

Name _____
 By _____ Oregon Department of Fish and Wildlife
 Address _____ 4034 Fairview Industrial Drive SE
 _____ Salem, OR 97302-1142

Priority January 16, 2017
 County Clackamas WM# 20

RELATED FILES

DEVELOPMENT

Date

Completion _____

Extended to _____

Final Proof received _____

Proposed Cert. Mailed _____

Application No. IS 88355

Permit No. _____

Certificate No. _____

Date

DENIED _____

MISFILED _____

WITHDRAWN _____

CANCELLED _____

Volume | Page

FEES PAID

Date	Amount	Receipt No.
12-1-17	\$810.00	125339

Cert. Fee

FEES REFUNDED

Date	Amount	Receipt No.

ASSIGNMENTS

Date

To Whom

Address

REMARKS

ISWR Application Sandy Beach Clear Creek

MAP LOCATION _____

MCCARTY Patricia E * WRD

From: MCCARTY Patricia E * WRD
Sent: Monday, January 22, 2018 2:11 PM
To: STEVENSON Anna P; FAUCERA Danette L; ZATTA Jaclyn D
Cc: STEVENSON Anna P; MCCARTY Patricia E * WRD
Subject: RE: New ISWRs Protests and administrative hold

Hi Anna,
OWRD will take no action on the listed applications before April 20, 2018.

Sincerely,
Patricia McCarty
Protest Program Coordinator
Oregon Water Resources Department
503-986-0820

From: Anna Pakenham Stevenson [<mailto:Anna.P.Stevenson@state.or.us>]
Sent: Thursday, January 18, 2018 10:03 AM
To: FAUCERA Danette L; ZATTA Jaclyn D; MCCARTY Patricia E * WRD
Cc: STEVENSON Anna P
Subject: New ISWRs Protests and administrative hold

Hello Patricia,
I wanted to let you know that ODFW reached out to the protestants associated with the new ISWR applications in the Hood and Sandy Basins (IS-88322, IS-88323, IS-88326, IS-88327, IS-88328, IS-88329, IS-88330, IS-88331, IS-88334, IS-88335, IS-88337, IS-88355, IS-88332, IS-88333, and IS-88336). We have requested meetings with these groups to discuss their concerns pertinent to ODFW aspects of the applications and if a resolution can be found. To allow time for this conversation ODFW is requesting from OWRD a 90-day administrative hold on these applications. We will be sure to let you know how those discussions proceed. Please let me know if you need further information.

Have a great day,
Anna

Anna Pakenham Stevenson
ODFW Water Program Manager
503-947-6084 (office)
971-718-2058 (cell)
anna.p.stevenson@state.or.us

STATE OF OREGON
WATER RESOURCES DEPARTMENT

RECEIPT # 125339

725 Summer St. N.E. Ste. A
SALEM, OR 97301-4172
(503) 986-0900 / (503) 986-0904 (fax)

INVOICE # _____

RECEIVED FROM: Steel Rives LLP

APPLICATION IS88355

BY: _____

PERMIT _____

CASH: ☐ CHECK: # 907928 OTHER: (IDENTIFY) _____

TRANSFER _____

TOTAL REC'D \$ 810.00

1083 TREASURY 4170 WRD MISC CASH ACCT

0407 COPIES \$ _____

OTHER: (IDENTIFY) \$ _____

0243 I/S Lease _____ 0244 Muni Water Mgmt. Plan _____ 0245 Cons. Water _____

4270 WRD OPERATING ACCT

MISCELLANEOUS

0407 COPY & TAPE FEES \$ _____

0410 RESEARCH FEES \$ _____

0408 MISC REVENUE: (IDENTIFY) \$ _____

TC162 DEPOSIT LIAB. (IDENTIFY) \$ _____

0240 EXTENSION OF TIME \$ _____

WATER RIGHTS:

0201 SURFACE WATER EXAM FEE \$ _____ 0202 RECORD FEE \$ _____

0203 GROUND WATER \$ _____ 0204 RECORD FEE \$ _____

0205 TRANSFER \$ _____

WELL CONSTRUCTION

0218 WELL DRILL CONSTRUCTOR EXAM FEE \$ _____ 0219 LICENSE FEE \$ _____

LANDOWNER'S PERMIT

0220 LANDOWNER'S PERMIT \$ _____

0223 OTHER (IDENTIFY) Protest Fees \$ 810.00

0536 TREASURY 0437 WELL CONST. START FEE

0211 WELL CONST START FEE \$ _____ CARD # _____

0210 MONITORING WELLS \$ _____ CARD # _____

OTHER (IDENTIFY) _____

0607 TREASURY 0467 HYDRO ACTIVITY LIC NUMBER

0233 POWER LICENSE FEE (FW/WRD) \$ _____

0231 HYDRO LICENSE FEE (FW/WRD) \$ _____

HYDRO APPLICATION \$ _____

TREASURY OTHER / RDX

FUND _____ TITLE _____

OBJ. CODE _____ VENDOR # _____

DESCRIPTION _____

RECEIPT: 125339

DATED: 12-1-17 BY: [Signature]

Distribution - White Copy - Customer, Yellow Copy - Fiscal, Blue Copy - File, Buff Copy - Fiscal

Please detach at perforation before depositing check

TOTAL

810.00

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760 SW Ninth Ave., Suite 3000
Portland, OR 97205-2584

State of Oregon Water Resources D.

SUPPLIER NUMBER

16765

CHECK NUMBER

907928

CHECK DATE

11-30-17

INVOICE NUMBER

SR112917-15

INVOICE DATE

11-29-17

DESCRIPTION

FILING FEE- Protest of
IS-88355

AMOUNT

810.00

STATE OF OREGON
WATER RESOURCES DEPARTMENT
WATER RIGHTS DIVISION

Before the Director of the Water Resources Department

In the Matter of Water Right	)	PROTEST OF OREGON FARM
Application IS-88355 in the name of	)	BUREAU FEDERATION AND
Oregon Department of Fish and Wildlife	)	CLACKAMAS COUNTY FARM
	)	BUREAU, AND REQUEST FOR
	)	CONTESTED CASE

On October 17, 2017, the Oregon Water Resources Department (the "Department") issued a proposed final order ("PFO") recommending approval of water right application IS-88355 (the "Application") filed by Oregon Department of Fish and Wildlife ("ODFW") on January 16, 2017. The PFO is attached hereto as Exhibit A, and the Application is attached hereto as Exhibit B. Pursuant to ORS 537.170 and OAR 690-077-0043, Oregon Farm Bureau Federation ("OFB") and Clackamas County Farm Bureau ("CFB") (collectively, "Protestants") protest the PFO and request a contested case hearing. Approval of the Application would limit the ability of Protestants and their members to respond to instream and out-of-stream water resources demands in the Hood River basin, and the Application is contrary to extensive cooperative planning efforts undertaken by Protestants and their members.

1. Protestants' Name, Address, and Telephone Number

The Protestants' contact information is as follows:

Mary Anne Cooper
Public Policy Counsel, Oregon Farm Bureau Federation
1320 Capitol Street NE, Suite 200
Salem, OR 97301
(503) 399-1701 (telephone)

Matt Bunch
President, Clackamas County Farm Bureau
1320 Capitol Street NE, Suite 200
Salem, OR 97301
(503) 399-1701 (telephone)

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Orders, notices, and other correspondence concerning this matter should be sent to legal counsel representing Protestants in this matter as follows:

David Filippi
Hayley Siltanen
Stoel Rives LLP
760 SW Ninth Avenue, Suite 3000
Portland, OR 97205
(503) 294-9529 (telephone)
david.filippi@stoel.com (email)
hayley.siltanen@stoel.com (email)

2. Protestants' Interest in the PFO

a. OFB and CFB's Interests

OFB is a voluntary, grassroots, nonprofit organization representing Oregon's farmers and ranchers in the public and policymaking arenas. As Oregon's largest general farm organization, its primary goal is to promote educational improvement, economic opportunity, and social advancement for its members and the farming, ranching, and natural resources industry. Today, OFB represents over 7,000-member farm families professionally engaged in the industry and has a total membership of over 60,000 Oregon families. CFB is the voice of agriculture in Clackamas County, representing member farm families across Clackamas County.

b. Injury to the Protestants' Interests

Water is essential for agriculture across the Hood River basin. In recent years, the water supply from the Hood River Basin has been barely sufficient or insufficient to meet irrigators' needs during the late summer and fall months. The instream water rights proposed to be granted in the PFO could severely curtail Protestants' and their members' ability to utilize their water rights as needed to successfully manage their operations and adapt to changing circumstances. The instream water rights could also limit Protestants' and their members' ability to apply for new water rights in the Hood River basin in the future and to access the water already reserved for future multipurpose storage in the basin. Protestants were among the primary proponents of the recent extension of the Hood River basin reservation, and the instream filing has the potential to limit future use of and access to that water.

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3. Argument

a. The Department wrongly determined that ODFW established a presumption that the Application is in the public interest.

An application for an instream water right is presumed to be in the public interest when each of the following criteria is met:

- “(a) The proposed use is allowed in the applicable basin program established pursuant to ORS 536.300 and 536.340 or given a preference under 536.310(12);
- “(b) Water is available;
- “(c) The proposed use will not injure other water rights; and
- “(d) The proposed use complies with the rules of the Commission.”

OAR 690-077-0033(1). If any one of the above-listed criteria is not satisfied, the presumption that the proposed instream use is in the public interest must be reversed. OAR 690-077-0033(2)(a).

Here, the public interest presumption is not established, because the proposed instream use has the potential to injure other water rights and the proposed use does not comply with the rules of the Water Resources Commission (“Commission”). Given that the criteria at OAR 690-077-0033(1) are not satisfied, the Department erred by failing either to deny the Application or to make “specific findings” that the Application will not impair or be detrimental to the public interest. *See* OAR 690-077-0037(2).

i. The Application will impair other water rights.

To establish a presumption that a proposed instream use is in the public interest, the Department must determine that the proposed use will not impair other water rights. Specifically, ORS 537.334(2) requires that an instream water right “not take away or impair any permitted, certificated or decreed right to any waters or to the use of any waters vested prior to the date the in-stream water right is established[.]” (Emphasis added.) In this case, the Department wrongly concluded that the Application will not impair existing water rights on the sole basis that “the proposed use is junior in priority and by operation of the prior appropriation doctrine will not injure other water rights.” PFO, at 3. As discussed in more detail in the pages that follow, the Application has the potential to impair not only future water right applications pursuant to the existing reservation, but the Application also has the potential to impair existing water rights that may be subject to future transfer applications or other proposed modifications, as well as other water-right related activities, whether related to storage, aquifer recharge, aquifer storage and recovery, etc. In addition, the Protestants are concerned that the establishment of the instream water rights as proposed in the Application, without appropriate findings in the final order or conditions in the final certificate, could undermine and result in impairment to existing water rights in other state and federal environmental reviews and permitting processes.

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- ii. **The Application does not comply with the Commission's rules, because ODFW did not provide written documentation of compliance with OAR 635-400-0020.**

The Commission's rules require ODFW to provide written documentation of compliance with the "requirements contained in [ODFW's] administrative rules for instream water rights, including application of the required methods to determine the requested flows." See OAR 690-077-0020(4)(k). Among the administrative rules with which ODFW must comply is OAR 635-400-0020, which provides standards for selection of streams or stream reaches for instream water right applications. In the Department's Initial Review of the Application, the Department asked ODFW to "provide additional documentation of how it has complied with its own administrative rules for instream water rights . . . specifically those found in OAR 635-400-0020." Based on a review of the Application case file, it does not appear that ODFW provided evidence of compliance with OAR 635-400-0020. On that basis, the Application does not comply with the Commission's rules as required by OAR 690-077-0033(1)(a).

- b. **The Department violated its rules by failing to adequately consider factors necessary to determine whether the public interest presumption was overcome.**

Even assuming that the Department correctly determined that the Application satisfies the criteria necessary to establish a public interest presumption, the Department erroneously failed to evaluate whether the presumption was overcome. Pursuant to OAR 690-077-0037(3), if the Department determines that the criteria for the public interest presumption are satisfied, the Department must "further evaluate the proposed use, any comments received, information available in its files or received from other interested agencies and any other available information to determine whether the public interest presumption is overcome." OAR 690-077-0037(3)(a). Such evaluation requires the Department to consider, "at minimum," the following factors:

- "(A) Threatened, endangered or sensitive species;
- "(B) Water quality, with special attention to sources either listed as water quality limited or for which total maximum daily loads have been set under Section 303(d) of the federal Clean Water Act and sources which the Environmental Quality Commission has classified as outstanding resource waters as defined in OAR 340-041-0002(42);
- "(C) Fish or wildlife;
- "(D) Recreation;
- "(E) Economic development; and
- "(F) Local comprehensive plans, including supporting provisions such as public facilities plans."

OAR 690-077-0037(3)(b).

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In this case, the PFO suggests that the Department did not properly “further evaluate the proposed use . . . to determine whether the public interest presumption is overcome.” See OAR 690-077-0037(3). The Department’s statement that, “[b]ased on an evaluation of the proposed use, the comments received, information available in its files or received from other interested and any other available information, . . . the proposed use will not impair or be detrimental to the public interest,” is conclusory and does not address the above-listed factors. See Protest, at 3. Specifically, the PFO fails to evaluate the likely effect of the Application on economic development. See OAR 690-077-0037(3)(b)(E). As discussed more fully in Part 3.c, the Application would further constrain the already limited supply of available irrigation water in the Hood River basin, which is necessary to sustain the Hood River basin’s agriculture-based economy. The Department erred by not considering the effect of additional water supply constraints on agricultural users.

In addition, the PFO does not contain any indication that the Department meaningfully considered public comments, including the April 20, 2017 letter submitted by East Fork Irrigation District (“EFID”), attached hereto as Exhibit C. Although the Department need not address every comment individually, the Department nevertheless must “consider all comments received[.]” OAR 690-077-0037(1). The Department’s conclusions in the PFO are unchanged from the Department’s Initial Review, and the PFO does not include any response to concerns voiced by EFID in its comment letter. Thus, there is no evidence that the Department considered EFID’s comments.

Because the PFO does not include any discussion of the effect of the Application on the factors listed at OAR 690-077-0037(3)(b), including economic development, and because there is no evidence that the Department considered the public comments submitted on the Application, the Department failed to comply with the requirements of OAR 690-077-0037.

c. The proposed instream use would be detrimental to the public interest because it limits the ability of agricultural users to secure future water rights and to develop needed storage.

If a proposed use “may impair or be detrimental to the public interest according to standards described in ORS 537.170(8),” the public interest presumption is overcome, and an application must be denied or conditioned to prevent harm to the public interest. OAR 690-077-0037(4)(b). Several of the standards listed in ORS 537.170(8) apply to evaluation of the Application.¹ Especially relevant here, ORS 537.170(8) requires the Department to consider

¹ ORS 537.170(8) lists, in full, the following standards:

- “(a) Conserving the highest use of the water for all purposes, including irrigation, domestic use, municipal water supply, power development, public recreation, protection of commercial and game fishing and wildlife, fire protection, mining, industrial purposes, navigation, scenic attraction or any other beneficial use to which the water may be applied for which it may have a special value to the public.
- “(b) The maximum economic development of the waters involved.

(continued . . .)

whether a proposed use “[c]onserv[es] the highest use of the water for all purposes, including irrigation, . . .” and provides for “[t]he maximum economic development of the waters involved.” ORS 537.170(8)(a),(b).

Irrigated agriculture plays a central role in Clackamas County’s economy.² Because the Application would impair the ability of agricultural users to secure irrigation water, today and in the future, ORS 537.170(8) weighs against approval of the Application.³

i. The Department must consider potential future uses of water when evaluating the public interest.

As a threshold matter, the Department must consider potential future water uses when evaluating whether the Application is detrimental to or impairs the public interest. Previously, the Department *expressly rejected* the argument that “[p]otential future uses of water are not properly to be considered in deciding whether to allow an Instream Water Right.”⁴ The Department explained that, because the public interest factors at ORS 537.170(8) are “very

(. . . continued)

- “(c) The control of the waters of this state for all beneficial purposes, including drainage, sanitation and flood control.
- “(d) The amount of waters available for appropriation for beneficial use.
- “(e) The prevention of wasteful, uneconomic, impracticable or unreasonable use of the waters involved.
- “(f) All vested and inchoate rights to the waters of this state or to the use of the waters of this state, and the means necessary to protect such rights.
- “(g) The state water resources policy formulated under ORS 536.295 to 536.350 and 537.505 to 537.534.”

² U.S. Dep’t of Agric., *2012 Census of Agriculture*, available at https://www.agcensus.usda.gov/Publications/2012/Online_Resources/County_Profiles/Oregon/cp41005.pdf (Clackamas County ranks third among Oregon counties for value of crops sold).

³ The amount of water allocable to an instream water right is limited to the estimated natural average flow (“ENAF”) occurring from the drainage system, except where periodic flows that exceed the natural flow are significant for the applied public use. OAR 690-077-0015(4). To the extent that ENAF quantities specified in the PFO differ from ENAF quantities previously calculated by the Department for Clear Creek, tributary to Sandy River, the Department has the burden of justifying the change. For example, as discussed in the Protest of Water Right Application IS-88329, the Department previously calculated different ENAF quantities for the South Fork Mill Creek than the ENAF quantities specified in the Proposed Final Order for that application.

⁴ Memorandum from Paul R. Cleary, Director, to Water Resources Commission, 6 (June 7, 2002) (Agenda Item E: Considerations of Exceptions and Issuance of Final Order on Water Right Application 70606 in the Name of Oregon Department of Fish and Wildlife).

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broad,” potential future uses of water *must* be considered when determining whether a proposed instream water right will impair or be detrimental to the public interest. *Id.*

ii. The Application blocks future appropriations for landowners who are already seeking water rights.

In this case, the proposed instream use could affect potential future uses of water in several ways. First, approval of the Application would prevent landowners who are already seeking water rights from securing water rights in the future. The demand for water rights stems from the fact that the Hood River Basin is closed to new appropriations of water. If the Application is approved, and should water rights be cancelled in the future, such cancellation would not make water available for new appropriations. Instead, the cancelled water rights would be swallowed up by the instream rights proposed in the Application. Thus, the Application significantly reduces the ability of landowners already seeking water rights to secure water rights in the future.

iii. The Application precludes future appropriation for storage, counter to the recommendations in Oregon’s 2017 Integrated Water Resources Strategy and the Hood River Basin Study.

The proposed instream use further injures the public interest by limiting future appropriations from the Hood River basin for storage. This outcome conflicts with the recommendations in Oregon’s 2017 Integrated Water Resources Strategy (the “Water Resources Strategy”) and in the locally-developed Hood River Basin Study (the “Basin Study”), both of which recognize storage as an important tool for satisfying water resource needs.

The Water Resources Strategy recognizes that, “[i]ncreasingly, water users are relying on tools such as water conservation, re-use, transferring existing water rights, and water storage to meet their needs during the summer months.” *Id.* at 16. For that reason, the Water Resources Strategy concludes that “[s]toring water, via built and natural systems, will be an important tool to meet Oregon’s water needs.” *Id.* at 59. To help meet future instream and out-of-stream water needs, the Water Resources Strategy recommends improving water-use efficiency and conservation and improving access to built storage. *Id.* at 95.

The need for increased storage is similarly recognized at a local level in the Basin Study. The Basin Study is the product of collaborative efforts by the U.S. Bureau of Reclamation and the Hood River County Water Planning Group (the “Planning Group”), who worked together to assess current and future water supply and demand in the Hood River basin and adjacent areas, and to identify a range of potential strategies to address any projected imbalances. Basin Study, at ES-1. Planning Group members included the Hood River Watershed Group, Columbia Gorge Fruit Growers Association, Hood River County Soil and Water Conservation District, multiple water districts, environmental groups, local resource specialists, Confederated Tribes of Warm Springs Oregon, Natural Resources Conservation Service, and a number of irrigation districts. *Id.* at ES-3.

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The Basin Study determined that, “[i]f no action is taken, potable and irrigation demands will continue to increase and exacerbate water imbalances in the future, particularly during the summer months.” *Id.* at ES-7. To address water demand challenges, the study evaluated three categories of actions: water conservation, groundwater recharge, and surface water storage. *Id.* Ultimately, the Basin Study concluded that “no single alternative will satisfy all of the water resource needs,” but that “due to the projection that summer streamflows are expected to get lower, a priority could be given to projects in the basin that have the ability to increase summer streamflow.” *Id.* at ES-10. Beyond conservation strategies (e.g., conversion of sprinkler systems to micro- or drip-irrigation), which are not independently sufficient to satisfy all water needs, the Basin Study’s top recommendation for safeguarding water resources related to increased storage. *Id.* at ES-10, 103.

The Application runs counter to the recommendations in the Water Resources Strategy and in the Basin Study because it inhibits Protestants’ members and irrigation districts’ ability to appropriate water for future storage. Approval of the Application could result in the loss of benefits associated with increased storage, which include: increased flows during low water months, water supply security for irrigators, and improved water quality. For those reasons, the Application is detrimental to the public interest.

iv. The Application contradicts the Commission’s renewal of water reservations in the Hood River basin.

Finally, approval of the Application does not align with the Commission’s recent decision to extend reservations for future economic development in the Hood River basin. In 2016, the Commission voted to extend reservations for the West Fork Hood River subbasin, East Fork Hood River subbasin, Neal Creek subbasin, Mosier Creek subbasin, Eightmile Creek subbasin and Fifteenmile Creek subbasin of the Hood River basin for an additional 20 years.⁵ Reservations for future economic development are intended “to ensure sufficient surface water will be available in the future to meet expected needs.” OAR 690-504-0100(1). Although water rights developed from the reservations in the Hood River basin have a priority date of November 6, 1992, which would make them senior to instream rights proposed in the Application, approval of the Application still has the potential to frustrate the purpose of the reserved rights. Specifically, water right permit applications to store reserved water must undergo public interest review. OAR 690-504-0100(6). Approval of the Application would likely increase the difficulty of successfully applying for reserved water rights in the future.

