Middle Fork Willamette juvenile downstream fish passage

CRFM FY 2018: $20.32M (Presidents Budget)

Fall Creek Dam Adult Fish Collection Facility construction completion

- Foster Fish Weir construction (construction award in FY17)
- High head bypass engineering evaluations for volitional juvenile fish passage
- Design work for Detroit phase 1 downstream fish passage
- Initiate P&S for Cougar Dam juvenile downstream fish passage
- On-going Middle Fork Willamette subbasin research

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WILLAMETTE 5 YEAR PLAN (FY19-FY23)

CRFM FY 2019:

- Design work for Detroit Dam juvenile downstream fish passage (phase 1)
- Complete P&S for Cougar Dam juvenile downstream fish passage
- Perform final modifications and oversight of Foster Fish Weir construction
- On-going Middle Fork Willamette subbasin research (FY19 check-in)

CRFM FY 2020:

- Initiate P&S for Detroit Dam juvenile downstream fish passage (phase 1)
- Award Cougar Dam juvenile downstream fish passage construction contract for 1st year of construction
- On-going Middle Fork Willamette subbasin research

CRFM FY 2021:

- Complete P&S for Detroit Dam juvenile downstream fish passage (phase 1) and award construction contract for 1st year of construction
- Continue 2nd year of construction of Cougar Dam juvenile downstream fish passage
- On-going Middle Fork Willamette subbasin research (FY21 check-in)

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WILLAMETTE 5 YEAR PLAN (FY19-FY23) CONTINUED

CRFM FY 2022:

- Continue 3rd year of construction of Cougar Dam juvenile downstream fish passage
- Continue 2nd year of construction of Detroit Dam juvenile downstream fish passage (phase 1)
- On-going Middle Fork Willamette subbasin research

CRFM FY 2023:

- Complete construction of Cougar Dam juvenile downstream fish passage and initiate performance evaluations
- Continue 3rd year of construction of Detroit Dam juvenile downstream fish passage (phase 1)
- On-going Middle Fork Willamette subbasin research

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WILLAMETTE BIOLOGICAL OPINIONS - IMPLEMENTATION

Questions?

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