4. Protest Filing Requirements

This Protest is timely filed. Any person may submit a written a protest to the PFO within 45 days from the date of publication of the PFO in the Department’s Weekly Notice. OAR 690-077-0043(6). The Department published notice of the PFO on October 17, 2017. Therefore, this protest must be filed on or before December 1, 2017.

⁵ Meeting Minutes, Joint Water Resources Commission and Environmental Quality Commission Meeting Hermiston, Oregon, 4 (Aug. 18, 2016).

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Protestants have included with this Protest the protest fee of \$810. See ORS 536.050(j).

Protestants have complied with the provisions of OAR 690-077-0043 and OAR 690-002-0030. The Protest is in writing and signed by the Protestant or the Protestant's attorney. OAR 690-002-0030(1). The Protest also includes:

- “(a) The name, address and telephone number of the protestant;
- “(b) A description of the protestant's interest in the proposed final order and, if the protestant claims to represent the public interest, a precise statement of the public interest represented;
- “(c) A detailed description of how the action proposed in the proposed final order would impair or be detrimental to the protestant's interest;
- “(d) A detailed description of how the proposed final order is in error or deficient and how to correct the alleged error or deficiency;
- “(e) Any citation of legal authority supporting the protest, if known[.]”

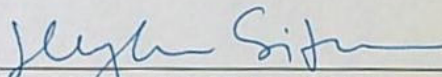
OAR 690-077-0043(1).

5. Conclusion and Request for Contested Case Hearing

For the reasons set forth above, the Department should either deny the Application or condition approval of the Application to subordinate instream rights to water rights for irrigation use.

DATED: December 1, 2017

Respectfully submitted,



David Filippi, OSB No. 965095
Hayley Siltanen, OSB No. 164825
Of Attorneys for Oregon Farm Bureau
Federation and Clackamas County Farm
Bureau

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April 20, 2017

Ronald C. Kohanek
Oregon Water Resources Department
725 Summer Street NE, Suite A
Salem, OR 97301

Sent via email to: ron.c.kohanek@oregon.gov

Subject: Instream Water Rights in the Hood Basin, Files IS88321, IS88322, IS88323, IS88324, IS88325, IS88326, IS88327, IS88328, IS88329, IS88331, IS88334, IS88335, IS88337

Dear Oregon Water Resources Department:

East Fork Irrigation District (EFID) is submitting comments on the Hood River Basin instream water right applications Oregon Department of Fish and Wildlife (ODFW) have submitted to Oregon Water Resources Department (OWRD). Hood River is a leader in locally driven watershed planning, and EFID is concerned that in ODFW's efforts to protect instream water throughout Oregon, they failed to engage with the local communities.

Hood River, in partnership with the US Bureau of Reclamation and the Hood River County Water Planning Group (HRCWPG), completed a basin study that assesses the current and future water supply and demand in the Hood River Basin. The HRCWPG included Hood River County, Hood River Watershed Group, Columbia Gorge Fruit Growers Association, Hood River County Soil and Water Conservation District, multiple water districts, environmental groups, local resource specialist, irrigation districts, OWRD, the Confederated Tribes of Warm Springs and the Natural Resources Conservation Service. The collaborative process developed various projects that could address both instream and out-of-stream needs. Additionally, in 2015 the Hood River Water Conservation Strategy, which stemmed from the Hood River Basin Study, identified, quantified and prioritized the opportunities for water conservation and instream flow enhancement in the Hood River Basin.

EFID is concerned that ODFW will upend all the hard work Hood River has put into local planning by attempting to appropriate all remaining water on 14 stream systems in the Hood Basin for instream use without considering the creative options for addressing instream needs development by the community. Unfortunately, it appears to EFID that ODFW is operating in a vacuum which undermines all the efforts already put forth by the basin. Our district has worked well with the Hood River Watershed Group and its many partners in the Hood River Basin. Moving forward, ODFW should involve all stakeholders in the community, especially when the community has water planning groups in place. Meeting with the water stewards of the community would only be beneficial to ODFW in addressing the needs of a specific basin.

Additionally, EFID has some specific concerns with the application pertaining to the East Fork Hood River (EFHR). The district currently has one point of diversion on the EFHR with a single headgate delivery system. The district's water supply comes from the NE slopes of Mt. Hood. EFID is in the process of exploring the possibility of a reservoir site, as an alternate water source to help meet late season water demands when the flow on the river is low. If a reservoir site is built, EFID could potentially capture winter water runoff, drainage or district water, benefiting not only EFID patrons, but the flows of the EFHR during low water months.

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Had ODFW engaged with the HRCWPG before applying for instream water rights within the Hood River Basin, they would have a more complete picture of the instream water needs and the well thought out projects the local community plans to implement in order to address those needs. One of the biggest issues EFID has with the instream water rights applied for by ODFW is that they will remove any flexibility the basin has to be creative in addressing all of the water supply demands now and into the future. The Hood River Basin's success in watershed planning illustrates that planning efforts work best when diverse interests develop and implement plans at the local watershed level, with the support from state government. In this instance, ODFW is not working as a collaborative partner, but is operating outside of the process and potentially restricting it. EFID requests that OWRD deny the instream water right applications put forth by ODFW and encourage them to work with the HRCWPG in developing instream protections that will work within the already identified plans.

Thank you for the opportunity for EFID to comment and express our concerns with the Hood River Basin instream water right applications submitted by ODFW. Please do not hesitate to contact me if you have any questions about our comments or would like to discuss this issue further.

Thank-You
John Buckley-District Manager
East Fork Irrigation District
PO Box 162
Odell, Oregon 97044
Office Phone: 541-354-1185
Cell Phone: 541-490-6127
E-Mail : johnnefid@hoodriverelectric.net

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CERTIFICATE OF SERVICE

I hereby certify that on December, 2017 I caused the original and one copy of the foregoing **Protest of Oregon Farm Bureau Federation and Clackamas County Farm Bureau; Request for Contested Case Hearing** to be served by hand delivery to the following address:

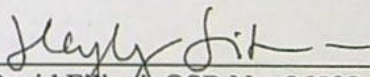
Director Tom Byler
Oregon Water Resources Department
725 Summer Street NE, Suite A
Salem, Oregon 97301-1271

I hereby certify that on December 1, 2017, I served a copy of the foregoing **Protest of Oregon Farm Bureau Federation and Clackamas County Farm Bureau; Request for Contested Case Hearing** to the following addresses by the method indicated below:

Anna Pakenham Stevenson
Oregon Department of Fish and Wildlife
4034 Fairview Industrial Drive SE
Salem, Oregon 97302-1142
anna.p.stevenson@state.or.us

(Via US Mail & Email)

DATED: December 1, 2017


David Filippi, OSB No. 96509
Hayley Siltanen, OSB No. 164825
Of Attorneys for Oregon Farm Bureau
Federation and Clackamas County Farm
Bureau

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DEC 01 2017

OWRD



Oregon

Kate Brown, Governor

Department of Fish and Wildlife

Fish Division
4034 Fairview Industrial Drive SE
Salem, OR 97302
(503) 947-6201
FAX (503) 947-6202
www.dfw.state.or.us/

Date: December 21, 2016

[Enter Addressee Here]

Generic Notification Letter: See addressee list on Page 6



REFERENCE: Proposed Instream Water Right Application in Your Jurisdiction

The Water Resources Department requires applicants intending to file an application for an instream water right to notify local governments that could be affected, so that the local government can make sure that the proposed new use does not result in a land use that would be incompatible with its comprehensive plan.

As such, we are notifying you under OAR 690-077-0020 (j) that we intend to submit applications to the Oregon Water Resources Department for instream rights in your area.

The proposed place of instream use would be in the following streams and respective reaches:

Clear Creek, tributary to the Sandy River:

Reach #1:

Description:

- In Clear Creek, tributary to the Sandy River, beginning at the mouth, river mile 0.0 in the SWNW quarter of Section 34, Township 2 S, Range 7 E W.M. in Clackamas County (45.3558, -121.9391) and continuing upstream to river mile 4.3 in the SENW quarter of Section 13, Township 2 S, Range 7 E W.M. in Clackamas County (45.3994, -121.8947).

Amount of water (in cubic feet per second) requested by month:

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Unit
45	45	45	45	45	45	30	8/6	6	6/45	45	45	CFS

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Bridal Veil Creek, tributary to Columbia River:

JAN 16 2017

Reach #1:

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Description:

- Beginning at the mouth of Bridal Veil Creek, tributary to the Columbia River, river mile 0.0 in the SW NW quarter of Section 22, Township 1 N, Range 5 E W.M. in Multnomah

County (45.5569, -122.1841), and continuing upstream to river mile 3.1 in the NENW quarter of Section 25, Township 1 N, Range 5 E W.M. in Multnomah County (45.5455, -122.1395).

Amount of water (in cubic feet per second) requested by month:

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Unit
0	0	0	0	0	0	0	5	4	0	0	0	CFS

Horsetail Creek, tributary to Oneonta Creek:

Reach #1:

Description:

- Beginning at the mouth of Horsetail Creek, tributary to Oneonta Creek, river mile 0.0 in the SESW quarter of Section 4, Township 1 N, Range 6 E W.M. in Multnomah County (45.5912, -122.0759), and continuing upstream to river mile 1.3 in the NESW quarter of Section 10, Township 1 N, Range 6 E W.M. in Multnomah County (45.5818, -122.057).

Amount of water (in cubic feet per second) requested by month:

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Unit
0	0	0	0	0	0	0	3	3	0	0	0	CFS

Latourell Creek, tributary to Columbia River:

Reach #1:

Description:

- Beginning at the mouth of Latourell Creek, tributary to the Columbia River, river mile 0.0 in the SWNE quarter of Section 25, Township 1 N, Range 4 E W.M. in Multnomah County (45.5433, -122.2585), and continuing upstream to the confluence of Henderson Creek and Latourell Creek, river mile 4.1 in the NWSE quarter of Section 32, Township 1 N, Range 5 E W.M. in Multnomah County (45.5231, -122.218).

Amount of water (in cubic feet per second) requested by month:

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Unit
0	0	0	0	0	0	0	3	3	0	0	0	CFS

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McCord Creek, tributary to Columbia River:

Reach #1:

Description:

- Beginning at the mouth of McCord Creek, tributary to the Columbia River, river mile 0.0 in the NWNW quarter of Section 31, Township 2 N, Range 7 E W.M. in Multnomah County (45.617, -121.9985), and continuing upstream to river mile 2.0 in the NWNE quarter of Section 7, Township 1 N, Range 7 E W.M. in Multnomah County (45.5897, -121.9886).

Amount of water (in cubic feet per second) requested by month:

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Unit
0	0	0	0	0	0	0	1	1	0	0	0	CFS

Moffet Creek, tributary to Columbia River:

Reach #1:

Description:

- Beginning at the mouth of Moffet Creek, tributary to the Columbia River, river mile 0.0 in the NESW quarter of Section 29, Township 2 N, Range 7 E W.M. in Multnomah County (45.6244, -121.9782), and continuing upstream to river mile 2.6 in the SWSW quarter of Section 5, Township 1 N, Range 7 E W.M. in Multnomah County (45.5927, -121.9745).

Amount of water (in cubic feet per second) requested by month:

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Unit
0	0	0	0	0	0	0	1	1	0	0	0	CFS

Multnomah Creek, tributary to Wahkeena Creek:

Reach #1:

Description:

- Beginning at the mouth of Multnomah Creek, tributary to Wahkeena Creek, river mile 0.0 in the SESE quarter of Section 12, Township 1 N, Range 5 E W.M. in Multnomah County

(45.5779, -122.1294), and continuing upstream to river mile 2.7 in the NESE quarter of Section 17, Township 1 N, Range 6 E W.M. in Multnomah County (45.5677, -122.0846).

Amount of water (in cubic feet per second) requested by month:

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Unit
0	0	0	0	0	0	0	4	4	0	0	0	CFS

Oneonta Creek, tributary to Columbia River:

Reach #1:

Description:

- Beginning at the mouth of Oneonta Creek, tributary to the Columbia River, river mile 0.0 in the SESW quarter of Section 4, Township 1 N, Range 6 E W.M. in Multnomah County (45.592, -122.0766), and continuing upstream to river mile 0.4 in the NWSE quarter of Section 9, Township 1 N, Range 6 E W.M. in Multnomah County (45.5821, -122.0727).

Amount of water (in cubic feet per second) requested by month:

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Unit
0	0	0	0	0	0	0	3	3	0	0	0	CFS

Tanner Creek, tributary to Columbia River:

Reach #1:

Description:

- Beginning at the mouth of Tanner Creek, tributary to the Columbia River, river mile 0.0 in the NWNW quarter, Section 28, Township 2 N, Range 7 E W.M. in Multnomah County (45.6327, -121.9611), and continuing upstream to river mile 5.4 in the NESE quarter of Section 16, Township 1 N, Range 7 E W.M. in Multnomah County (45.5655, -121.9402).

Amount of water (in cubic feet per second) requested by month:

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Unit
0	0	0	0	0	0	0	15	15	0	0	0	CFS

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Wahkeena Creek, tributary to Columbia River:

Reach #1:

Description:

- Beginning at the mouth of Wahkeena Creek, tributary to the Columbia River, river mile 0.0 in the NESE quarter of Section 12, Township 1 N, Range 5 E W.M. in Multnomah County (45.5791, -122.1299), and continuing upstream to river mile 0.8 in the NENE quarter of Section 13, Township 1 N, Range 5 E W.M. in Multnomah County (45.5731, -122.1268).

Amount of water (in cubic feet per second) requested by month:

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Unit
0	0	0	0	0	0	0	2	2	0	0	0	CFS

If you have any questions regarding the proposed applications, or are interested in receiving additional information, please contact Anna Pakenham Stevenson at 503-947-6084 or Anna.p.stevenson@state.or.us

Sincerely,

Anna Pakenham Stevenson
Water Quality and Quantity Program Manager

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Letter to [Name}
December 21, 2016
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Addressee's for Sandy Basin Notification Letter

Multnomah County
Land Use Planning
1600 SE 190th Avenue
Portland, Oregon 97233

City of Troutdale
219 E Historic Columbia River Hwy
Troutdale, OR 97060

City of Gresham
1333 NW Eastman Parkway
Gresham, OR 97030

Clackamas County Planning Department
150 Beavercreek Road
Oregon City, OR 97045

City of Sandy
39250 Pioneer Blvd.
Sandy, OR 97055

Portland General Electric
PGE
P.O. Box 4404
Portland, OR 97208

CONFEDERATED TRIBES OF THE WARM
SPRINGS RESERVATION OF OREGON
PO Box C
1233 Veteran's Street
Warm Springs, OR 97761

CONFEDERATED TRIBES OF SILETZ INDIANS
201 SE Swan Avenue
P.O. Box 549
Siletz, OR 97380

CONFEDERATED TRIBES OF GRAND RONDE
9615 Grand Ronde Road
Grand Ronde, OR 97347

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PROPOSED FINAL ORDER

Authority

Use of Water: Public use, specifically fish life and wildlife.
County: Clackamas County

Location: CLEAR CREEK, TRIBUTARY TO THE SANDY RIVER, BEGINNING AT APPROXIMATELY RIVER MILE 4.3 (45.3994, -121.8947) (SEnw, SECTION 13, TOWNSHIP 2S, RANGE 7E, WM): CONTINUING DOWNSTREAM TO THE MOUTH AT APPROXIMATELY RIVER MILE 0.0 (45.3558, -121.9391) (SWNW, SECTION 34, TOWNSHIP 2S, RANGE 7E, WM) CLACKAMAS COUNTY

Source of Water: Clear Creek in Sandy Basin

Amount of Water (in cubic feet per second "CFS") requested by month

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
45	45	45	45	45	45	30	8/6	6	6/45	45	45

2. On March 17, 2017, the Department mailed the applicant notice of its Initial Review, determining that "Some percentage of the water applied for has been determined allocable for the purposes identified in this application." The applicant did not notify the Department to stop processing the application within 14 days of that date.
3. On March 21, 2017, the Department gave public notice of the initial review in its weekly notice. The public notice included a request for comments, and information for interested persons about obtaining future notices and a copy of the Proposed Final Order.
4. Written comments were received from WaterWatch of Oregon. The Department has carefully considered the comments.
5. This Proposed Final Order confirms the preliminary findings made in the initial review.

Presumption Criteria (a) Consistency with Basin Program

6. "Fish life" is a classified use allowed under the Sandy Basin Program (OAR 690-503-0040(2)). ORS 537.343(1); OAR 690-077-0039(2)

Presumption Criteria (b) Water Availability

7. An assessment of surface water availability was completed and a copy of this assessment is in the file. The amount of out-of-stream appropriations is not a factor in determining the amount of an instream water right. OAR 690-077-0015(3). The amount allocable to an instream water right is limited to the estimated average natural streamflow occurring from the drainage system, except where periodic flows that exceed the natural flow are significant for the applied public use. OAR 690-077-0015(4). The table below compares the estimated average natural flow (EANF) of Clear Creek on a monthly basis (in CFS) to the requested flows in the application. The last row is the allowable amount and the amount in the proposed certificate. Water is not available in the times and amounts requested. ORS 537.343(1); OAR 690-077-0039(2)(c)

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
EANF	90	92	85	107	105	53	27	24	24	35	92	94
Flows Requested	45	45	45	45	45	45	30	8/6	6	6/45	45	45
Allowable amount	45	45	45	45	45	45	27	8/6	6	6/35	45	45

Presumption Criteria (c) Injury Determination

8. The proposed use is junior in priority and by operation of the prior appropriation doctrine will not injure other water rights. ORS 537.343(1); OAR 690-077-0039(2)(d)

Presumption Criteria (d) Whether the use complies with rules of the Commission

9. The Department placed the application on the Department's Public Notice for a 30-day comment period. Consistent with OAR 690-077-0031, copies of the notice were sent to the planning departments of affected local governments with a request that a copy of said notice be posted in a conspicuous location in the county courthouse. No land use information was received by the Department during the initial review 30 day public comment period. Pursuant to OAR 690-077-0031(5) the Department may presume the proposed instream water right is compatible with the comprehensive land use plans and land use regulations of affected local governments.
10. The proposed use complies with rules of the Water Resources Commission not otherwise described above.

Whether the proposed use would impair or be detrimental to the public interest as provided in ORS 537.170

11. Based on an evaluation of the proposed use, the comments received, information available in its files or received from other interested agencies and any other available information, the Department has determined that the proposed use will not impair or be detrimental to the public interest as provided in ORS 537.170. OAR 690-077-0039(2)(e)

Determination of Presumption that a proposed surface water use will not impair or be detrimental to the public interest

12. Based on the review of the presumption criteria (a)-(d) above, and Finding of Fact #9, #10 and #11, the Department finds that a rebuttable presumption has been established. 537.343(1); OAR 690-077-0039(2)(g)

CONCLUSIONS OF LAW

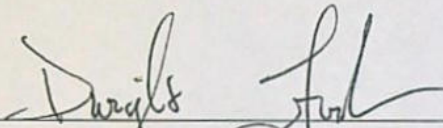
The proposed use would not impair or be detrimental to the public interest.

When issuing certificates, ORS 537.343(1) authorizes the Department to include provisions or restrictions concerning the use, control and management of the water to be appropriated for the project. The attached draft permit is conditioned accordingly.

PROPOSED ORDER

The Department recommends approval of Application IS-88355 and issuance of a certificate consistent with the attached draft certificate.

DATED October 17, 2017

A handwritten signature in black ink, appearing to read "Dwight French", is written over a horizontal line.

Dwight French, Water Rights Services Division Administrator, for
Thomas M. Byler, Director

Protests

Under the provisions of ORS 537.153(7), the Proposed Final Order may be protested. Protests must be received in the Water Resources Department no later than **December 1, 2017**. Protests must be in writing, and must include the following:

- Your name, address, and telephone number;
- A description of your interest in the Proposed Final Order, and, if you claim to represent the public interest, a precise statement of the public interest represented;
- A detailed description of how the action proposed in the Proposed Final Order would impair or be detrimental to your interest;
- A detailed description of how the Proposed Final Order is in error or deficient, and how to correct the alleged error or deficiency;
- Any citation of legal authority to support your protest, if known;
- To affect the department's determination that the proposed use in this application will, or will not, impair or be detrimental to the public interest ORS 537.153(6) requires that a protest demonstrate by a preponderance of evidence any of the following: (a) One or more of the criteria for establishing the presumption are, or are not, satisfied; or (b) The specific aspect of the public welfare, safety and health under ORS 537.525 that would be impaired or detrimentally affected, and specifically how the identified aspect of the public welfare, safety and health under ORS 537.525 would be impaired or be adversely affected;
- If you are the applicant, the protest fee of \$410 required by ORS 536.050; and
- If you are not the applicant, the protest fee of \$810 required by ORS 536.050 and proof of service of the protest upon the applicant.
- If you are the applicant, a statement of whether or not you are requesting a contested case hearing.

Requests for Standing

Under the provisions of ORS 537.153(7) persons other than the applicant who support a Proposed Final Order can request standing for purposes of participating in any contested case proceeding on the Proposed Final Order or for judicial review of a Final Order.

Requests for standing must be received in the Water Resources Department no later than **December 1, 2017**. Requests for standing must be in writing, and must include the following:

- The requester's name, mailing address and telephone number;
- If the requester is representing a group, association or other organization, the name, address and telephone number of the represented group;
- A statement that the requester supports the Proposed Final Order as issued;
- A detailed statement of how the requester would be harmed if the Proposed Final Order is modified; and
- A standing fee of \$230. If a hearing is scheduled, an additional fee of \$580 must be submitted along with a petition for party status.

After the protest period has ended, the Director will either issue a Final Order or schedule a contested case hearing. The contested case hearing will be scheduled only if a protest has been submitted and either:

- upon review of the issues, the director finds that there are significant disputes related to the proposed use of water, or
- the applicant requests a contested case hearing within 30 days after the close of the protest period.

If you do not request a hearing within 30 days after the close of the protest period, or if you withdraw a request for a hearing, notify the Department or the administrative law judge that you will not appear or fail to appear at a scheduled hearing, the Director may issue a Final Order by default. If the Director issues a Final Order by default, the Department designates the relevant portions of its files on this matter, including all materials that you have submitted relating to this matter, as the record for purpose of proving a *prima facie* case upon default.

You may be represented by an attorney at the hearing. Legal aid organizations may be able to assist a party with limited financial resources. Generally, partnerships, corporations, associations, governmental subdivisions or public or private organizations are represented by an attorney. However, consistent with OAR 690-002-0020 and OAR 137-003-0555, an agency representative may represent a partnership, corporation, association, governmental subdivision or public or private organization if the Department determines that appearance of a person by an authorized representative will not hinder the orderly and timely development of the record in this case.

Notice Regarding Service Members: Active duty service members have a right to stay proceedings under the federal Service Members Civil Relief Act. 50 U.S.C. App. §§501-597b. You may contact the Oregon State Bar or the Oregon Military Department for more information. The toll-free telephone number for the Oregon State Bar is: 1 (800) 452-8260. The toll-free telephone number of the Oregon Military Department is: 1 (800) 452-7500. The Internet address for the United States Armed Forces Legal Assistance Legal Services Locator website is: <http://legalassistance.law.af.mil>

This document was prepared by R. Craig Kohanek. If you have any questions about any of the statements contained in this document I can be reached at 503-986-0823.

If you have questions about how to file a protest or a request for standing, please refer to the respective sections in this Proposed Final Order entitled "Protests" and "Requests for Standing". If you have previously filed a protest and want to know its status, please contact Patricia McCarty at 503-986-0820.

If you have other questions about the Department or any of its programs please contact our Customer Service Group at 503-986-0801. Address all other correspondence to: Water Rights Section, Oregon Water Resources Department, 725 Summer St NE Ste A, Salem OR 97301-1266, Fax: 503-986-0901.

STATE OF OREGON
COUNTY OF CLACKAMAS
PROPOSED CERTIFICATE OF WATER RIGHT

THIS CERTIFICATE ISSUED TO

OREGON WATER RESOURCES DEPARTMENT
725 SUMMER STREET NE, STE A
SALEM, OR 97301

The specific limits for the use are listed below along with the conditions of use.

APPLICATION FILE NUMBER: IS-88355

SOURCE OF WATER: CLEAR CREEK, TRIBUTARY TO SANDY RIVER

COUNTY: CLACKAMAS

BENEFICIAL USE: PUBLIC USE, SPECIFICALLY FISH LIFE AND WILDLIFE

DATE OF PRIORITY: JANUARY 16, 2017

To be maintained in:

CLEAR CREEK, TRIBUTARY TO THE SANDY RIVER, BEGINNING AT APPROXIMATELY RIVER MILE 4.3 (45.3994, -121.8947) (SENW, SECTION 13, TOWNSHIP 2S, RANGE 7E, WM): CONTINUING DOWNSTREAM TO THE MOUTH AT APPROXIMATELY RIVER MILE 0.0 (45.3558, -121.9391) (SWNW, SECTION 34, TOWNSHIP 2S, RANGE 7E, WM) CLACKAMAS COUNTY.

The right is established under Oregon Revised Statute 537.341

The following conditions apply to the use of the water under this certificate:

1. The right is limited to not more than the amounts, in cubic feet per second, during the time periods listed below:

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
45	45	45	45	45	45	27	8/6	6	6/35	45	45

The water right holder shall measure and report the instream flow along the reach of the stream or river described in the certificate as may be required by the standards for instream water right reporting of the Water Resources Commission.

For purposes of water distribution, this instream right shall not have priority over human consumption.

The instream flow allocated pursuant to this water right is not in addition to other instream flows created by a prior water right or designated minimum perennial stream flow.

The flows are measured at the lower end of the stream reach to protect necessary flows throughout the reach.

Issued _____

DRAFT

Dwight French
Water Right Services Division Administrator, for
Thomas M. Byler, Director
Oregon Water Resources Department

Mailing List for IS PFO

Scheduled Mailing Date:

Application: IS-88355

Applicant:

Oregon Department of Fish & Wildlife
4034 Fairview Industrial Drive SE
Salem, OR 97302

Copies Mailed

by:

SP

(STAFF)

on:

10-17-17

(DATE)

OWRD copies:

WRD - Watermaster: Amy Kim, District 20 - Electronic
WRD - Regional Manager: Mike McCord - Electronic
WRD - Data Center - Paper
WRD - Water Availability - Paper
WRD - File - Paper

Other persons to receive copies:

ODFW: Anna Pakenham Stevenson - Send certified mail

Caseworker: Craig Kohanek

Instream Water Right Proposed Final Orders

Proposed Final Order Stage (PFO)

The proposed final order is the Department's penultimate decision on the water use request. The PFO documents the agency's decision through specific findings, including review of comments received. If appropriate, it includes a draft permit specifying any conditions or restrictions on the use. Persons interested in receiving a mailed copy of a PFO must pay a statutorily-required fee of \$25. (Any person paying \$25 to receive a PFO by mail will also receive a copy of the Final Order when it is issued.) PFO's may be viewed free of charge online at: <http://apps.wrd.state.or.us/apps/wr/wrinfo/>. Those disagreeing with the Department's decision as expressed in the PFO have 45 days to file a protest.

The protest deadline for proposed final orders appearing in this public notice is 5 p.m., Friday, December 1, 2017.

The protest filing fee is \$410 for the applicants and \$810 for non-applicants. Detailed requirements for filing a protest are included in the PFO. Persons who support the PFO may file a "standing" fee of \$230 to retain the ability to participate in future proceedings relating to an application. Before participation in a hearing is allowed, an additional \$580 will be required to request to participate as a party or limited party.

Each person submitting a protest or a request for standing shall raise all reasonably ascertainable issues and submit all reasonably available arguments supporting the person's position by the close of the protest period. Failure to raise a reasonably ascertainable issue in a protest or in a hearing, or failure to provide sufficient specificity to afford the Department an opportunity to respond to the issue, precludes judicial review based on that issue.

App#	<u>IS-88322</u>
County/Basin	Hood River / Hood (4)
Applicant Name	OREGON DEPARTMENT OF FISH AND WILDLIFE 4034 FAIRVIEW INDUSTRIAL DR SE SALEM, OR 97302-1142
Sources/TRSQ40Q160	EAST FORK HOOD RIVER > HOOD RIVER / 1.00N 10.00E 28 SENW
Use/Quantity	INSTREAM USES / 210,000 CFS
Quantity by month	JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC
In CFS	180 210 210 210 210 210 150 150 169 160 180 180
Stream Reach	River Mile 6.2 to Mouth
Priority Date	12/01/2016
Stage/Status	PFO / PROPOSE TO APPROVE

App#	<u>IS-88323</u>
County/Basin	Hood River / Hood (4)
Applicant Name	OREGON DEPARTMENT OF FISH AND WILDLIFE 4034 FAIRVIEW INDUSTRIAL DR SE SALEM, OR 97302-1142
Sources/TRSQ40Q160	GREEN POINT CREEK > WEST FORK HOOD RIVER / 1.00N 9.00E 9 NWNE
Use/Quantity	INSTREAM USES / 120,000 CFS
Quantity by month	JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC
In CFS	90 110 107 120 120 64.7 26.8 16.5 16.2 29 65.2 87.9
Stream Reach	River Mile 3.1 to Mouth
Priority Date	12/01/2016
Stage/Status	PFO / PROPOSE TO APPROVE

App# IS-88326
County/Basin Wasco / Hood (4)
Applicant Name OREGON DEPARTMENT OF FISH AND WILDLIFE
4034 FAIRVIEW INDUSTRIAL DR SE
SALEM, OR 97302-1142
Sources/TRSQ40Q160 MILL CREEK > COLUMBIA RIVER / 1.00N 12.00E 22 SESW
Use/Quantity INSTREAM USES / 26.000 CFS
Quantity by month JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC
In CFS 10 10 15 26 25.5 15.4 12.6 10.7 9.72 8.43 10 10
Stream Reach River Mile 8.1 to Mouth
Priority Date 12/01/2016
Stage/Status PFO / PROPOSE TO APPROVE

App# IS-88327
County/Basin Hood River / Hood (4)
Applicant Name OREGON DEPARTMENT OF FISH AND WILDLIFE
4034 FAIRVIEW INDUSTRIAL DR SE
SALEM, OR 97302-1142
Sources/TRSQ40Q160 NEAL CREEK > HOOD RIVER / 1.00N 11.00E 6 SWSW
Use/Quantity INSTREAM USES / 41.900 CFS
Quantity by month JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC
In CFS 26.4 41.9 40.1 27.6 9.98 4.91 2.41 1.95 2.15 2.96 4.8 10.6
Stream Reach River Mile 5.8 to Mouth
Priority Date 12/01/2016
Stage/Status PFO / PROPOSE TO APPROVE

App# IS-88328
County/Basin Hood River / Hood (4)
Applicant Name OREGON DEPARTMENT OF FISH AND WILDLIFE
4034 FAIRVIEW INDUSTRIAL DR SE
SALEM, OR 97302-1142
Sources/TRSQ40Q160 ODELL CREEK > HOOD RIVER / 2.00N 10.00E 34 NESW
Use/Quantity INSTREAM USES / 16.300 CFS
Quantity by month JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC
In CFS 8.55 15.7 16.3 9.25 .88 .17 .08 .09 .07 .13 .43 2.75
Stream Reach River Mile 4.0 to Mouth
Priority Date 12/01/2016
Stage/Status PFO / PROPOSE TO APPROVE

App# IS-88329
County/Basin Wasco / Hood (4)
Applicant Name OREGON DEPARTMENT OF FISH AND WILDLIFE
4034 FAIRVIEW INDUSTRIAL DR SE
SALEM, OR 97302-1142
Sources/TRSQ40Q160 SOUTH FORK MILL CREEK > MILL CREEK / 1.00S 11.00E 20 NENW
Use/Quantity INSTREAM USES / 12.100 CFS
Quantity by month JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC
In CFS 0 0 0 0 0 12.1 10 8.7 7 7 7 0
Stream Reach River Mile 10.1 to Mouth
Priority Date 12/01/2016
Stage/Status PFO / PROPOSE TO APPROVE

App# IS-88330
County/Basin Hood River / Hood (4)
Applicant Name OREGON DEPARTMENT OF FISH AND WILDLIFE
4034 FAIRVIEW INDUSTRIAL DR SE
SALEM, OR 97302-1142
Sources/TRSQ40Q160 WEST FORK HOOD RIVER > HOOD RIVER / 1.00S 8.00E 25 SWNW
Use/Quantity INSTREAM USES / 250.000 CFS
Quantity by month JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC
In CFS 150 250 250 250 250 250 150 147 139 141 190 190
Stream Reach River mile 14.7 to Mouth
Priority Date 12/01/2016
Stage/Status PFO / PROPOSE TO APPROVE

App# IS-88331
 County/Basin Wasco / Hood (4)
 Applicant Name OREGON DEPARTMENT OF FISH AND WILDLIFE
 4034 FAIRVIEW INDUSTRIAL DR SE
 SALEM, OR 97302-1142
 Sources/TRSQ40Q160 FIFTEENMILE CREEK > COLUMBIA RIVER / 1.00S 13.00E 25 SWSE
 Use/Quantity INSTREAM USES / 34.000 CFS
 Quantity by month JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC
 In CFS 13 13 20 34 34 34 12.8 5.9 6.1 7.9 11.2 13
 Stream Reach River Mile 30.6 to Mouth
 Priority Date 12/01/2016
 Stage/Status PFO / PROPOSE TO APPROVE

App# IS-88337
 County/Basin Wasco / Hood (4)
 Applicant Name OREGON DEPARTMENT OF FISH AND WILDLIFE
 4034 FAIRVIEW INDUSTRIAL DR SE
 SALEM, OR 97302-1142
 Sources/TRSQ40Q160 FIFTEENMILE CREEK > COLUMBIA RIVER / 2.00S 11.00E 28 NWSW
 Use/Quantity INSTREAM USES / 26.000 CFS
 Quantity by month JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC
 In CFS 10 10 15 26 26 26 9 4 4 7 10 10
 Stream Reach River Mile 49.4 to 30.6
 Priority Date 12/31/2016
 Stage/Status PFO / PROPOSE TO APPROVE

App# IS-88334
 County/Basin Hood River / Hood (4)
 Applicant Name OREGON DEPARTMENT OF FISH AND WILDLIFE
 4034 FAIRVIEW INDUSTRIAL DR SE
 SALEM, OR 97302-1142
 Sources/TRSQ40Q160 EAST FORK HOOD RIVER > HOOD RIVER / 2.00S 10.00E 5 SESE
 Use/Quantity INSTREAM USES / 175.000 CFS
 Quantity by month JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC
 In CFS 175 175 175 175 175 175 110 110 145 145 175 175
 Stream Reach River Mile 16.8 to 6.2
 Priority Date 12/31/2016
 Stage/Status PFO / PROPOSE TO APPROVE

App# IS-88335
 County/Basin Hood River / Hood (4)
 Applicant Name OREGON DEPARTMENT OF FISH AND WILDLIFE
 4034 FAIRVIEW INDUSTRIAL DR SE
 SALEM, OR 97302-1142
 Sources/TRSQ40Q160 EAST FORK HOOD RIVER > HOOD RIVER / 2.00S 10.00E 8 SWSE
 Use/Quantity INSTREAM USES / 127.000 CFS
 Quantity by month JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC
 In CFS 75 75 75 127 127 127 127 75 75 50 50 75
 Stream Reach River Mile 17.8 to 16.8
 Priority Date 12/31/2016
 Stage/Status PFO / PROPOSE TO APPROVE

App# IS-88355
 County/Basin Clackamas / Sandy (3)
 Applicant Name OREGON DEPARTMENT OF FISH AND WILDLIFE
 4034 FAIRVIEW INDUSTRIAL DR SE
 SALEM, OR 97302-1142
 Sources/TRSQ40Q160 CLEAR CREEK > SANDY RIVER / 2.00S 7.00E 13 SENW
 Use/Quantity INSTREAM USES / 45.000 CFS
 Quantity by month JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC
 In CFS 45 45 45 45 45 45 27 8/6 6 6/35 45 45
 Stream Reach River Mile 4.3 to Mouth
 Priority Date 01/16/2017
 Stage/Status PFO / PROPOSE TO APPROVE

App# IS-88332
 County/Basin Hood River / Hood (4)
 Applicant Name OREGON DEPARTMENT OF FISH AND WILDLIFE
 4034 FAIRVIEW INDUSTRIAL DR SE
 SALEM, OR 97302-1142
 Sources/TRSQ40Q160 CLEAR BRANCH > MIDDLE FORK HOOD RIVER / 1.00S 9.00E 27 NWNE
 Use/Quantity INSTREAM USES / 45.000 CFS
 Quantity by month JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC
 In CFS 44 39 42 50 50 50 30 21 18 21 34 35
 Stream Reach River Mile 1.2 to Mouth
 Priority Date 05/01/2017
 Stage/Status PFO / PROPOSE TO APPROVE

App# IS-88333
 County/Basin Hood River / Hood (4)
 Applicant Name OREGON DEPARTMENT OF FISH AND WILDLIFE
 4034 FAIRVIEW INDUSTRIAL DR SE
 SALEM, OR 97302-1142
 Sources/TRSQ40Q160 COE BRANCH > CLEAR BRANCH / 2.00S 9.00E 4 NWSE
 Use/Quantity INSTREAM USES / 20.000 CFS
 Quantity by month JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC
 In CFS 14 14 20 20 20 14 14 20 20 20 14 14
 Stream Reach River Mile 3.5 to Mouth
 Priority Date 05/01/2017
 Stage/Status PFO / PROPOSE TO APPROVE

App# IS-88336
 County/Basin Hood River / Hood (4)
 Applicant Name OREGON DEPARTMENT OF FISH AND WILDLIFE
 4034 FAIRVIEW INDUSTRIAL DR SE
 SALEM, OR 97302-1142
 Sources/TRSQ40Q160 ELIOT BRANCH > CLEAR BRANCH / 2.00S 9.00E 10 NESW
 Use/Quantity INSTREAM USES / 11.000 CFS
 Quantity by month JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC
 In CFS 11 11 11 11 11 11 11 11 11 11 11 11
 Stream Reach River Mile 4.5 to Mouth
 Priority Date 05/01/2017
 Stage/Status PFO / PROPOSE TO APPROVE

Clear Creek, tributary of Sandy River (WAB # 30300107)

Method: Apply the regional regression equations from Cooper (2002) with basin characteristics calculated at a pour point using the coordinates from the downstream end of study reach, then correct the modeled flows with gage 14138900 (North Fork Bull Run River near Multnomah Falls, OR).

Input file:

```
30300107 1 50 1
3 2 0.00 30300107 0 2 0.00 14138900 0
30300107 1 80 1
3 2 0.00 30300107 0 2 0.00 14138900 0
```

Table 1. Monthly instream flows requested by ODFW (ISWR) and natural streamflows from OWRD (NSF) for study reach. Green indicates months where flows exceed ISWR, red when flows are lower.

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
ISWR	45	45	45	45	45	45	30	8\6	6	6\45	45	45
NSF_50	90	92	85	107	105	53	27	24	24	35	92	94

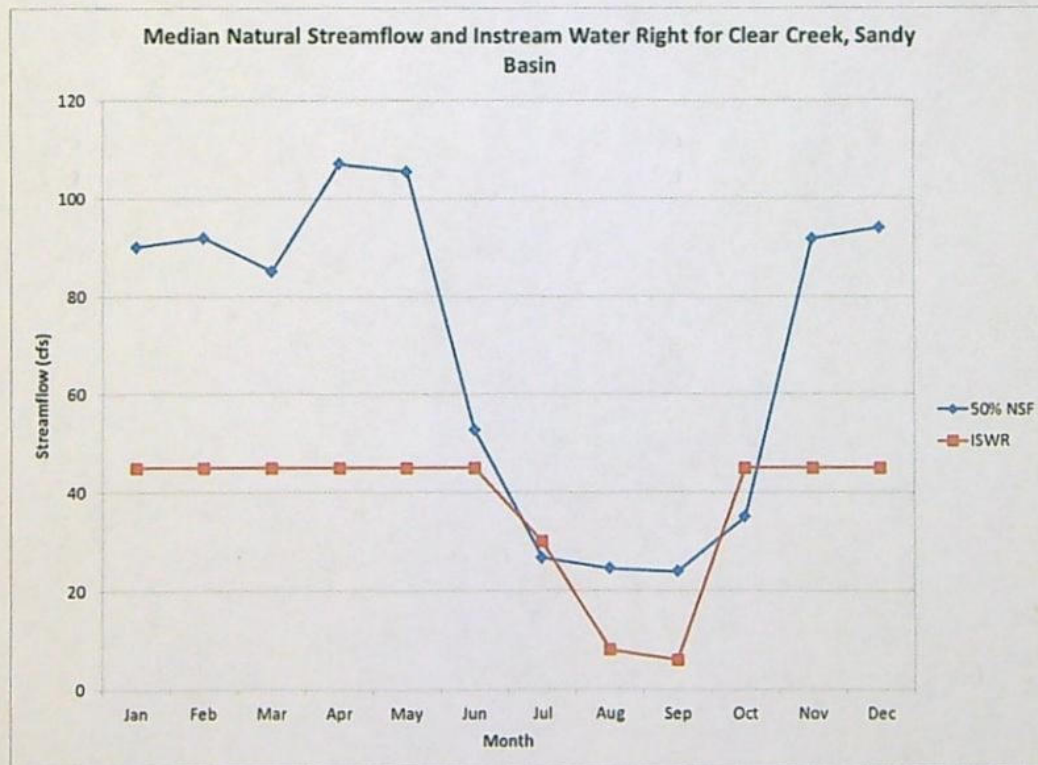


Figure 1. Monthly hydrograph comparing estimated median natural streamflow and proposed instream water rights.

References

Cooper, R.M. 2002. Determining Surface Water Availability in Oregon. State of Oregon, Water Resources Department, Open File Report SW 02-002, Salem, Oregon. 158 pages

KOHANEK Ron C * WRD

From: Anna Pakenham Stevenson <anna.p.stevenson@state.or.us>
Sent: Monday, January 16, 2017 8:59 AM
To: WALLIN Timothy * WRD; FRENCH Dwight W; KOHANEK Ron C * WRD; STAHR Kenneth L * WRD; MCCARTY Patricia E * WRD
Cc: STEVENSON Anna P
Subject: Sandy ISWR application from ODFW
Attachments: 2C and 3-BASIN-Lower Willamette and Sandy 1964.pdf; Jacobsen&Nott OASIS spawning report15STWAnnualReport.pdf; Sandy ISWR Application Clear Creek.pdf; Sandy Notification Letterhead for application.pdf

Hello Dwight, Tim, Ken, Patricia, and Craig,

Please see ODFW application materials for the Sandy Basin.

Descriptions of reaches were sent to WRD on December 7, 2016 (reference below).

Attached are:

1. ISWR application for Clear Creek
2. Sample notification letter (note- all Sandy reaches are on this letter because the notifications went out before knowing we were only applying on Clear Creek)
3. Basin Investigative Report For the Sandy- used in determining flow values
4. OASIS report- used in determining flow values

As always, thank you for all the work on your end in processing these applications.

Best,
Anna

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OWRD

From: Anna Pakenham Stevenson <Anna.P.Stevenson@coho2.dfw.state.or.us>
Subject: Sandy ISWR reaches
Date: December 7, 2016 at 3:58:29 PM MST
To: STAHR Kenneth L * WRD <Kenneth.L.Stahr@oregon.gov>, GALL Ivan K * WRD <Ivan.K.Gall@oregon.gov>, MATTICK Michael J <Michael.J.MATTICK@state.or.us>, HENDRICKS Nikki M <Nikki.M.HENDRICKS@state.or.us>

Hello Ken, Ivan, Nikki, and Michael,

Please see the reach descriptions and locations for the ISWRs we will be filing on in the Sandy Basin. Michael and Nikki – would you assist us by identifying (name, address, and phone number) the water and irrigation districts in your basin. This is needed for the ISWR application.

Thank you all for the assistance and please do not hesitate to contact me if you have any questions/comments/concerns.

Best,
Anna

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Clear Creek, tributary to the Sandy River:

Reach #1:

Description:

- In Clear Creek, tributary to the Sandy River, beginning at the mouth, river mile 0.0 in the SWNW quarter of Section 34, Township 2 S, Range 7 E W.M. in Clackamas County (45.3558, -121.9391) and continuing upstream to river mile 4.3 in the SENW quarter of Section 13, Township 2 S, Range 7 E W.M. in Clackamas County (45.3994, -121.8947).

Amount of water (in cubic feet per second) requested by month:

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Unit
45	45	45	45	45	45	30	8/6	6	6/45	45	45	CFS

Bridal Veil Creek, tributary to Columbia River:

Reach #1:

Description:

- Beginning at the mouth of Bridal Veil Creek, tributary to the Columbia River, river mile 0.0 in the SW NW quarter of Section 22, Township 1 N, Range 5 E W.M. in Multnomah County (45.5569, -122.1841), and continuing upstream to river mile 3.1 in the NENW quarter of Section 25, Township 1 N, Range 5 E W.M. in Multnomah County (45.5455, -122.1395).

Amount of water (in cubic feet per second) requested by month:

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Unit
0	0	0	0	0	0	0	5	4	0	0	0	CFS

Horsetail Creek, tributary to Oneonta Creek:

Reach #1:

Description:

- Beginning at the mouth of Horsetail Creek, tributary to Oneonta Creek, river mile 0.0 in the SESW quarter of Section 4, Township 1 N, Range 6 E W.M. in Multnomah County (45.5912, -122.0759), and continuing upstream to river mile 1.3 in the NESW quarter of Section 10, Township 1 N, Range 6 E W.M. in Multnomah County (45.5818, -122.057).

Amount of water (in cubic feet per second) requested by month:

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Unit
0	0	0	0	0	0	0	3	3	0	0	0	CFS

Latourell Creek, tributary to Columbia River:

Reach #1:

Description:

- Beginning at the mouth of Latourell Creek, tributary to the Columbia River, river mile 0.0 in the SWNE quarter of Section 25, Township 1 N, Range 4 E W.M. in Multnomah County (45.5433, -122.2585), and continuing upstream to the confluence of Henderson Creek and Latourell Creek, river mile 4.1 in the NWSE quarter of Section 32, Township 1 N, Range 5 E W.M. in Multnomah County (45.5231, -122.218).

Amount of water (in cubic feet per second) requested by month:

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Unit
0	0	0	0	0	0	0	3	3	0	0	0	CFS

McCord Creek, tributary to Columbia River:

Reach #1:

Description:

- Beginning at the mouth of McCord Creek, tributary to the Columbia River, river mile 0.0 in the NWNW quarter of Section 31, Township 2 N, Range 7 E W.M. in Multnomah County (45.617, -121.9985), and continuing upstream to river mile 2.0 in the NWNE quarter of Section 7, Township 1 N, Range 7 E W.M. in Multnomah County (45.5897, -121.9886).

Amount of water (in cubic feet per second) requested by month:

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Unit
0	0	0	0	0	0	0	1	1	0	0	0	CFS

Moffet Creek, tributary to Columbia River:

Reach #1:

Description:

- Beginning at the mouth of Moffet Creek, tributary to the Columbia River, river mile 0.0 in the NESW quarter of Section 29, Township 2 N, Range 7 E W.M. in Multnomah

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County (45.6244, -121.9782), and continuing upstream to river mile 2.6 in the SWSW quarter of Section 5, Township 1 N, Range 7 E W.M. in Multnomah County (45.5927, -121.9745).

Amount of water (in cubic feet per second) requested by month:

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Unit
0	0	0	0	0	0	0	1	1	0	0	0	CFS

Multnomah Creek, tributary to Wahkeena Creek:

Reach #1:

Description:

- Beginning at the mouth of Multnomah Creek, tributary to Wahkeena Creek, river mile 0.0 in the SESE quarter of Section 12, Township 1 N, Range 5 E W.M. in Multnomah County (45.5779, -122.1294), and continuing upstream to river mile 2.7 in the NESE quarter of Section 17, Township 1 N, Range 6 E W.M. in Multnomah County (45.5677, -122.0846).

Amount of water (in cubic feet per second) requested by month:

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Unit
0	0	0	0	0	0	0	4	4	0	0	0	CFS

Oneonta Creek, tributary to Columbia River:

Reach #1:

Description:

- Beginning at the mouth of Oneonta Creek, tributary to the Columbia River, river mile 0.0 in the SESW quarter of Section 4, Township 1 N, Range 6 E W.M. in Multnomah County (45.592, -122.0766), and continuing upstream to river mile 0.4 in the NWSE quarter of Section 9, Township 1 N, Range 6 E W.M. in Multnomah County (45.5821, -122.0727).

Amount of water (in cubic feet per second) requested by month:

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Unit
0	0	0	0	0	0	0	3	3	0	0	0	CFS

Tanner Creek, tributary to Columbia River:

Reach #1:

Description:

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- Beginning at the mouth of Tanner Creek, tributary to the Columbia River, river mile 0.0 in the NWNW quarter, Section 28, Township 2 N, Range 7 E W.M. in Multnomah County (45.6327, -121.9611), and continuing upstream to river mile 5.4 in the NESE quarter of Section 16, Township 1 N, Range 7 E W.M. in Multnomah County (45.5655, -121.9402).

Amount of water (in cubic feet per second) requested by month:

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Unit
0	0	0	0	0	0	0	15	15	0	0	0	CFS

Wahkeena Creek, tributary to Columbia River:

Reach #1:

Description:

- Beginning at the mouth of Wahkeena Creek, tributary to the Columbia River, river mile 0.0 in the NESE quarter of Section 12, Township 1 N, Range 5 E W.M. in Multnomah County (45.5791, -122.1299), and continuing upstream to river mile 0.8 in the NENE quarter of Section 13, Township 1 N, Range 5 E W.M. in Multnomah County (45.5731, -122.1268).

Amount of water (in cubic feet per second) requested by month:

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Unit
0	0	0	0	0	0	0	2	2	0	0	0	CFS

Anna Pakenham Stevenson
 ODFW Water Program Manager
 503-947-6084 (office)
 971-718-2058 (cell)
anna.p.stevenson@state.or.us

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JAN 16 2017
OWRD

KOHANEK Ron C * WRD

From: MOORE Beth <beth.moore@state.or.us>
Sent: Monday, May 01, 2017 9:16 AM
To: 'ron.c.kohanek@wrд.state.or.us'
Cc: WILLIAMS Karen; MRAZIK Steve; PEERMAN Wade
Subject: FW: [Reminder] OWRD: WR Application IS88355(Surface Water) has been submitted for your District or Region. [DEQ]
Attachments: DEQ_Division33_Review_IS88355_Clear Creek_ BAM.pdf
Importance: High

Craig,

Attached please find DEQ's review for water right application IS88355. Thank you for the opportunity to review.

Beth Moore
Basin Coordinator
DEQ Northwest Region
700 NE Multnomah St., Suite 600
Portland, OR 97232
503-229-6402

From: wrд_automated_email@oregon.gov [mailto:wrд_automated_email@oregon.gov]
Sent: Tuesday, April 11, 2017 6:00 PM
To: WILLIAMS Karen
Subject: [Reminder] OWRD: WR Application IS88355(Surface Water) has been submitted for your District or Region. [DEQ]
Importance: High

DEQ review request for proposed water right application IS88355

Oregon Water Resources Department - Automated e-mail notice

Application Stakeholder(s): OREGON DEPARTMENT OF FISH AND WILDLIFE, PAKENHAM STEVENSON, ANNA; OREGON DEPARTMENT OF FISH AND WILDLIFE

Application Type: Surface Water

Notice Number: 2

Diversion Location:

County	Clackamas
TRSQQ	2.00S 7.00E 13 SENW
Basin	Sandy

Source	CLEAR CREEK
Tributary To	SANDY RIVER

To view the OWRD Web page for IS88355 please click the link below.

http://apps.wrd.state.or.us/apps/wr/wr_review/wr_details.aspx?snp_id=192119

To view the Pending Reviews for your district or region and obtain Review Forms, click the following link.

http://apps.wrd.state.or.us/apps/wr/external_review/deq_review.aspx?directory_id=130169

If you have questions about this review request please contact Caseworker: KOHANEK, CRAIG at or ron.c.kohanek@wr.state.or.us

**This message has been generated automatically by an unmonitored email account.
Please do not "reply" to this message. Thank you.**



April 20, 2017

Water Rights Section
Oregon Water Resources Department
725 Summer Street NE, Suite A
Salem, OR 97301-1271

RE: Comments, Sandy Basin Instream Water Right Application IS 88355, Clear Creek

Dear Oregon Water Resources Department,

Thank you for the opportunity to comment on the IR for ODFW's application for instream water right for Clear Creek in the Sandy River Basin (IS 88355). WaterWatch strongly supports the issuance of the instream water right in the amounts requested by ODFW in its application. That said, we did have some comments/concerns with the IR as proposed.

1. There is no statutory authority to restrict ODFW requested flow amounts to ENAF

The IR proposes limiting the flow amounts protected by the instream water right to the estimated average natural flow (ENAF). The WRD is relying on OAR 690-077-0015(4) as support for this restriction. As the WRD is aware, there is currently an ongoing rulemaking regarding Division 77. One of the outstanding issues is the legality of this provision of rule. The Rules Advisory Committee has been advised that this, among other issues, is under review by the Department of Justice. There are a couple issues to highlight related to this rule.

First, there is no statutory authority that allows carte blanche limitation on instream water rights applications. While the Instream Water Right Act does allow the WRD to reduce the amount applied for in an instream water right application by another state agency, this is only allowed upon findings that sets the basis for the reduction in the specific instance associated with the facts of a specific application. ORS 537.343(2). Moreover, the OWRD can only do this if the conditioning is consistent with the intent of ORS 537.332 to 537.360. To set an overarching limit to all agency applied instream water rights based on an overall "estimated average natural flow" (ENAF) is not supported by statute and is contrary to the intent of the Act to protect water instream for the beneficial uses of fish, wildlife, recreation and pollution abatement. The ENAF flow number has nothing to do with the beneficial use that these rights are supposed to protect and simply provides a false ceiling for the purposes of application processing. As to the IR, the OWRD simply applied the ENAF to the application to reduce the amounts requested by ODFW; OWRD did not make any findings that set the basis for the reduction specific to the circumstances of the application as is required by statute. The OWRD was in error in this regard.

Second, even if DOJ were to find that the noted section of the Division 77 rules were consistent with statute (which we do not believe is the case), the OWRD appears to be ignoring the whole of the section of rule they cite. The IR states that:

"Water allocable for instream use is limited to the average natural flow. Specifically, (OAR 690-077-0015(4)) states "If natural streamflow or natural lake levels are the source for meeting instream water rights, the amount allowed during any identified time period for the water right shall not exceed the estimated average natural flow or level occurring from the drainage system....."

The IR fails to completely cite OAR 690-077-0015(4) which continues on with:

.....except where periodic flow or level are significant for the uses applied for. An example of such an exception would be high flow events that allow for fish passage or migration over obstacles.

In other words, even if the DOJ were to determine that a carte blanche ENAF screen could be applied to instream water rights, the OWRD would still need to make findings that the requested amount was not significant for the uses applied for each individual application in order to reduce the amount requested to ENAF. The OWRD did not do this and thus the IR is in error.

As a factual matter, the ODFW requested flow numbers are to support the conservation, maintenance and enhancement of aquatic, fish and wildlife. The flows applied for include water for fish and wildlife migration, spawning, nesting, brooding, egg incubation, larval or juvenile development and aquatic rearing and aquatic life. Flows vary based on life cycle and life stage development needs. These flows were determined by ODFW, the state agency with expertise to determine the amount of water needed for fish and wildlife. Thus, even if the OWRD were to apply the above noted provision of the Division 77 rules, it is clear that the flows are significant for the uses applied for. Thus, even under the disputed rule, OWRD analysis should have resulted in a recommendation that the full amount of the water right be approved as the flows are "significant" for the uses applied for. Thus, under both statute and rule the IR is in error.

2. The OWRD erred in its application of the state's water allocation policy

In addition to restricting the flow amounts requested by ODFW by ENAF, the OWRD also applies its water availability screen to the application to further reduce requested amount. While we do not disagree that the permitting statutes require that the WRD find that water is available for the use, we believe the OWRD was in error in how it applied the state's water allocation policy. The state's water allocation policy, read as a whole, is clearly focused on protecting streams against further depletion. See OAR 690-400(11), OAR 690-410-070. Specifically, the water allocation policy makes clear that the waters of the state shall be protected from over-appropriation by new out of stream users of surface water or new uses of groundwater. OAR 690-410-070(1). To achieve this the OAR 690-410-070(2)(a) states:

The surface waters of this state shall be allocated to new out-of-stream uses only during the months or half month periods when the allocations will not contribute to over-appropriation. However, when a stream is over-appropriated, some additional uses may be allowed where the public interest is those uses is high and uses are conditioned to protect instream values (emphasis added).

In other words, the water availability restrictions under this rule apply to out-of-stream diversions. The allocation policy is not designed to restrict instream water rights. The Division 77 rules corroborate this interpretation by directing that "the amount of appropriation for out-of-stream purposes shall not be a factor in determining the amount of an instream water right." OAR 690-77-0015(3)¹. To try to restrict water that remains instream via a rule that is supposed to apply to consumptive uses of surface water is in error, and frankly, makes no sense.

Moreover, even if the Division 410 rules did apply to instream applications, instream water rights would easily meet the "exception" to the rule which is that, notwithstanding that a stream is over-appropriated, additional uses can be approved where the public interest is high and uses are conditioned to protect instream values. See OAR 690-410-070(2)(a). Clearly, instream water rights that are held in trust for all Oregonians to protect water instream easily meet both of these hurdles.

¹ The state's water availability model is subtracts out the consumptive uses of water rights, thus would not comport with the Division 77 regarding analysis of out-of-stream rights.

3. The OWRD fails to analyze the application in light of the many public interest factors that would support the issuance of the instream water rights in the amount requested by ODFW.

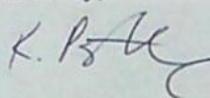
In looking at this application, the WRD failed to analyze a number of public interest factors that would support issuance of the ODFW application in the amount requested, which includes, but is not limited to:

- OAR 690-410-030 (d) states that protecting streamflows which are needed to support public uses is a high priority for the state. Public use is defined as, among other things, protection and enhancement of fish life, wildlife and fish and wildlife habitat and any other ecological values OAR 690-400-010(13).
- The 2012 Integrated Water Resources Strategy directs the state to apply for instream water rights to protect both base and elevated flows.²
- As noted, the Division 77 rules state that the amount of appropriation for out-of-stream purposes shall not be a factor in determining the amount of an instream water right.

Conclusion: WaterWatch supports issuance of the Sandy River Basin (Clear Creek) instream water rights in the amount requested by ODFW. As to the amount proposed under the IR, we do not believe the OWRD has a factual, legal or policy basis upon which to support the restrictions proposed in the IR.

Thank you for consideration of our comments.

Sincerely,



Kimberley Priestley
Sr. Policy Analyst

Cc: Laurie Aunan, Governor's Natural Resources Policy Advisor

² WRC 2012 Integrated Water Resources Strategy, Page 100.



Oregon
Kate Brown, Governor

Water Resources Department

725 Summer St NE, Suite A
Salem, OR 97301
(503) 986-0900
Fax (503) 986-0904

April 11, 2017

Director
In Care of Anna Pakenham-Stevenson
Oregon Department of Fish and Wildlife
4034 Fairview Industrial Drive SE
Salem, OR 97302-1142

Reference: Instream water right in the Sandy Basin, File IS 88355.

Dear Oregon Department of Fish and Wildlife:

**THIS IS NOT A WATER RIGHT CERTIFICATE
AND IS SUBJECT TO CHANGE AT THE NEXT PHASE OF PROCESSING**

This letter is to inform you of the preliminary analysis of your water right application. This document, called an "Initial Review", is to inform you of the potential limitations to your proposed instream water rights and to describe some of your options. Based on the information you have provided, the Oregon Water Resources Department (OWRD) has made the following preliminary determinations:

Initial Review Determinations:

1. The referenced applications are complete and not defective. However, OWRD requests the applicant provide additional information of how it has complied with its own administrative rules for instream water rights, as required by OAR 690-077-0020(4)(k), specifically those found in OAR 635-400-0020.
2. The proposed use is not prohibited, restricted or limited by law except for water availability limitations in certain months as depicted below.
3. The reach proposed in this application for an instream water is in the Sandy Basin.
4. The instream fish life uses and wildlife use are allowed under the Sandy Basin Program (OAR 690-503-0020(1)).
5. Water for instream use is limited to the estimated average natural flow. Specifically, OAR 690-077-0015(4) states "If natural streamflow or natural lake levels are the source for meeting instream water rights, the amount allowed during any identified time period for the water right shall not exceed the estimated average natural flow or level occurring from the drainage system ..."
6. All amounts of water are in cubic feet per second.
7. Summary of determination: Some percentage of the water applied for has been determined allocable for the purpose identified in each application. That volume is shown in the table below titled "Allowable instream use" and if less than the volume shown in "Requested for Fish life and fish habitat" table is limited to the volume shown "Estimated average natural flow" table.

1. Application 88355**Priority date: 01/16/2017****APPLICATION FROM OREGON DEPARTMENT OF FISH & WILDLIFE**Description:

- Clear Creek, tributary to the Sandy River, at (45.3994, -121.8947) (SENW, S13, T2S, R7E, WM) in Clackamas County and continuing downstream to the mouth at (45.3558, -121.9391), (SWNW, S34, T2S, R7E, WM) in Clackamas County.

Requested for Fish life and fish habitat

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
45	45	45	45	45	45	30	8/6	6	6/45	45	45

Estimated average natural flow

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
90	92	85	107	105	53	27	24	24	35	92	94

Allowable water use

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
45	45	45	45	45	45	27	8/6	6	6/35	45	45

The applications can be moved to the next phase of the water rights application review process. Comments received within the comment period will be evaluated at the next phase of the process.

Withdrawal:

If you choose not to proceed, you may withdraw your application. To accomplish this you must notify the Department in writing by March 31, 2016.

To Proceed with Your Application:

If you choose to proceed with an application, you do not have to notify the Department. Your application will automatically be placed on the Department's Public Notice to allow others the opportunity to comment. After the comment period the Department will complete a public interest review and issue a proposed final order.

If you have any question:

Feel free to call Craig Kohanek at (503) 986-0823 if you have questions. Please have the application number(s) available if you call.

APPLICATION FACT SHEET

Application File Number: IS 88355

Applicant: Oregon Department of Fish and Wildlife

County: Clackamas

Watermaster: Amy Kim, District 20

Priority Date: January 24, 2017

Source: 1) Clear Creek, tributary to the Sandy River.

Uses: Fish life and wildlife

Water Quantity:

IS 88355: (All amounts of water are in cubic feet per second)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
45	45	45	45	45	45	27	8/6	6	6/35	45	45

Basin Name & Number: Sandy Basin #3

Stream Index Reference: OWRD Streamcode 0312200160 – Clear Cr

PUBLIC NOTICE DATE: 3/17/2017

30 DAY COMMENT DEADLINE DATE: 3/20/2017

Mailing List for IR Copies

Application: IS 88355

Date: April 11, 2017

Original mailed to:

Applicant:

Director
In Care of Anna Pakenham-Stevenson
Oregon Department of Fish and Wildlife
4034 Fairview Industrial Drive SE
Salem, OR 97302-1142

Copies Mailed	
by:	_____
	(STAFF)
on:	_____
	(DATE)

Copies sent to:

1. WRD - File
2. WRD - Water Availability: Carlos Ortiz-Turner
3. WRD - Laura Wilke

IR, Map, and Fact Sheet Copies sent to:

(NOTE: please send only one copy per office, even if there is more than one name on the list)

1. Watermaster: Amy Kim, District 20
2. ODFW District Biologists: Todd Alsbury
3. ODFW: Anna Pakenham Stevenson
4. Columbia River Intertribal Fish Commission:
5. US Fish & Wildlife: Nancy Gilbert, 63095 Deschutes Market Rd, Bend OR 97701-9794
6. NW Power & Conservation Council, 851 SW Sixth Ave., Suite 1020, Portland, OR 97204-1347
7. DEQ: Steve Mrazik & Karen Williams, Northwest Region
8. DOA: Salem: Jim Johnson & Paul Measeles
9. DSL: Shawn Zumwalt
10. Confederated Tribes of the Warm Springs Indian Reservation: Robert Brunhoe – Natural Resources Mgr.

Copies sent to Other Interested Persons (CWRE, Agent, Well Driller, Commenter, etc.):

Caseworker: Ronald C. Kohanek

KOHANEK Ron C * WRD

From: MOORE Beth <beth.moore@state.or.us>
Sent: Monday, May 01, 2017 9:16 AM
To: 'ron.c.kohane@wrdd.state.or.us'
Cc: WILLIAMS Karen; MRAZIK Steve; PEERMAN Wade
Subject: FW: [Reminder] OWRD: WR Application IS88355(Surface Water) has been submitted for your District or Region. [DEQ]
Attachments: DEQ_Division33_Review_IS88355_Clear Creek_ BAM.pdf
Importance: High

Craig,

Attached please find DEQ's review for water right application IS88355. Thank you for the opportunity to review.

Beth Moore
Basin Coordinator
DEQ Northwest Region
700 NE Multnomah St., Suite 600
Portland, OR 97232
503-229-6402

From: wrd_automated_email@oregon.gov [mailto:wrdd_automated_email@oregon.gov]
Sent: Tuesday, April 11, 2017 6:00 PM
To: WILLIAMS Karen
Subject: [Reminder] OWRD: WR Application IS88355(Surface Water) has been submitted for your District or Region. [DEQ]
Importance: High

DEQ review request for proposed water right application IS88355

Oregon Water Resources Department - Automated e-mail notice

Application Stakeholder(s): OREGON DEPARTMENT OF FISH AND WILDLIFE, PAKENHAM STEVENSON, ANNA; OREGON DEPARTMENT OF FISH AND WILDLIFE

Application Type: Surface Water

Notice Number: 2

Diversion Location:

County	Clackamas
TRSQQ	2.00S 7.00E 13 SENW
Basin	Sandy

Source	CLEAR CREEK
Tributary To	SANDY RIVER

To view the OWRD Web page for IS88355 please click the link below.

http://apps.wrd.state.or.us/apps/wr/wr_review/wr_details.aspx?snp_id=192119

To view the Pending Reviews for your district or region and obtain Review Forms, click the following link.

http://apps.wrd.state.or.us/apps/wr/external_review/deq_review.aspx?directory_id=130169

If you have questions about this review request please contact Caseworker: KOHANEK, CRAIG at or ron.c.kohanek@wr.state.or.us

**This message has been generated automatically by an unmonitored email account.
Please do not "reply" to this message. Thank you.**

DEQ DIVISION 33 APPLICATION REVIEW SHEET

Recommendations for Water Right Applications that may affect the
Habitat of Sensitive, Threatened or Endangered Fish Species, OAR 690-33-310 through 340.

Application #: IS 88355 Applicant's Name: Oregon Department of Fish and Wildlife, Anna Pakenham Stevenson, ODFW

1) Is there a connection to a 303(d) listed water quality limited water body? ☐ NO ☒ YES

Explain: Clear Creek is listed as water quality limited for biological criteria and temperature as shown below.

Table 1: 303(d) listings

Oregon's 2012 Integrated Report						
Basin Name Subbasin 4th Field HUC	Water Body River Miles Segment Miles	Pollutant	Season	Criteria	Beneficial Uses	Status
Lower Columbia Lower Columbia-Sandy 17080001	Clear Creek 0 to 7 7	Biological Criteria	Year Round	Biocriteria: Waters of the state must be of sufficient quality to support aquatic species without detrimental changes in the resident biological communities.	Aquatic life	Cat 5: 303(d) TMDL needed
Lower Columbia Lower Columbia-Sandy 17080001	Clear Creek 0 to 1.4 1.4	Temperature	August 15 - June 15	Salmon and steelhead spawning: 13.0 degrees Celsius 7-day-average maximum	Salmon and steelhead spawning	Cat 4A: TMDL approved
Lower Columbia Lower Columbia-Sandy 17080001	Clear Creek 0 to 7 7	Temperature	Year Round (Non-spawning)	Core cold water habitat: 16.0 degrees Celsius 7-day-average maximum	Core cold water habitat	Cat 4A: TMDL approved

2) What is the potential for this use to impact a water quality limited water body: ☐ HIGH ☐ MEDIUM ☒ LOW

Temperature impairments may be improved as a result of this use in certain times of the year. The temperature of this waterbody or receiving waterbody is already known to be insufficient for the essential habitat of sensitive, threatened, and endangered fish. Any additional capacity to absorb heat or an increase in dissolved oxygen concentrations would further improve the habitat.

Biocriteria: Waters of the State must be of sufficient quality to support aquatic species without detrimental changes in the resident biological communities. Oregon's biological criteria narrative standard is based on EPA guidance recommending using biological community assessments as an indicator for aquatic life beneficial use support. Resident biological communities are the local food webs that support fish and other aquatic life. Protected stream flows, habitat protection, and decreased pollutant loads or concentrations may improve the biological community within the reach or downstream, and therefore result in the protection of habitat of sensitive, threatened, or endangered fish species.

Table 2. Surface water in stream request for Clear Creek				
	Requested In Stream Water Amount		Requested In Stream Time Period	
Priority Date	Max Rate (cfs)	Rate (cfs)	Start Date	End Date
1/16/2017	45.0	45.0	1/1	6/30
1/16/2017	30.0	30.0	7/1	7/31
1/16/2017	8.0	8.0	8/1	8/15
1/16/2017	6.0	6.0	8/16	10/15
1/16/2017	45.0	45.0	10/16	12/31

3) If the answer to question (2) is HIGH or MEDIUM, will the proposed use still result in diminution of water quality for the habitat of sensitive, threatened, or endangered fish species? ☐ NO ☐ YES

If YES, how?

4) Can conditions be applied to mitigate the impact of the use?

☒ NO

☐ YES; recommend from Menu of Conditions and skip to question 7.

5) If conditions cannot be identified to offset impacts, would the proposed use affect the Habitat of Sensitive, Threatened, or Endangered Fish Species? ☒ NO ☐ YES

If YES, please explain:

6) If a permit is issued, are there any conditions you would like to see included in the permit?

7) Your recommendation under OAR 690-033-0330 (2): ☐ Approval with conditions
☒ Approval without conditions
☐ Denial

DEQ Representative signature: Beth Moore Date: Apr. 27, 2017

WRD Contact: Caseworker: KOHANEK, CRAIG Water Rights Division, 503-986-0900 / Fax 503-986-0901

MENU OF CONDITIONS FOR WRD, ODFW, DEQ AND AG

The following condition will be included in any permit issued unless ODFW explicitly requests that it be omitted:

The permittee shall not construct, operate or maintain any dam or artificial obstruction to fish passage in the channel of the subject stream without providing a fishway to ensure adequate upstream and downstream passage for fish, unless the permittee has requested and been granted a fish passage waiver or exemption through the Oregon Department of Fish and Wildlife. The permittee is hereby directed to contact an Oregon Department of Fish and Wildlife Fish Passage Coordinator before beginning construction of any in-channel obstruction.

fishself The permittee shall install, maintain, and operate fish screening and by-pass devices consistent with current Oregon Department of Fish and Wildlife (ODFW) standards. Fish screening is to prevent fish from entering the proposed diversion while by-pass devices provide adequate upstream and downstream passage for fish. The required screen and by-pass devices are to be in place and functional prior to diversion of any water. Permittee shall obtain written approval from ODFW that the installation of the required screen and by-pass devices meets the state's criteria or the permittee shall submit documentation that ODFW has determined screens and/or by-pass devices are not necessary.

fishapprove The permittee shall install, maintain, and operate fish screening and by-pass devices consistent with current Oregon Department of Fish and Wildlife (ODFW) standards. Fish screening is to prevent fish from entering the proposed diversion while by-pass devices provide adequate upstream and downstream passage for fish. The required screen and by-pass devices are to be in place and functional, and approved in writing by ODFW prior to diversion of any water. The permittee may submit evidence in writing that ODFW has determined screens and/or by-pass devices are not necessary.

fishdiv33 If the riparian area is disturbed in the process of developing a point of diversion, the permittee shall be responsible for restoration and enhancement of such riparian area in accordance with ODFW's Fish and Wildlife Habitat Mitigation Policy OAR 635-415. For purposes of mitigation, the ODFW Fish and Wildlife Habitat Mitigation Goals and Standards, OAR 635-415, shall be followed.

The use may be restricted if the quality of the source stream or downstream waters decrease to the point that those waters no longer meet existing state or federal water quality standards due to reduced flows.

The permittee shall install, maintain, and operate fish screening and by-pass devices consistent with current Oregon Department of Fish and Wildlife (ODFW) standards. Fish screening is to prevent fish from entering the proposed diversion while by-pass devices provide adequate upstream and downstream passage for fish. The required screen and by-pass devices are to be in place and functional, and approved in writing by ODFW prior to diversion of any water. The permittee may submit evidence in writing that ODFW has determined screens and/or by-pass devices are not necessary.

fishmay Notwithstanding that ODFW has made a determination that fish screens and/or by-pass devices are not necessary at the time of permit issuance, the permittee may be required in the future to install, maintain, and operate fish screening and by-pass devices to prevent fish from entering the proposed diversion and to provide adequate upstream and downstream passage for fish.

b52 Water may be diverted only when Department of Environmental Quality sediment standards are being met.

b5 The water user shall install and maintain adequate treatment facilities meeting current DEQ requirements to remove sediment before returning the water to the stream.

b51a The period of use has been limited to _____ through _____.

b57 Before water use may begin under this permit, a totalizing flow meter must be installed at each diversion point.

b58 Before water use may begin under this permit, a staff gage that measures the entire range and stage between full reservoir level dead pool storage must be installed in the reservoir. The staff gage shall be United States Geological Survey style porcelain enamel iron staff gage style A, C, E or I. Additionally, before water use may begin under this permit, if the reservoir is located in channel then weirs or other suitable measuring devices must be installed upstream and downstream of the reservoir, and, a gated valve outlet must be installed. A written waiver may be obtained from the local Watermaster if in his judgment the installation of the weir(s) will provide no public benefit.

futile call The use of water allowed herein may be made only at times when waters from the (NAME OF SURFACE WATER) would not otherwise flow into a tributary of the _____ River or sufficient water is available to satisfy all prior rights, including rights for maintaining instream flows.

riparian If the riparian area is disturbed in the process of developing a point of diversion, the permittee shall be responsible for restoration and enhancement of such riparian area in accordance with ODFW's Fish and Wildlife Habitat Mitigation Policy OAR 635-415. For purposes of mitigation, the ODFW Fish and Wildlife Habitat Mitigation Goals and Standards, OAR 635-415, shall be followed.

wq The use may be restricted if the quality of the source stream or downstream waters decrease to the point that those waters no longer meet existing state or federal water quality standards due to reduced flows.

fence The stream and its adjacent riparian area shall be fenced to exclude livestock.

bly Water must be diverted to a trough or tank through an enclosed water delivery system. The delivery system must be equipped with an automatic shutoff or limiting flow control mechanism or include a means for returning water to the stream source through an enclosed delivery system. The use of water shall not exceed 0.10 cubic feet per second per 1000 head of livestock.

STATE OF OREGON

CERTIFICATE OF WATER RIGHT

THIS CERTIFICATE ISSUED TO

Oregon Water Resources Department
158 12th Street NE
Salem, Oregon 97310

The specific limits for the use are listed below along with conditions of use.

Source: SANDY RIVER tributary to COLUMBIA RIVER

County: CLACKAMAS

Purpose: Providing stream flows for migration, spawning, egg incubation, fry emergence, and juvenile rearing.

To be maintained in:

SANDY RIVER FROM BULL RUN RIVER AT RIVER MILE 18.5 (NWNW, SECTION 31, TOWNSHIP 1S, RANGE 5E WM, CLACKAMAS COUNTY); TO THE MOUTH AT RIVER MILE 0.0 (SECTION 14, TOWNSHIP 1N, RANGE 3E WM, MULTNOMAH COUNTY)

The right is established under Oregon Revised Statutes 537.341.

The date of priority is 4/1/91.

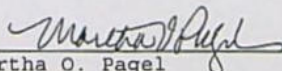
The following conditions apply to the use of water under this certificate:

1. The right is limited to not more than the amounts, in cubic feet per second, during the time periods listed below:

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1900	1900	2000	2000	2000	1400	800	400	500	650	1500	1500

2. The water right holder shall measure and report the in-stream flow along the reach of the stream or river described in the certificate as may be required by the standards for in-stream water right reporting of the Water Resources Commission.
3. For purposes of water distribution, this instream right shall not have priority over human or livestock consumption.
4. The instream flow allocated pursuant to this water right is not in addition to other instream flows created by a prior water right or designated minimum perennial stream flow.
5. The flows are to be measured at the lower end of the stream reach to protect necessary flows throughout the reach.

Witness the signature of the Water Resources Director,
affixed OCTOBER 18, 1996.


Martha O. Pagel

Recorded in State Record of Water Right Certificate number 73015.



Oregon Water Resources Department
Water Availability Analysis

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Water Availability Analysis

SANDY R > COLUMBIA R - AB ZIGZAG R
SANDY BASIN

Water Availability as of 1/17/2017

Exceedance Level: 50%

Time: 10:14 AM

Watershed ID #: 30300105 ([Map](#))

Date: 1/17/2017

[Download Data](#)

Water Availability

Select any Watershed for Details

Nesting Order	Watershed ID #	Stream Name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Sto
1	71480	SANDY R> COLUMBIA R- AT MOUTH	Yes	Yes	No	No	No	No	No	Yes	No	No	No	Yes	Yes
2	72145	SANDY R> COLUMBIA R- AB UNN STR	Yes	Yes	No	No	No	No	No	No	No	No	No	Yes	Yes
3	30300104	SANDY R> COLUMBIA R- AB BULL RUN R	Yes	Yes	No	No	No	No	No	No	No	No	No	Yes	Yes
4	30300106	SANDY R> COLUMBIA R- AB BADGER CR AT 14137000	Yes	Yes	No	No	No	No	No	No	No	No	No	Yes	Yes
5	71559	SANDY R> COLUMBIA R- AB SALMON R	Yes	Yes	No	No	No	No	No	No	No	No	No	Yes	Yes
6	30300105	SANDY R> COLUMBIA R- AB ZIGZAG R	Yes	Yes	No	No	No	No	No	No	No	No	No	Yes	Yes

Limiting Watersheds

Monthly Streamflow in Cubic Feet per Second
Annual Volume at 50% Exceedance in Acre-Feet

Month	Limiting Watershed ID #	Stream Name	Water Available?	Net Water Available
JAN	72145	SANDY R > COLUMBIA R - AB UNN STR	Yes	110.00
FEB	72145	SANDY R > COLUMBIA R - AB UNN STR	Yes	80.30
MAR	72145	SANDY R > COLUMBIA R - AB UNN STR	No	-299.00
APR	72145	SANDY R > COLUMBIA R - AB UNN STR	No	-89.50
MAY	72145	SANDY R > COLUMBIA R - AB UNN STR	No	-309.00
JUN	72145	SANDY R > COLUMBIA R - AB UNN STR	No	-639.00
JUL	72145	SANDY R > COLUMBIA R - AB UNN STR	No	-134.00

AUG	72145	SANDY R > COLUMBIA R - AB UNN STR	No	-109.00
SEP	72145	SANDY R > COLUMBIA R - AB UNN STR	No	-116.00
OCT	72145	SANDY R > COLUMBIA R - AB UNN STR	No	-241.00
NOV	72145	SANDY R > COLUMBIA R - AB UNN STR	No	-495.00
DEC	72145	SANDY R > COLUMBIA R - AB UNN STR	Yes	320.00
ANN	30300105	SANDY R > COLUMBIA R - AB ZIGZAG R	Yes	31,000.00

Detailed Reports for Watershed ID #71480

SANDY R > COLUMBIA R - AT MOUTH
SANDY BASIN

Water Availability as of 1/17/2017

Watershed ID #: 71480 ([Map](#))

Date: 1/17/2017

Exceedance Level: 50%

Time: 10:14 AM

Water Availability Calculation

Monthly Streamflow in Cubic Feet per Second
Annual Volume at 50% Exceedance in Acre-Feet

Month	Natural Stream Flow	Consumptive Uses and Storages	Expected Stream Flow	Reserved Stream Flow	Instream Flow Requirement	Net Water Available
JAN	3,190.00	1,100.00	2,090.00	0.00	1,900.00	188.00
FEB	3,130.00	1,080.00	2,050.00	0.00	1,900.00	148.00
MAR	2,760.00	991.00	1,770.00	0.00	2,000.00	-231.00
APR	3,120.00	1,150.00	1,970.00	0.00	2,000.00	-31.50
MAY	2,740.00	1,010.00	1,730.00	0.00	2,000.00	-272.00
JUN	1,620.00	532.00	1,090.00	0.00	1,400.00	-312.00
JUL	950.00	267.00	683.00	0.00	800.00	-117.00
AUG	633.00	183.00	450.00	0.00	400.00	50.40
SEP	682.00	230.00	452.00	0.00	500.00	-48.30
OCT	843.00	358.00	485.00	0.00	650.00	-165.00
NOV	2,210.00	978.00	1,230.00	0.00	1,500.00	-268.00
DEC	3,230.00	1,130.00	2,100.00	0.00	1,500.00	598.00
ANN	1,510,000.00	543,000.00	969,000.00	0.00	997,000.00	59,700.00

Detailed Report of Consumptive Uses and Storage

Consumptive Uses and Storages in Cubic Feet per Second

Month	Storage	Irrigation	Municipal	Industrial	Commercial	Domestic	Agricultural	Other	Total
JAN	1.07	0.00	1,090.00	1.38	0.00	5.26	0.04	0.00	1,100.00
FEB	0.96	0.00	1,070.00	1.38	0.00	5.26	0.04	0.00	1,080.00
MAR	0.13	0.04	984.00	1.38	0.00	5.26	0.04	0.00	991.00
APR	0.24	0.13	1,140.00	1.38	0.00	5.26	0.04	0.00	1,150.00
MAY	0.13	1.30	1,000.00	1.38	0.00	5.26	0.04	0.00	1,010.00
JUN	0.06	2.09	523.00	1.38	0.00	5.26	0.04	0.00	532.00
JUL	0.00	3.95	257.00	1.38	0.00	5.26	0.04	0.00	267.00
AUG	0.00	3.14	173.00	1.38	0.00	5.26	0.04	0.00	183.00
SEP	0.00	1.07	223.00	1.38	0.00	5.26	0.04	0.00	230.00
OCT	0.00	0.13	351.00	1.38	0.00	5.26	0.04	0.00	358.00
NOV	0.49	0.00	970.00	1.38	0.00	5.26	0.04	0.00	978.00
DEC	1.36	0.00	1,120.00	1.38	0.00	5.26	0.04	0.00	1,130.00

Detailed Report of Reservations for Storage and Consumptive Uses

Reserved Streamflow in Cubic Feet per Second

No reservations were found for this watershed.

Detailed Report of Instream Flow Requirements

Instream Flow Requirements in Cubic Feet per Second

Application #	Status	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
IS71480A	CERTIFICATE	1,900.00	1,900.00	2,000.00	2,000.00	2,000.00	1,400.00	800.00	400.00	500.00	650.00	1,500.00	1,500.00
Maximum		1,900.00	1,900.00	2,000.00	2,000.00	2,000.00	1,400.00	800.00	400.00	500.00	650.00	1,500.00	1,500.00

Detailed Reports for Watershed ID #72145

SANDY R > COLUMBIA R - AB UNN STR
SANDY BASIN

Water Availability as of 1/17/2017

Watershed ID #: 72145 ([Map](#))

Exceedance Level: 50%

Date: 1/17/2017

Time: 10:14 AM

Water Availability Calculation

Monthly Streamflow in Cubic Feet per Second
Annual Volume at 50% Exceedance in Acre-Feet

Month	Natural Stream Flow	Consumptive Uses and Storages	Expected Stream Flow	Reserved Stream Flow	Instream Flow Requirement	Net Water Available
JAN	3,110.00	1,100.00	2,010.00	0.00	1,900.00	110.00
FEB	3,060.00	1,080.00	1,980.00	0.00	1,900.00	80.30
MAR	2,690.00	989.00	1,700.00	0.00	2,000.00	-299.00
APR	3,060.00	1,150.00	1,910.00	0.00	2,000.00	-89.50
MAY	2,700.00	1,010.00	1,690.00	0.00	2,000.00	-309.00
JUN	1,590.00	529.00	1,060.00	0.00	1,700.00	-639.00
JUL	929.00	263.00	666.00	0.00	800.00	-134.00
AUG	620.00	179.00	441.00	0.00	550.00	-109.00
SEP	662.00	228.00	434.00	0.00	550.00	-116.00
OCT	815.00	356.00	459.00	0.00	700.00	-241.00
NOV	2,180.00	975.00	1,200.00	0.00	1,700.00	-495.00
DEC	3,150.00	1,130.00	2,020.00	0.00	1,700.00	320.00
ANN	1,480,000.00	541,000.00	938,000.00	0.00	1,050,000.00	31,000.00

Detailed Report of Consumptive Uses and Storage

Consumptive Uses and Storages in Cubic Feet per Second

Month	Storage	Irrigation	Municipal	Industrial	Commercial	Domestic	Agricultural	Other	Total
JAN	0.50	0.00	1,090.00	0.35	0.00	4.68	0.04	0.00	1,100.00
FEB	0.41	0.00	1,070.00	0.35	0.00	4.68	0.02	0.00	1,080.00
MAR	0.13	0.01	984.00	0.35	0.00	4.68	0.02	0.00	989.00
APR	0.24	0.05	1,140.00	0.35	0.00	4.68	0.02	0.00	1,150.00
MAY	0.13	0.52	1,000.00	0.35	0.00	4.68	0.02	0.00	1,010.00
JUN	0.06	0.83	523.00	0.35	0.00	4.68	0.02	0.00	529.00
JUL	0.00	1.57	256.00	0.35	0.00	4.68	0.02	0.00	263.00
AUG	0.00	1.25	173.00	0.35	0.00	4.68	0.02	0.00	179.00
SEP	0.00	0.42	222.00	0.35	0.00	4.68	0.02	0.00	228.00

OCT	0.00	0.05	351.00	0.35	0.00	4.68	0.02	0.00	356.00
NOV	0.13	0.00	970.00	0.35	0.00	4.68	0.02	0.00	975.00
DEC	0.70	0.00	1,120.00	0.35	0.00	4.68	0.02	0.00	1,130.00

Detailed Report of Reservations for Storage and Consumptive Uses

Reserved Streamflow in Cubic Feet per Second

No reservations were found for this watershed.

Detailed Report of Instream Flow Requirements

Instream Flow Requirements in Cubic Feet per Second

Application #	Status	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
SY90301A	SWW	1,900.00	1,900.00	2,000.00	2,000.00	2,000.00	1,700.00	800.00	550.00	550.00	700.00	1,700.00	1,700.00
IS72145A	CERTIFICATE	1,900.00	1,900.00	2,000.00	2,000.00	2,000.00	1,600.00	800.00	550.00	550.00	700.00	1,700.00	1,700.00
Maximum		1,900.00	1,900.00	2,000.00	2,000.00	2,000.00	1,700.00	800.00	550.00	550.00	700.00	1,700.00	1,700.00

Detailed Reports for Watershed ID #30300104

SANDY R > COLUMBIA R - AB BULL RUN R
SANDY BASIN

Water Availability as of 1/17/2017

Watershed ID #: 30300104 ([Map](#))

Date: 1/17/2017

Exceedance Level: 50%

Time: 10:14 AM

Water Availability Calculation

Monthly Streamflow in Cubic Feet per Second
Annual Volume at 50% Exceedance in Acre-Feet

Month	Natural Stream Flow	Consumptive Uses and Storages	Expected Stream Flow	Reserved Stream Flow	Instream Flow Requirement	Net Water Available
JAN	1,720.00	35.80	1,680.00	0.00	600.00	1,080.00

FEB	1,680.00	35.70	1,640.00	0.00	600.00	1,040.00
MAR	1,500.00	35.10	1,460.00	0.00	600.00	865.00
APR	1,770.00	35.10	1,730.00	0.00	600.00	1,130.00
MAY	1,680.00	35.30	1,640.00	0.00	600.00	1,040.00
JUN	1,030.00	35.50	995.00	0.00	600.00	395.00
JUL	608.00	35.90	572.00	0.00	600.00	-27.90
AUG	424.00	36.00	388.00	0.00	424.00	-36.00
SEP	406.00	35.40	371.00	0.00	406.00	-35.40
OCT	449.00	35.10	414.00	0.00	449.00	-35.10
NOV	1,190.00	35.50	1,150.00	0.00	600.00	555.00
DEC	1,740.00	35.90	1,700.00	0.00	600.00	1,100.00
ANN	855,000.00	25,800.00	829,000.00	0.00	403,000.00	434,000.00

Detailed Report of Consumptive Uses and Storage

Consumptive Uses and Storages in Cubic Feet per Second

Month	Storage	Irrigation	Municipal	Industrial	Commercial	Domestic	Agricultural	Other	Total
JAN	0.71	0.00	30.20	0.35	0.00	4.56	0.01	0.00	35.80
FEB	0.63	0.00	30.20	0.35	0.00	4.56	0.01	0.00	35.70
MAR	0.00	0.01	30.20	0.35	0.00	4.56	0.01	0.00	35.10
APR	0.00	0.02	30.20	0.35	0.00	4.56	0.01	0.00	35.10
MAY	0.00	0.22	30.20	0.35	0.00	4.56	0.01	0.00	35.30
JUN	0.00	0.35	30.20	0.35	0.00	4.56	0.01	0.00	35.50
JUL	0.00	0.67	30.40	0.35	0.00	4.56	0.01	0.00	35.90
AUG	0.00	0.53	30.50	0.35	0.00	4.56	0.01	0.00	36.00
SEP	0.00	0.18	30.40	0.35	0.00	4.56	0.01	0.00	35.40
OCT	0.00	0.02	30.20	0.35	0.00	4.56	0.01	0.00	35.10
NOV	0.37	0.00	30.20	0.35	0.00	4.56	0.01	0.00	35.50
DEC	0.77	0.00	30.20	0.35	0.00	4.56	0.01	0.00	35.90

Detailed Report of Reservations for Storage and Consumptive Uses

Reserved Streamflow in Cubic Feet per Second

No reservations were found for this watershed.

Detailed Report of Instream Flow Requirements

Instream Flow Requirements in Cubic Feet per Second

Application #	Status	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
SR389A	APPLICATION	600.00	600.00	600.00	600.00	600.00	600.00	600.00	424.00	406.00	449.00	600.00	600.00
Maximum		600.00	600.00	600.00	600.00	600.00	600.00	600.00	424.00	406.00	449.00	600.00	600.00

Detailed Reports for Watershed ID #30300106

SANDY R > COLUMBIA R - AB BADGER CR AT 14137000

SANDY BASIN

Water Availability as of 1/17/2017

Watershed ID #: 30300106 ([Map](#))

Date: 1/17/2017

Exceedance Level: 50%

Time: 10:14 AM

Water Availability Calculation

Monthly Streamflow in Cubic Feet per Second

Annual Volume at 50% Exceedance in Acre-Feet

Month	Natural Stream Flow	Consumptive Uses and Storages	Expected Stream Flow	Reserved Stream Flow	Instream Flow Requirement	Net Water Available
JAN	1,530.00	33.60	1,500.00	0.00	0.00	1,500.00
FEB	1,510.00	33.60	1,480.00	0.00	0.00	1,480.00
MAR	1,340.00	33.60	1,310.00	0.00	0.00	1,310.00
APR	1,630.00	33.60	1,600.00	0.00	0.00	1,600.00
MAY	1,590.00	33.70	1,560.00	0.00	0.00	1,560.00
JUN	990.00	33.70	956.00	0.00	0.00	956.00
JUL	588.00	33.90	554.00	0.00	0.00	554.00
AUG	415.00	34.10	381.00	0.00	0.00	381.00
SEP	391.00	33.80	357.00	0.00	0.00	357.00
OCT	424.00	33.60	390.00	0.00	0.00	390.00
NOV	1,100.00	33.60	1,070.00	0.00	0.00	1,070.00
DEC	1,550.00	33.60	1,520.00	0.00	0.00	1,520.00
ANN	787,000.00	24,400.00	762,000.00	0.00	0.00	762,000.00

Detailed Report of Consumptive Uses and Storage

Consumptive Uses and Storages in Cubic Feet per Second

Month	Storage	Irrigation	Municipal	Industrial	Commercial	Domestic	Agricultural	Other	Total
JAN	0.01	0.00	29.00	0.35	0.00	4.27	0.00	0.00	33.60
FEB	0.01	0.00	29.00	0.35	0.00	4.27	0.00	0.00	33.60
MAR	0.00	0.00	29.00	0.35	0.00	4.27	0.00	0.00	33.60
APR	0.00	0.00	29.00	0.35	0.00	4.27	0.00	0.00	33.60
MAY	0.00	0.05	29.00	0.35	0.00	4.27	0.00	0.00	33.70
JUN	0.00	0.08	29.00	0.35	0.00	4.27	0.00	0.00	33.70
JUL	0.00	0.16	29.20	0.35	0.00	4.27	0.00	0.00	33.90
AUG	0.00	0.13	29.30	0.35	0.00	4.27	0.00	0.00	34.10
SEP	0.00	0.04	29.20	0.35	0.00	4.27	0.00	0.00	33.80
OCT	0.00	0.00	29.00	0.35	0.00	4.27	0.00	0.00	33.60
NOV	0.00	0.00	29.00	0.35	0.00	4.27	0.00	0.00	33.60
DEC	0.03	0.00	29.00	0.35	0.00	4.27	0.00	0.00	33.60

Detailed Report of Reservations for Storage and Consumptive Uses

Reserved Streamflow in Cubic Feet per Second

No reservations were found for this watershed.

Detailed Report of Instream Flow Requirements

Instream Flow Requirements in Cubic Feet per Second

No instream flow requirements were found for this watershed.

Detailed Reports for Watershed ID #71559

SANDY R > COLUMBIA R - AB SALMON R
SANDY BASIN

Water Availability as of 1/17/2017

Watershed ID #: 71559 ([Map](#))

Date: 1/17/2017

Exceedance Level: 50%

Time: 10:14 AM

Water Availability Calculation

Monthly Streamflow in Cubic Feet per Second
Annual Volume at 50% Exceedance in Acre-Feet

Month	Natural Stream Flow	Consumptive Uses and Storages	Expected Stream Flow	Reserved Stream Flow	Instream Flow Requirement	Net Water Available
JAN	828.00	1.83	826.00	0.00	250.00	576.00
FEB	837.00	1.83	835.00	0.00	250.00	585.00
MAR	760.00	1.83	758.00	0.00	250.00	508.00
APR	898.00	1.84	896.00	0.00	250.00	646.00
MAY	882.00	1.91	880.00	0.00	250.00	630.00
JUN	615.00	1.96	613.00	0.00	200.00	413.00
JUL	396.00	2.23	394.00	0.00	150.00	244.00
AUG	297.00	2.18	295.00	0.00	100.00	195.00
SEP	278.00	2.05	276.00	0.00	250.00	25.90
OCT	284.00	1.84	282.00	0.00	250.00	32.20
NOV	570.00	1.83	568.00	0.00	250.00	318.00
DEC	864.00	1.84	862.00	0.00	250.00	612.00
ANN	452,000.00	1,400.00	451,000.00	0.00	163,000.00	288,000.00

Detailed Report of Consumptive Uses and Storage

Consumptive Uses and Storages in Cubic Feet per Second

Month	Storage	Irrigation	Municipal	Industrial	Commercial	Domestic	Agricultural	Other	Total
JAN	0.00	0.00	0.00	0.09	0.00	1.74	0.00	0.00	1.83
FEB	0.00	0.00	0.00	0.09	0.00	1.74	0.00	0.00	1.83
MAR	0.00	0.00	0.00	0.09	0.00	1.74	0.00	0.00	1.83
APR	0.00	0.01	0.00	0.09	0.00	1.74	0.00	0.00	1.84
MAY	0.00	0.08	0.00	0.09	0.00	1.74	0.00	0.00	1.91
JUN	0.00	0.13	0.00	0.09	0.00	1.74	0.00	0.00	1.96

JUL	0.00	0.25	0.15	0.09	0.00	1.74	0.00	0.00	2.23
AUG	0.00	0.20	0.15	0.09	0.00	1.74	0.00	0.00	2.18
SEP	0.00	0.07	0.15	0.09	0.00	1.74	0.00	0.00	2.05
OCT	0.00	0.01	0.00	0.09	0.00	1.74	0.00	0.00	1.84
NOV	0.00	0.00	0.00	0.09	0.00	1.74	0.00	0.00	1.83
DEC	0.01	0.00	0.00	0.09	0.00	1.74	0.00	0.00	1.84

Detailed Report of Reservations for Storage and Consumptive Uses

Reserved Streamflow in Cubic Feet per Second

No reservations were found for this watershed.

Detailed Report of Instream Flow Requirements

Instream Flow Requirements in Cubic Feet per Second

Application #	Status	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
IS71559A	CERTIFICATE	250.00	250.00	250.00	250.00	250.00	200.00	150.00	100.00	250.00	250.00	250.00	250.00
Maximum		250.00	250.00	250.00	250.00	250.00	200.00	150.00	100.00	250.00	250.00	250.00	250.00

Detailed Reports for Watershed ID #30300105

SANDY R > COLUMBIA R - AB ZIGZAG R

SANDY BASIN

Water Availability as of 1/17/2017

Watershed ID #: 30300105 ([Map](#))

Date: 1/17/2017

Exceedance Level: 50%

Time: 10:14 AM

Water Availability Calculation

Monthly Streamflow in Cubic Feet per Second

Annual Volume at 50% Exceedance in Acre-Feet

Month	Natural Stream Flow	Consumptive Uses and Storages	Expected Stream Flow	Reserved Stream Flow	Instream Flow Requirement	Net Water Available
JAN	395.00	0.16	395.00	0.00	0.00	395.00
FEB	402.00	0.16	402.00	0.00	0.00	402.00
MAR	325.00	0.16	325.00	0.00	0.00	325.00
APR	382.00	0.16	382.00	0.00	0.00	382.00
MAY	410.00	0.20	410.00	0.00	0.00	410.00
JUN	262.00	0.23	262.00	0.00	0.00	262.00
JUL	152.00	0.29	152.00	0.00	0.00	152.00
AUG	107.00	0.26	107.00	0.00	0.00	107.00
SEP	105.00	0.19	105.00	0.00	0.00	105.00
OCT	88.00	0.16	87.80	0.00	0.00	87.80
NOV	261.00	0.16	261.00	0.00	0.00	261.00
DEC	394.00	0.16	394.00	0.00	0.00	394.00
ANN	198,000.00	138.00	198,000.00	0.00	0.00	198,000.00

Detailed Report of Consumptive Uses and Storage

Consumptive Uses and Storages in Cubic Feet per Second

Month	Storage	Irrigation	Municipal	Industrial	Commercial	Domestic	Agricultural	Other	Total
JAN	0.00	0.00	0.00	0.00	0.00	0.16	0.00	0.00	0.16
FEB	0.00	0.00	0.00	0.00	0.00	0.16	0.00	0.00	0.16
MAR	0.00	0.00	0.00	0.00	0.00	0.16	0.00	0.00	0.16
APR	0.00	0.00	0.00	0.00	0.00	0.16	0.00	0.00	0.16
MAY	0.00	0.04	0.00	0.00	0.00	0.16	0.00	0.00	0.20
JUN	0.00	0.07	0.00	0.00	0.00	0.16	0.00	0.00	0.23
JUL	0.00	0.13	0.00	0.00	0.00	0.16	0.00	0.00	0.29
AUG	0.00	0.10	0.00	0.00	0.00	0.16	0.00	0.00	0.26
SEP	0.00	0.03	0.00	0.00	0.00	0.16	0.00	0.00	0.19
OCT	0.00	0.00	0.00	0.00	0.00	0.16	0.00	0.00	0.16
NOV	0.00	0.00	0.00	0.00	0.00	0.16	0.00	0.00	0.16
DEC	0.00	0.00	0.00	0.00	0.00	0.16	0.00	0.00	0.16

Detailed Report of Reservations for Storage and Consumptive Uses

Reserved Streamflow in Cubic Feet per Second

[Print Report](#)**Oregon Water Resources Department
Attribute Report**

Report Date: Jan 17, 2017

General:

TRSQQ:	WM2.00S7.00E13SWNE WM2.00S7.00E13SENW WM2.00S7.00E13NESW WM2.00S7.00E13NENW WM2.00S7.00E13SWNW WM2.00S7.00E13NWSW WM2.00S7.00E13NWNW WM2.00S7.00E13NWNE
DLC:	-
Latitude:	45.3994000000
Longitude:	-121.8948716614
Buffer (ft):	1320
Elevation (ft):	2339
Basin Name:	Sandy
Basin Plan:	2C (11)-Lower Willamette (Sandy)
County:	Clackamas
WM District:	20
WM Region:	NORTHWEST
ODFW Region, District:	Northwest Region, NWWD-Cascade Unit
Irrigation District AOI:	-
Irrigation District, Other:	-
Dams (Permit):	-
Water Rights:	Platcard for WM2.00S7.00E13 Platcard for WM2.00S7.00E13 Platcard for WM2.00S7.00E13 Platcard for WM2.00S7.00E13 Platcard for WM2.00S7.00E13 Platcard for WM2.00S7.00E13 Platcard for WM2.00S7.00E13 Platcard for WM2.00S7.00E13
Well Logs:	Logs for WM2.00S7.00E13 Logs for WM2.00S7.00E13 Logs for WM2.00S7.00E13 Logs for WM2.00S7.00E13 Logs for WM2.00S7.00E13 Logs for WM2.00S7.00E13 Logs for WM2.00S7.00E13 Logs for WM2.00S7.00E13

Rules:

Withdrawn Authority: SANDY RIVER , ORS 538.251 & 260 - Including tributaries, except for domestic, stock, municipal, fish culture, aesthetic, recreation, or public park purposes, and except for: (1) Beaver Creek and tributaries, (2) Buck Creek and tributaries, (3) tributary in N1/4, Section 10, T1S, R4E, (loc

Groundwater Retricted: -

GW Retricted Subunit: -

GW ODEQ Management Area: -

GW Umatilla Muni Wells (5mile): -

Rule 4D: Rules apply

Division 33 (Area, Watershed, species): LOWER COLUMBIA, Upper Sandy River, Coho Salmon, Chinook Salmon, Coastal Cutthroat Trout, Steelhead

Water Quality Limited Pollutant: Clear Creek
R. Mile: 0 to 7
HUC4: 17080001
Pollutant: Temperature
Season: NaN
Uses: Core cold water habitat
Status: Cat 4A: Water quality limited, TMDL approved
Action: No 2010 action

Clear Creek
R. Mile: 0 to 7
HUC4: 17080001
Pollutant: Habitat Modification
Season: NaN
Uses: Salmonid fish rearing; Salmonid fish spawning; Resident fish and aquatic life
Status: Water quality limited not needing a TMDL
Action: No 2010 action

Clear Creek
R. Mile: 0 to 7
HUC4: 17080001
Pollutant: Biological Criteria
Season: NaN
Uses: Aquatic life
Status: Cat 5: Water quality limited, 303(d) list, TMDL needed
Action: Status modification - EPA addition to 303(d) list

Is in Deschutes Study Area: -

Deschutes Zone Impact: -

Deschutes Zone Overlay: -

Scenic Water Way: Sandy River Scenic Waterway OAR 736-040-0075
Status: ABOVE

Hydrography:

OWRD Streamcode: 0312200160 - Clear Cr

General

Oregon Public Land Survey Quarter-quarters. Bureau of Land Management, Oregon Water Resources Department.. n.d. 1:24,000.

Donated Land Claims. Oregon Water Resources Department. January 1, 1995. 1:100,000.

Elevation. ESRI World Elevation. February 2000. 1:121,000.

OWRD Administrative Basins. Oregon Water Resources Department. January 1, 1995.

Oregon Counties. Bureau of Land Management (BLM), Oregon State Office.. January 1, 2008.

OWRD Watermaster Districts. Oregon Water Resources Department. March 31, 2014.

OWRD Regions. Oregon Water Resources Department. January 1, 1995.

ODFW Districts and Regions. Oregon Department of Fish and Wildlife. August 28, 2012.

Water Organizations Oregon Water Resources Department. April 1, 2013. 1:24,000.

Large Dams Inventory. Oregon Water Resources Department. August 12, 2014. 1:24,000.

Rules

Withdrawn Authority Areas. Oregon Water Resources Commission. January 1, 2007.

OWRD Groundwater Restricted Areas. Oregon Water Resources Department. October 5, 2016.

OWRD Groundwater Restricted Areas - Subunits. Oregon Water Resources Department. April 1, 2009.

ODEQ Groundwater Management Areas (GWMAs). Oregon Department of Environmental Quality. April 21, 2008.

Groundwater Umatilla Municipal Wells 5-mile buffer. Oregon Water Resources Department. June 28, 2012.

National Marine Fisheries Service (NMFS) 4(d) Rule. National Marine Fisheries Service. January 1, 2007.

OAR Chapter 690, Division 33 - HUC 10 . Oregon Department of Fish & Wildlife. January 1, 2003.

Oregon Water Quality Assessment 2010. This data set was assembled by the Oregon Department of Environmental Quality, Water Quality Division, Standards and Assessments Section. GIS data prepared by the Watershed Management Section, Drinking Water Program.. August 16, 2013.

Deschutes USGS Groundwater Study Area. Water Resources Commission, U.S. Geological Survey (USGS) Water Resources Division (Portland, OR), Oregon Water Resources Department.. January 1, 2001. 1:100,000.

Deschutes Zones of Impact. Oregon Water Resources Department.. October 25, 2007.

Deschutes Zones Overlay. Oregon Water Resources Department. October 25, 2007.

Oregon State Scenic Waterway areas. Oregon Water Resources Department, Oregon Parks and Recreation Department.. January 1, 2007.

Hydrography

Routed OWRD Streamcodes (conflated to the NHD). Oregon Water Resources Dept.. August 11, 2014.

. Unknown. n.d.

Watershed Boundary Dataset (WBD), 10-digit (watershed). Pacific Northwest Hydrography Framework, U.S. Geological Survey (USGS), National Resources Conservation Service (NRCS).. June 11, 2014. 1:24,000.

Water Availability Basins. Oregon Water Resources Department.. n.d. 1:100,000.

Priority Watersheds for Streamflow Restoration. Oregon Water Resources Dept. and the Oregon Dept. of Fish & Wildlife.. January 15, 2004.

Stream Gage Stations. Oregon Water Resources Department and US Geological Survey. n.d.

[close](#)

[Print Report](#)

Instream Water Right Application Completeness Checklist

Minimum Requirements OAR 690-077-0020

Application 15-88355 County Clackamas Priority Date 1/16/17

Township 2S Range 7E Section 13

Amount 6-45 cfs Use Fish life, wildlife WM Dist. #

Agency (ies) Applying ODFW

Caseworker Assigned: ☐ Barbe ☒ Craig ☐ Kim ☐ Lisa ☐ Scott

- ☒ Contact info: Name(s) and address(es) of the agency(ies) applying (OAR 690-077-0020(4)(a));
- ☒ Public uses that will be served by the requested instream water right and the flows necessary to support the public uses (OAR 690-077-0020(4)(b));
- ☒ River, stream, or lake name (OAR 690-077-0020(4)(c));
- ☒ If a stream, the reach delineated by river mile and stream to which it is tributary (OAR 690-077-0020(4)(d));
- ☒ The appropriate section of a Department basin map with the applicable lake or stream identified (OAR 690-077-0020(4)(e));
- ☒ The instream flow requested by month and year in cubic feet per second or acre-feet or lake elevation (OAR 690-077-0020(4)(f));
- ☒ A description of the technical data and methods used to determine the requested amounts (OAR 690-077-0020(4)(g));
- ☒ Evidence of notification of other qualified applicant agencies (OAR 690-077-0020(4)(h));
- ☒ If a multi-agency request, the amounts and times requested for each category of public use (OAR 690-077-0020(4)(i));
- ☒ Identification of affected local governments (pursuant to OAR 690-077-0010) and copies of letters notifying each affected local government of the intent to file the instream water right application (OAR 690-077-0020(4)(j));
- ☐ Written documentation of how the agency applying for an instream water right has complied with the requirements contained in its own administrative rules for instream water rights including application of the required methods to determine the requested flows (OAR 690-077-0020(4)(k));
- ☒ Any other information required in the application form that is necessary to evaluate the application in accordance with applicable statutory requirements (OAR 690-077-0020(4)(l))

Does the applicant:

- ☐ propose a means and location for measuring the instream water right; (OAR 690-077-0020(5)(a))
- ☐ propose a strategy and responsibility for monitoring flows for the instream right; (OAR 690-077-0020(5)(b))
- ☐ Identify any provisions needed for managing the water right to protect the public uses; (OAR 690-077-0020(5)(c))

-Don't address 635-400-0020
02635-400-0030 -

Instream Water Right Application Completeness Checklist

Minimum Requirements OAR 690-077-0020

HA If this is a request for an instream water right to be supplied from stored water, does it identify the reservoir and have documentary evidence that an agreement has been entered into with the owners of the reservoir for a sufficient interest in the reservoir to impound enough water for the purposes set forth in the request. (OAR 690-077-0020(6));

- ☐ Yes
- ☐ No

Reviewed by: B. Craig Kohonek Date: 1/16/2016

S:\groups\wr\instream - state agency\Application checklist



Oregon Water Resources Department
725 Summer Street NE, Suite A
Salem OR 97301-1266
503-986-0900
www.oregon.gov/owrd

Application for Instream Water Right Certificate

SECTION 1: ORGANIZATION INFORMATION AND SIGNATURE

Organization Information

NAME OREGON DEPT. OF FISH AND WILDLIFE		PHONE 503-947-6000	FAX 503-947-6202
ADDRESS 4034 FAIRVIEW INDUSTRIAL DR. SE			CELL
CITY SALEM	STATE OR	ZIP 97302-1142	E-MAIL *

Agent Information — The agent is authorized to represent the applicant in all matters relating to this application.

AGENT / BUSINESS NAME ANNA PAKENHAM STEVENSON / OREGON DEPT. OF FISH AND WILDLIFE		PHONE 503-947-6084	FAX 503-947-6202
ADDRESS 4034 FAIRVIEW INDUSTRIAL DR. SE			CELL
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* By providing an e-mail address, consent is given to receive all correspondence from the Department electronically. (Note that paper copies of the Final Order documents will also be mailed.)

Applicant Signature

Anna Pakenham Stevenson
Water Program Manager
Print Name and Title

January 13, 2017
Date

Applicant Signature

Print Name and Title

Date

SECTION 2: NOTIFICATION TO DEQ, ODFW, AND PARKS

Please indicate the date you notified other state agencies of your intent to file an instream water right application.

Oregon Department of Environmental Quality was notified on: December 7 2016

Oregon Department of Fish and Wildlife was notified on: N/A

Oregon Parks and Recreation Department was notified on: December 7 2016

SECTION 3: NOTIFICATION TO AFFECTED LOCAL GOVERNMENTS

☒ Please provide copies of letters of your intent to file an instream water right application to each affected local government within whose jurisdiction the instream use is proposed. Affected local government means any city, county or metropolitan service district formed under ORS Chapter 268 or an association of local governments performing land-use planning functions under ORS 197.190.

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SECTION 4: SOURCE AND REACH

Stream or lake name: Clear Creek

Tributary to: Sandy River

If the source is a stream, indicate the reach delineated by river mile (the upstream point to the downstream point) of the proposed instream water right:

In Clear Creek, tributary to the Sandy River, beginning at the mouth, river mile 0.0 in the SWNW quarter of Section 34, Township 2 S, Range 7 E W.M. in Clackamas County (45.3558, -121.9391) and continuing upstream to river mile 4.3 in the SENW quarter of Section 13, Township 2 S, Range 7 E W.M. in Clackamas County (45.3994, -121.8947).

If the source is stored water that is authorized under a water right permit, certificate, or decree, attach a copy of the document or list the document number (for decrees, list the volume and page, or decree name). _____

☐ If the source is stored water and you do not, or will not, own the reservoir(s), please enclose a copy of your written agreement with the owner of the reservoir to release flows identified in this application.

SECTION 5: PUBLIC USES AND AMOUNTS

The public uses to be served by the requested instream water right are: For the conservation, maintenance and enhancement of aquatic and fish life, wildlife, and fish and wildlife habitat. Applied flows include water for fish and wildlife migration, spawning, nesting, brooding, egg incubation, larval or juvenile development, juvenile and adult rearing and aquatic life. Flow levels will vary based on life cycle and life stage development needs.

The monthly (or half-monthly) flows in cubic feet-per-second (CFS) or acre-feet (AF) or by lake elevation (LE) necessary to support the public uses are:

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Unit
45	45	45	45	45	45	30	8/6	6	6/45	45	45	CFS

If this is a multi-agency request, please indicate the monthly (or half-monthly) flows in cubic feet-per-second (cfs) or acre-feet (af) or by lake elevation (le) that are necessary to support the public uses for each category of public use.

USE	J	F	M	A	M	J	J	A	S	O	N	D	
													☐ CFS ☐ AF ☐ LE
													☐ CFS ☐ AF ☐ LE

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SECTION 6: DATA, METHODS, AND COMPLIANCE

Please describe the technical data and methods used to determine the requested amounts.

The Oregon Method (Thompson 1972) was used in the Basin Investigations to develop flow recommendations. The Oregon Method is a habitat based method that determines the degree of habitat at different streamflow rates and life stages. It requires repeated measurements at different flows. The criteria cover fish spawning, adult migration, and rearing habitat. The desired flow levels are determined by examining flow vs. habitat at different flow levels. Methods for assessing flow needs for spawning, rearing and passage were described by Thompson (1972) as follows:

-Spawning and incubation flows were based on transect measurements with species-specific depth, velocity, and substrate criteria. Repeated measurements over a range of flows were used to develop a relationship of total spawning area vs. discharge. In the case of Clear Creek and other streams draining the Cascades with headwaters above the snow zone, streams are colder than average and tend to have late-spawning steelhead. Based on recent data from OASIS (Jacobsen et al. 2015), about 20% of the spawning in the Sandy and Clackamas basins occurs in late April and into May. In the cold water, eggs will be in the gravel for 100-120 days, at least through July. For this reason, we have extended the BIR 45 cfs spawning/incubation flow through June, to protect eggs in the gravel, and we have extended the BIR transition flow of 30 cfs through July.

-Rearing flows were based on repeated measurements, over a range of flows, of the following parameters: adequate depth over key riffles, riffle-pool ratio (i.e. sufficient connectivity between pools), average riffle and pool depths and velocities, and availability of instream cover.

-Passage flows were based on repeated depth measurements at transects across the shallowest riffles judged most likely to impede upstream migration of adult salmonids. Passage criteria were based on the percentage of adequate depth along the transects as a function of discharge.

Please provide written documentation of how your agency complied with the requirements contained in your own administrative rules for instream water rights, including application of the required methods to determine requested flows.

ODFW followed all procedures laid out in the agency's 635-400-0015 rules- Determination of Instream Flow Measurement Methodologies. Specifically, the Basin Investigation Report (BIR) flows for this instream flow recommendation were based on 'The Oregon Method', an approved method for determining an instream flow requirement. The BIR identifies fish and wildlife resources of the basin, their distribution, limiting factors, harvest, and water requirements. Stream flow recommendations of the BIR are specifically designed to meet the seasonal biological requirements of the basin's fish. These BIR flow recommendations were used in this instream water right application (see attached BIR: "Lower Willamette Basin" Appendix I page 2).

ODFW will also coordinate with OWRD instream water rights monitoring (635-400-0025). Specifically, ODFW will coordinate with OWRD to develop monitoring plans for instream water rights and to revise the existing Memorandum of Understanding between the Department and WRD to include issues related to instream water rights, such as measuring, monitoring and enforcement of instream water rights.

References:

Jacobsen R., J. Nott, E. Brown, M. Weeber and M. Lewis. 2015. Assessment of Western Oregon Adult Winter Steelhead and Lamprey - Redd Surveys 2015. Monitoring Program Report Number OPSWODFW-2015-09. Oregon Department of Fish and Wildlife, Salem, Oregon.

Thompson, K.E., 1972. Determining stream flows for fish life. Pages 31-50 plus appendices in Proceedings of the Instream Flow Requirement Workshop, March 15-16, 1972, Portland, Oregon. Pacific Northwest River Basins Commission.

SECTION 7: WITHIN A DISTRICT

If the reach is located within an irrigation district or other water district, please provide their contact information.

Irrigation District Name None	Address	
City	State	Zip

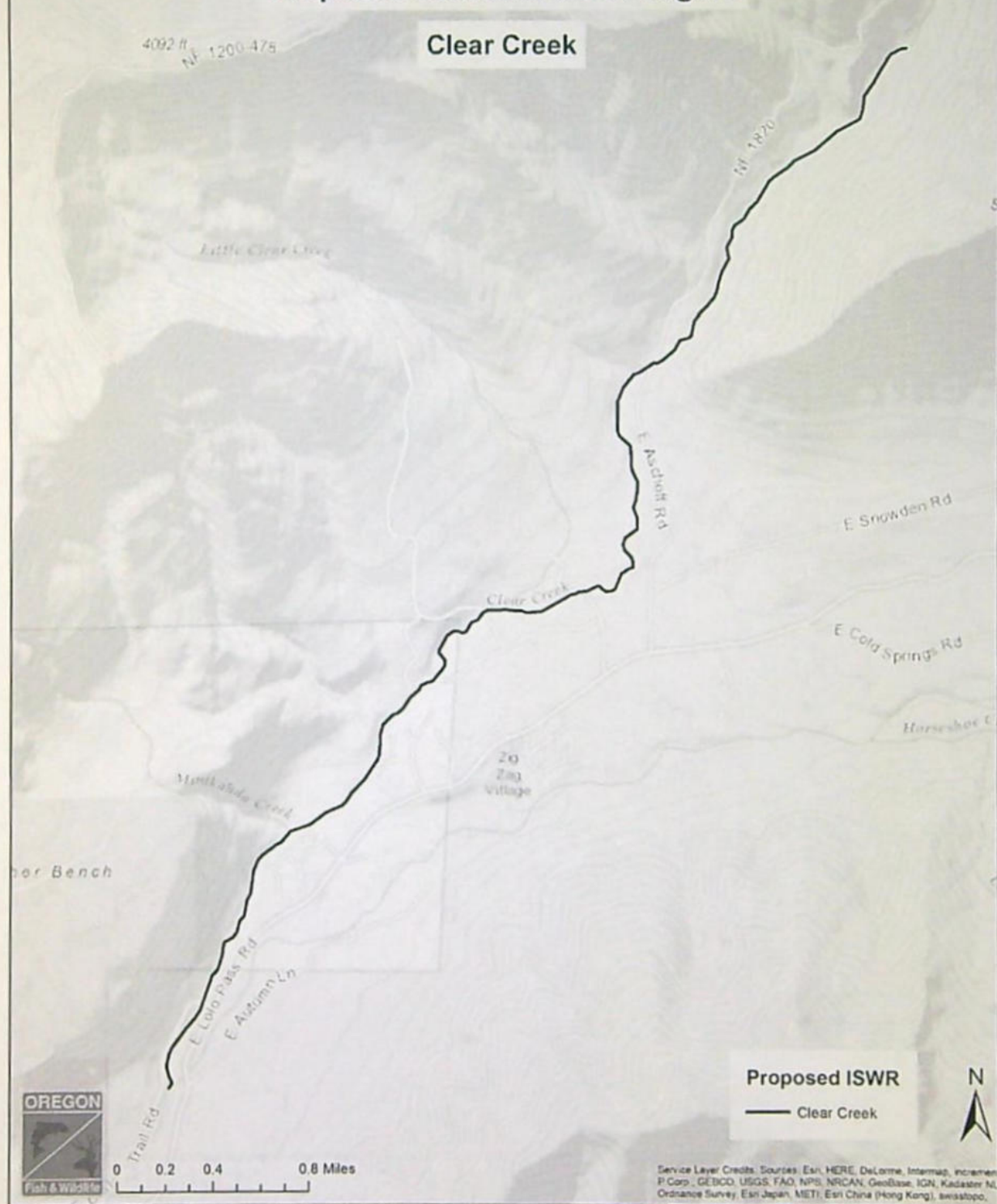
SECTION 8: REMARKS

Use this space to clarify any information you have provided in the application. _____

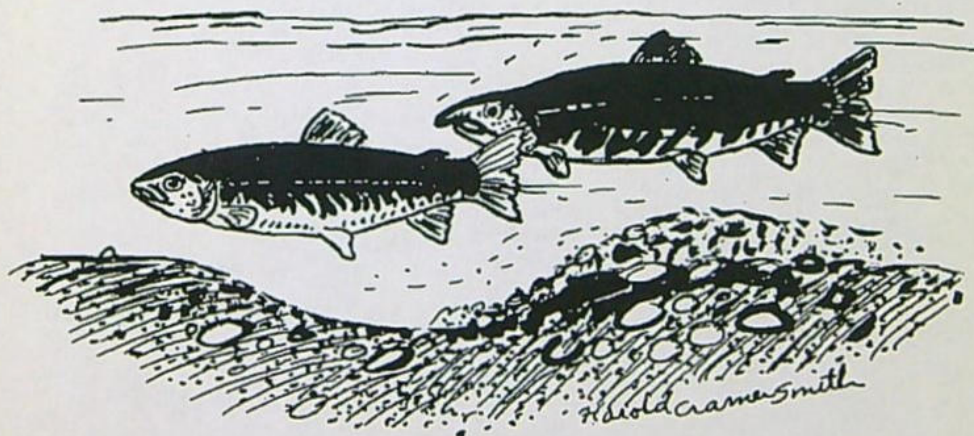
SECTION 9: MAP

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Sandy River Watershed Proposed Instream Water Rights



Basin Investigations



LOWER WILLAMETTE BASIN

OREGON STATE GAME COMMISSION

1634 S. W. Alder Street
P. O. Box 3503
Portland, Oregon 97208

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THE FISH AND WILDLIFE RESOURCES OF THE
LOWER WILLAMETTE BASIN, OREGON, AND
THEIR WATER USE REQUIREMENTS

A Report with Recommendations to the
OREGON STATE WATER RESOURCES BOARD

By

James M. Hutchison
Aquatic Biologist
Survey Crew Leader

and

Warren W. Aney
Game Biologist

OREGON STATE GAME COMMISSION
Basin Investigations Section

FEDERAL AID TO FISH RESTORATION
Progress Report

Fisheries Stream Flow Requirements
Project F-69-R-1, Job Number 2

Portland, Oregon
June 1964

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2. Distribution of Silver Salmon, Lower Willamette Basin
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INTRODUCTION

The Oregon State Game Commission's Basin Investigations Section began study in the Lower Willamette Basin relevant to this report in the spring of 1962. Most intensive field work was conducted in 1963. Primary objectives were to define water problems and needs associated with the basin's fish and wildlife resources and to submit findings and recommendations to the State Water Resources Board. This will enable the Board to give consideration to these needs along with other beneficial water uses when developing a comprehensive program for the area.

Results of the study are contained in this report. A similar report concerning the fish and wildlife resources of the Middle Willamette Basin was completed in February 1963. Study will continue in the Upper Willamette Basin in 1964 to provide complete coverage of the Willamette system.

Resumes of the resources--including abundance, distribution and value of various species--tabulations of data, and explanations of methods employed in the field studies are contained. One of the most important inclusions is the list of recommended minimum stream flows for fish production found in Appendix I.

Field surveys were conducted primarily by James M. Hutchison, Gary M. Hewitt and Wernald H. Christianson, Aquatic Biologists, and Ronald J. Sloan, Student Trainee. Personnel of the Fish Commission of Oregon, State Sanitary Authority, State Water Resources Board and U. S. Geological Survey cooperated with the development of some study aspects.

FISH RESOURCES OF THE LOWER WILLAMETTE BASIN

WILLAMETTE RIVER

Species Occurrence and Distribution

The most common anadromous fish entering the Willamette River are spring chinook and coho (silver) salmon, steelhead trout and shad. Accurate population calculations are available only for spring chinook, although substantial numbers of the other

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three species are known to exist.

Numbers of spring chinook entering the river each year are determined by Oregon Fish Commission counts at the Willamette Falls ladder, a cooperative analysis by the Oregon Fish Commission and Oregon Game Commission of the sport catch, and estimation of escapement into the Clackamas River. Since calculations of total chinook migration began in 1946, runs have been relatively uniform with the 48,100 fish total in 1963 being close to the 50,300 fish 18-year average (Hasselman and Stout, 1964). These data are presented in Table 1.

Willamette Falls ladder counts are not conducted during the major portions of adult coho (silver) salmon and steelhead trout migrations; consequently, it is difficult to determine sizes of these runs. Observations of sport catches and spawning of the two species indicate that numbers of each in the Willamette system above the falls are somewhat below those of spring chinook.

The size and timing of salmon and steelhead runs are closely associated with water quality of the lower Willamette River and passage of adults over Willamette Falls. Degree of successful passage of juvenile downstream migrants through several turbines at the falls also affects numbers of returning fish. These factors will be discussed in more detail later in this report.

Fall chinook salmon and sea-run cutthroat trout also enter the river, but knowledge is limited regarding distributions or sizes of these populations. Most or all of the fall chinook go into the Clackamas River.

Large numbers of shad are found in the lower river each spring, particularly in the section immediately below Willamette Falls. None are known to ascend the falls, although some may do so.

Despite poor summer water qualities, high populations of rough fish and warm-water game fish exist in the Willamette River both above and below the falls. Trap nets placed in the Portland harbor in the summer of 1961 by Game Commission and State Sanitary Authority personnel caught shad, white sturgeon, brown bullhead,

TABLE 1

Escapement and Sport Catch of Willamette River
Spring Chinook Salmon, 1946-1963

Year	Willamette Falls Escapement (calculated)	Clackamas R. Escapement (estimated)	Sport Catch Below Willamette Falls	Total Run (calculated)	Sport Catch as Per Cent of Run
1946	53,000	3,000	12,600	68,600	18
1947	45,000	2,000	12,000	59,000	20
1948	30,000	1,800	8,500	40,100	21
1949	27,000	1,800	9,100	37,900	24
1950	14,500	1,500	8,800	24,800	35
1951	34,300	2,000	13,300	49,600	27
1952	52,200	2,800	12,500	67,500	19
1953	76,400	4,000	16,400	96,800	17
1954	31,100	1,800	11,500	44,400	26
1955	22,000	1,500	9,000	32,500	28
1956	58,600	3,000	16,000	77,600	21
1957	39,300	2,000	11,500	52,800	22
1958	45,200	2,100	15,500	62,800	25
1959	31,900	3,000	18,500	53,400	35
1960	14,400	1,800	8,000	24,200	33
1961	18,900	2,200	6,400	27,500	23
1962	26,000	3,000	9,100	38,200	24
1963	30,300	4,000	13,600	48,100	28
Average	36,000	2,400	11,800	50,300	24

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TABLE 2

A Comparison of Willamette River Spring Chinook Salmon
Sport Fishery Data, 1946-1963

Year	Angling Intensity in Man Days	Average Catch per Day	Angling Effort per Salmon in Days	Average Fish Weight in Pounds
1946	61,900	0.20	5.0	17.0
1947	91,900	0.12	8.3	16.3
1948	83,600	0.10	10.0	16.5
1949	85,500	0.11	9.4	18.2
1950	73,400	0.12	8.3	16.6
1951	92,600	0.14	7.0	17.2
1952	91,100	0.13	7.7	16.8
1953	102,800	0.16	6.3	18.6
1954	104,100	0.11	9.2	18.6
1955	77,700	0.12	8.6	15.9
1956	84,100	0.19	5.3	18.4
1957	95,500	0.12	8.3	16.1
1958	137,900	0.11	8.9	18.2
1959	134,100	0.14	7.2	19.1
1960	92,300	0.09	11.6	16.4
1961	75,100	0.09	11.7	15.6
1962	74,000	0.12	8.1	16.8
1963	84,800	0.16	6.2	19.0
Average	91,244	0.13	7.7	17.3

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black crappie, white crappie, yellow perch, bluegill sunfish, warmouth bass, carp, chiselmouth, squawfish, Columbia River chub, coarsescale sucker, and Pacific lamprey. Most of these species and others also exist in the river above the falls. Table 3 lists fish species and their general distributions in the basin.

Angler Effort and Catch

Heaviest sport angling pressure in the lower Willamette River is exerted upon spring chinook salmon. This fishery takes place almost entirely below Willamette Falls, extending from a dead line below the falls to the river's mouth and throughout Multnomah Channel (Willamette Slough). It is the most concentrated inland salmon fishery and receives more chinook angling pressure than any Oregon river, with the possible exception of the Columbia.

Angling for this fish is conducted primarily from boats. Some bank angling occurs at the mouth of the Clackamas River and at the Black Point just below Willamette Falls. Most fishing takes place in the months of March, April and May, just before and during the period of heaviest upstream migration.

This is the only Willamette River fishery for which total catch calculations are made. Census of the fishery was initiated in 1941 and 1942 by the U. S. Fish and Wildlife Service and resumed in 1946 as a joint study by the Oregon Game and Fish Commissions. The present method consists of obtaining an estimate of the salmon catch per boat per day multiplied by the number of boats fishing each day during the entire season. Basic data are obtained from airplane counts of boats fishing on various days throughout the season and catch records from cooperating moorage operators. For the 18-year period beginning in 1946, anglers have caught an average of 11,800 spring chinook annually and have required 7.7 days of effort to catch each salmon. Tables 1 and 2 include effort and catch figures.

Coho salmon and steelhead trout angling is concentrated mainly just below Willamette Falls and at the mouth of the Clackamas River. Both boat and bank

TABLE 3

Known Fish Species Present and Their Distribution in the
Lower Willamette Basin

Species	Abb. ^{1/}	General Distribution
<u>Catfish</u> ^{2/}		All introduced.
Black bullhead	B1B	Introduced into main stem Columbia, possibly other streams.
Brown bullhead	BrB	Very common in most lowland lakes and streams.
Channel catfish	CC	Introduced into Columbia and Willamette main stems.
Yellow bullhead	YB	Planted locally; abundant in Willamette Valley.
<u>Lamprey</u> (2 species)	L	Most streams; spawn in similar areas as do steelhead
<u>Minnows</u>		
Carp	Cp	Introduced. Common in most lowland lakes, streams.
Chiselmouth	C1m	Lowland streams and sloughs.
Columbia River chub	CRC	Main stem Columbia and Willamette; possibly lower Tualatin.
Goldfish	GF	Introduced. Scattered throughout basin.
Oregon chub	OC	Main stem Willamette; possibly lower Tualatin.
Redside shiner	RsS	Very common in lowland streams; extending into some higher streams.
Squawfish	Sq	Common in many lowland lakes and streams.
Tench	T	Introduced. Columbia main stem; probably lower Willamette.
<u>Perch</u>		
Yellow perch ^{2/}	YP	Introduced into many lowland lakes and streams.
<u>Salmonids</u> ^{2/}		
Brook trout	EB	Introduced. High lakes and streams (see App. III).
Brown trout	Br	Introduced. Harriet Lake; a few in upper Clackamas and Sandy systems.
Chinook salmon, fall	ChF	Lower Clackamas, Sandy and Scappoose systems, Tanner Creek.
Chinook salmon, spring	ChS	See Plate 3.
Chum salmon	CS	Columbia River; possibly Beaver Cr. (Sandy R.), Milton Cr. and Tanner Cr.
Cutthroat trout, coastal	Ct	Most streams in basin.
Cutthroat trout, spotted	SCt	Introduced. A few high lakes.
Dolly Varden trout	DV	A few in upper Clackamas and Sandy systems.
Golden trout	GT	Introduced. A few high lakes (see Appendix III).
Kokanee salmon	K	Introduced. A few lakes (see Appendix III).
Pink salmon	PS	Columbia River.
Rainbow trout	Rb	Planted in many streams and lakes (see Appendix III)
Silver salmon	Sl	See Plate 2.
Steelhead	St	See Plate 1.
Whitefish	Wf	Many lakes and streams of cooler temperature.

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Table 3 (continued)

Species	Abb.	General Distribution
<u>Sculpins</u> (cottids)	Cot	Very common in all streams and some lakes.
<u>Shad</u> ^{2/}	Sh	Introduced. Main stem Columbia, lower Sandy and Willamette Rivers.
<u>Smelt</u> , Columbia River	Sm	Main stem Columbia, lower Sandy River.
<u>Stickleback</u> , three-spined	Skb	Many lowland streams and lakes.
<u>Sturgeon</u> (2 species) ^{2/}	Sg	Main stem Columbia and Willamette Rivers.
<u>Suckers</u> (2 species)	Su	Most lowland lakes and streams; up some rivers.
<u>Sunfish</u> ^{2/}		All introduced.
Bass, largemouth	LB	Most lowland waterways.
Bass, smallmouth	SB	Main stem Columbia and Willamette; possibly other waters.
Bluegill sunfish	BG	Most lowland waterways.
Crappie, black	BC	" " "
Crappie, white	WC	" " "
Green sunfish	GS	Known only in Blue Lake, May spread to other waters.
Pumpkinseed	PK	Many lowland waterways.
Warmouth bass	Wm	" " "
<u>Troutperch</u>	TP	Most lowland streams.

^{1/} Abbreviations used in other tables.

^{2/} Species defined as "game fish" in 1963-64 Oregon Game Code.

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methods are popular. Fishing pressure as compared to the spring chinook fishery is moderate. Coho salmon angling occurs primarily in November and December, and steelhead angling from December until the beginning of spring chinook season.

Moderate to heavy shad fishing exists in the river directly below Willamette Falls in May, June and July. This fishery is gaining in popularity, a trend that will continue if present high shad numbers endure.

Angling for sturgeon is light to moderate in the river throughout the basin. It is conducted during much of the year, with heaviest pressure in spring months. Most fishing occurs at Oregon City. There, sturgeon anglers may frequently be seen fishing from the railing alongside Highway 99E near the center of town.

Warm-water game fish bear considerable angling pressure. This can be attributed both to substantial fish numbers and to proximity of the lower river to the state's largest population center. Excluding the Sauvie Island area, which will be discussed in the Columbia Subbasin section, the river above Willamette Falls experiences the greater fishing pressure.

Commercial fishing is not presently permitted for salmonids in any basin stream except the Columbia River. Sport and commercial fishing for anadromous species is extensive in the portion of the Columbia River encompassed by the Lower Willamette Basin boundaries.

Factors Influencing the Resource

Willamette Falls Passage Problems Willamette Falls is located in the Willamette River near Oregon City at river mile 26.8.^{1/} Its height varies radically with changes in river flow and from tailwater fluctuations caused by backwater from the Columbia River.

Problems exist at the falls which affect successful upstream and downstream passage of anadromous fish. The falls created an obstacle to adult salmon and steelhead trout even before man began alterations there in the nineteenth century.

^{1/} Stream miles referred to in this report were obtained from State Water Resources Board Map No. 2C.8.

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Installation of turbines for power generation added injuries and mortalities of downstream migrant fish.

Improvement of both upstream and downstream fish passage and protective facilities is presently needed. Preliminary studies were completed on evaluation of existing upstream passage facilities at the falls, including recommendations for improvements, in 1960 for the Oregon Fish Commission (Holmes and Bell, 1960). A study to investigate engineering considerations relating to improved passage of downstream migrant fish was made for the Oregon Game Commission in 1962 (Cornell and others, 1962). It is expected that these two studies will form sound basis for realization of needed corrective measures.

Provision of upstream passage facilities at the falls began about 1885. The present ladder, located near the center of the falls, was built in 1904. Since then several alterations have been made; however, it remains largely inadequate. During periods of high river flow excessive water velocities in the fishway prevent fish passage. Conversely, during low flow periods the water is diverted to turbines, causing inadequate volumes to pass over the falls to attract fish to the fishway entrances (Holmes and Bell, 1960).

Most of the turbines discharge a short distance below the falls into a bay-like area on the west bank known as the "Cul-de-sac". High numbers of fish are attracted into this blind alley by this large water volume, compounding the difficulties encountered by fish in finding the ladder entrances.

Another hazard is created by certain water conditions associated with a large pothole known as the "Wet Hole". This deep, natural depression is situated near the base of the falls along the east bank. When the lower river level recedes below the rim of the hole, adult chinook frequently are trapped, unable to escape unless they are salvaged or tailwater level rises again.

Downstream migrants have difficulty in achieving safe passage past the falls because a major portion of the river flow passes through the power turbines during

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times of downstream migration. The Oregon Game Commission conducted studies at the falls in 1960 and 1961 to determine injuries and mortalities suffered by downstream migrants passing through the turbines of Crown Zellerbach Corporation, Portland General Electric Company and Publishers' Paper Company. Results revealed that the percentage of mortality experienced varied with each installation and operating condition. All three installations tested produced definite mortalities and injuries. Kills ranged from 7.7 to 100 per cent of the fish which passed through them.

Water Quality Pollution influencing fish and other aquatic organisms is more critical in the Willamette River than in any other large Oregon stream. Sources are most numerous in the river area from Willamette Falls to the mouth, although several important pollutant contributors exist in the river system above the falls. Cumulative effect of pollution becomes progressively more acute toward the mouth.

The most detrimental effect of Willamette River pollution upon fish is the lowering of the water's dissolved oxygen content. This is the oxygen utilized by fish in respiration. Dissolved oxygen concentration of five parts per million is considered minimal for proper survival of salmonids.

Dissolved oxygen concentrations less than five parts per million occur for extensive periods each year. The most prolonged periods occur in the Portland harbor where below minimal concentrations extend through most of July, August and September--often from June into October. These low levels not only influence health and survival of fish, but also limit or delay entry of anadromous fish, particularly coho salmon, into the river system. Vast potentials for such species as summer steelhead and fall chinook exist in streams of the Willamette drainage. Successful introduction of such fish will not be possible, however, without further pollution abatement.

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The State Sanitary Authority maintains an active program in monitoring river quality, recommending pollution control measures and enforcing water pollution laws. This agency is working toward eventual maintenance of a minimum of five parts per million dissolved oxygen in the lower Willamette River. Minimum dissolved oxygen values measured in the Portland harbor by the State Sanitary Authority since 1953 are given in Table 4.

TABLE 4

Monthly Averages of Lowest Dissolved Oxygen Values
Expressed in Parts per Million, Recorded in Portland Harbor ^{1/}

Year	June	July	August	September	October
1953	- -	2.7 (2.0)	1.5 (0.7)	1.9 (0.9)	5.1 (3.2)
1954	6.7 (6.7) ^{2/}	5.5 (3.8)	2.9 (2.7)	4.3 (3.2)	5.1 (5.1)
1955	7.2 (5.9)	5.6 (4.1)	3.0 (2.2)	3.8 (3.3)	- -
1956	- -	4.0 (2.5)	3.0 (2.6)	4.3 (4.2)	5.1 (3.8)
1957	3.6 (2.8)	2.4 (0.8)	1.5 (0.6)	3.0 (1.4)	5.0 (2.9)
1958	4.8 (1.8)	4.4 (2.9)	3.4 (2.4)	4.5 (3.8)	5.9 (5.7)
1959	4.7 (2.9)	4.3 (1.5)	2.9 (2.2)	5.2 (3.1)	8.7 (8.7)
1960	5.8 (5.2)	4.4 (3.5)	3.6 (3.0)	4.8 (4.3)	5.4 (3.7)
1961	4.6 (3.0)	3.4 (1.9)	2.6 (1.8)	5.0 (4.1)	6.4 (5.1)
1962	6.1 (5.2)	4.4 (3.5)	3.6 (2.8)	3.6 (2.7)	5.5 (3.8)
1963	4.5 (2.5)	4.5 (3.4)	3.2 (2.0)	3.0 (2.0)	4.8 (3.4)

^{1/} Source: Oregon State Sanitary Authority.

^{2/} Monthly minimums are shown in parentheses.

Included in Table 5 are weekly water temperatures and dissolved oxygen values obtained in the river at six locations between Canby and Portland harbor in 1963.

Next to dissolved oxygen, summer and fall water temperature is probably the water quality factor most limiting the health and survival of fish in the lower Willamette River. Water temperatures below 65° F. are generally considered best for rearing salmonids. Table 6 shows water temperatures recorded in the Portland harbor by the State Sanitary Authority since 1953. From this it can be seen that temperatures exceeding 65° F. (18.3° C.) have occurred each year since 1953 in July, August and September. Temperatures exceeding 75° F. (23.9° C.) have been recorded during portions of six of the 11 years since 1953. Temperatures

TABLE 5

Weekly Dissolved Oxygen (DO₂) and Water Temperature (°C) Measurements
Obtained at Six Locations in the Lower Willamette River by the
State Sanitary Authority, 1963 ^{1/}

Dates	Canby Ferry		Marina Mart		Sportcraft		Oswego		Steel Bridge		S.P.&S.-R.R.	
	DO ₂	°C	DO ₂	°C	DO ₂	°C	DO ₂	°C	DO ₂	°C	DO ₂	°C
May 21	8.0	18	7.8	18	8.9	17	-	-	8.3	17	8.2	17
28	7.6	16	7.3	16	7.9	16	7.9	16	7.4	16	6.8	16
June 4	7.3	16.5	7.2	16.5	7.5	16.5	7.1	16.5	5.5	17	4.9	17
11	7.9	17	7.3	17	7.9	17	7.8	17	6.9	16	6.5	16
18	6.4	23	6.1	22	5.6	22	5.2	21	4.5	20	4.7	20
25	7.5	17	6.2	17	5.8	18	5.3	17	4.0	18	2.5	19
July 2	8.0	18	7.0	17	6.5	17	6.3	18	5.4	17	5.1	17
9	7.0	19	6.7	20	6.6	19	6.5	19	5.7	18	5.8	18
16	6.5	20	6.4	20	6.3	20	5.9	19	5.7	18	4.8	18
23	5.6	20	6.0	20	5.7	20	5.7	20	4.4	19	3.6	19
30	6.4	21	5.7	20	6.1	20	5.2	20	4.4	20	3.9	20
Aug. 6	5.8	21	5.6	20	5.9	21	5.5	20	4.3	20	4.2	20
13	5.8	22	4.8	22	5.1	22	4.5	22	3.7	21	3.1	21
20	6.9	21	6.0	21	5.7	21	5.1	21	2.5	21	2.5	21
27	5.2	19	5.5	20	5.9	20	5.7	20	4.2	20	2.9	20
Sept. 3	6.3	20	4.2	20	5.6	20	6.1	20	2.9	19	2.8	19
10	3.4	21	4.1	21	4.8	21	4.6	21	4.4	20	3.7	20
17	4.8	18	3.9	18	3.8	18	5.2	18	2.6	19	2.0	19
24	4.3	18	4.0	18	4.7	18	4.8	17	3.9	16.5	3.4	17
Oct. 1	7.1	18	6.8	18	6.6	18	5.8	18	4.4	18	3.4	17
9	6.9	16	6.4	16	6.4	16	6.4	16	5.2	16.5	4.3	17
16	6.3	16	6.3	15.5	6.3	15.5	6.2	15.5	4.7	16	3.9	16
23	8.1	14	7.3	13	7.7	13	7.6	13	5.7	14	5.2	14
29	7.8	12	8.0	12	8.3	12	8.4	11.5	8.3	11	7.8	12
Nov. 5	8.4	11	8.1	11	8.7	11	8.4	11	6.9	11	5.8	11
13	9.2	10	10.0	10	10.4	10	10.5	10	10.5	10	10.2	10
20	9.8	9	9.7	9	11.6	9	11.7	9	11.0	9	11.1	9
Dec. 3	10.4	6	10.3	6	11.9	6	11.6	6	11.3	5.5	11.0	6

^{1/} Additional measurements, including other water quality factors, at these and other Willamette River locations were obtained in 1963 and in prior years.

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TABLE 6

Maximum Water Temperatures ($^{\circ}\text{C}$) Recorded in Portland Harbor, 1/

Year	June	July	August	September	October
1953	-	20.0	23.0	20.0	17.0
1954	13.0	22.0	21.0	20.0	15.0
1955	15.0	20.0	22.0	20.0	-
1956	-	25.0	24.0	21.0	16.0
1957	20.5	23.0	22.5	22.0	17.0
1958	21.5	27.5	26.0	21.0	17.0
1959	20.0	25.5	23.0	19.0	14.0
1960	21.0	26.0	24.0	19.0	17.0
1961	22.0	25.0	25.0	20.0	17.0
1962	21.0	24.0	22.0	20.0	17.0
1963	22.0	21.0	22.0	22.0	19.0

1/ Source: Oregon State Sanitary Authority

of the latter magnitude can force fish to seek more favorable habitat in other river areas, contribute to fish disease problems, and actually cause some mortalities.

Toxic materials discharged into the river can cause direct fish kills. Few actual fish kills have been recorded. This is probably because pollution, with resulting low dissolved oxygen values, and warm temperatures are not prevalent during major periods of anadromous fish migrations, and the remaining fish are driven from the area by advancing poor water quality factors before mortalities occur. On the other hand, large size of the area coupled with rapid decomposition of fish in warm water may be obscuring some fish kills caused by pollution and toxicants.

Pollution of the river is from a multitude of sources. Municipalities and paper processing mills are the main contributors. Four pulp mills, located at Salem, Newberg, West Linn and Oregon City, are responsible for the major sources of biochemical oxygen demand. Present waste disposal facilities at these mills are not generally adequate to maintain desirable dissolved oxygen levels for fish. All cities on the main river have been ordered by the State Sanitary Authority to provide secondary treatment or the equivalent of 85 per cent BOD (biological oxygen demand) removal for their wastes. The following statement from the 1962

annual report of that agency is whole-heartedly supported by the Oregon Game Commission:

"In order to maintain satisfactory bacteriological and dissolved oxygen conditions in the waters of the main Willamette it will be necessary that all municipalities provide secondary treatment, that the oxygen demand of the pulp mill and other industrial wastes be further reduced and that minimum stream flows be regulated and augmented as much as possible."

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TUALATIN SUBBASIN

Species Occurrence and Distribution

The coho salmon is the most numerous and widespread anadromous fish found in the Tualatin system. The Oregon Fish Commission estimates the present Tualatin run to average about 6,000 fish.

Steelhead and cutthroat trout are the only other anadromous species known to exist in the drainage. Less than 500 steelhead are known to enter the Tualatin River. Definite reasons for such low numbers are difficult to pinpoint but are probably closely associated with poor summer rearing conditions. In recent years steelhead have been recorded in the river to Lee Falls (river mile 74.7) and in tributaries East Dairy, Gales and Scoggin Creeks. Several spawning steelhead were observed in Gales Creek when making spawning flow studies in the spring of 1962.

Cutthroat trout enter the Tualatin River each winter to spawn. These fish are both sea-run and Willamette River resident forms. Runs are normally moderate. Smaller resident cutthroat trout occur throughout the year in most streams in moderate to high numbers. They are most plentiful in the headwater streams possessing cool summer temperatures.

Known and suspected coho and chinook salmon and steelhead trout distributions in Lower Willamette Basin streams are illustrated on Plates 1, 2 and 3 in the

appendix. Distribution data for construction of the plates were obtained from Oregon Game Commission and Oregon Fish Commission records.

Spring chinook salmon were seen spawning in Gales Creek in September 1945 (Parkhurst and others, 1950). No subsequent records of chinook in the Tualatin system have been received. Scarcity of cool summer resting pools for adults is suspected to have contributed to the disappearance of this species. Spawning potential for salmon and steelhead is good, with best gravel supplies located in East Dairy, Gales, McKay and Scoggin Creeks, and in the Tualatin River in the vicinity of Cherry Grove.

Several warm-water game and rough species are common throughout the area. Highest populations occur in the main stem Tualatin River and its larger tributaries, being most concentrated in the lower reaches of each. Lake Oswego, through which Tualatin River water is diverted, also contains substantial populations of these species.

Angler Effort and Catch

Trout angling pressure, generally moderate, is directed toward native cutthroat trout and hatchery-reared fish. Stocking of legal-sized rainbow and cutthroat is conducted each year in the larger streams of the subbasin (Appendix III).

Limited angling for coho salmon takes place each fall and early winter. Angling for this fish and for migratory cutthroat is presently permitted in the main stem Tualatin below Highway 219 bridge.

Warm-water game fish receive moderate angling pressure. Most pressure is directed upon the lower Tualatin River. Table 7 lists information concerning the more important warm-water fishing areas in the Lower Willamette Basin. Yellow perch, bluegill sunfish, crappies, bullhead catfish and largemouth bass are most commonly caught in these areas. Lake Oswego and other low elevation lakes frequently lack public access, yet they receive considerable angling pressure from landowners and local residents.

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TABLE 7

Popular Angling Areas for Warm-Water Game Fish
in the Lower Willamette Basin

Water	County	Acres	Public Access	Known Game Fish Present	Location
Benson Lake	Mult.	40	Yes	WC, LB, Rb	Near Multnomah Falls on Columbia R. highway
Blue Lake	Mult.	125	Yes	LB, Rb, BC, BG, GS	Three miles northwest of Troutdale and 1 mile south of Columbia R.
Borrow Pit	Wash.	2	Yes	LB, BG	Junction of Gales Cr. Road and Highway 6
Burnham Pond	Col.	3	Yes	LB, BG	At Goble northwest of St. Helens
Bybee Lake	Mult.	200	Yes	WC, LB, BG, Brb	2 miles southeast of the Willamette R. junction with Columbia R.
Columbia R.	Col. & Mult.	-	Yes	Several salmonids and warm-water species	Entire river and adjacent ponds and sloughs
Columbia Slough Pond #5	Mult.	6	Yes	Brb, YP, Wm	Immediately to the east of N.E. 47th St. in Portland
Columbia Slough Pond #6	Mult.	10	Yes	Brb, YP, Wm	Immediately to the east of N.E. 33rd St. in Portland
Fairview Lake	Mult.	110	Limited	LB, BC, BG, GS	Immediately adjoining Blue Lake on the south
Lake Oswego	Clack.	-	No	Several warm-water species. Some young anadromous species	Just off Highway 43 at town Lake Oswego
Mirror Lake	Mult.	50	Yes	WC, BrB, LB, BG	Rooster Rock State Park on Highway 30
Oak Grove Lake	Mult.	-	Yes	BC, WC, Wm, BrB, LB	In town of Oak Grove
Ramsey Lake	Mult.	150	Yes	WC, BrB, YP, BG, LB	Immediately east of the junction of the Willamette R. and the Columbia R.
Sauvie Island (see Fig. 7)	Col. & Mult.	approx. 3,000	Yes	Mixture of warm-water game fish	Ten miles northwest of Portland
Smith Lake	Mult.	400	Yes	WC, LB, BG, BrB	Bordered on east by N. Portland Road and on south by Columbia Slough
Vanport Sloughs	Mult.	100	Yes		In old Vanport housing area south of P.I. Building, west of N. Denver Avenue
Bayan Slough	Mult.	-	Yes	BG, Wm, WC, PK, BrB	One of Vanport Sloughs
Force Lake	Mult.	-	Yes	Wm, BG	" " " "
Mud Slough	Mult.	-	Yes	Wm, BG	" " " "
Tualatin R.	Mult.	-	Yes	Several salmonids & warm-water species	Lower portions of Tualatin R.
Willamette R.	Mult. & Clack.	-	Yes	Several salmonids & warm-water spp. Sh, Sg	Entire river within basin. Most angling is above Willamette Falls

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Factors Influencing the Resource

Dams and Barriers

Critical fish passage problems are created by a dam on the Tualatin River at river mile 3.8 (Figure 1). This structure's purpose is to divert water to Lake Oswego. The canal headgate is at river mile 6.8. Only about six feet high when splash boards are installed, the dam nevertheless forms a complete barrier to upstream coho salmon passage during low flow periods. Fish passage is not possible until the splash boards are removed or washed out by fall freshets. A wooden ladder which was located at the north end of the dam was washed away in the spring of 1959 and has not been replaced. Limited amounts of water escape from the dam in summer and fall months, preventing successful upstream passage of coho salmon through the 3.8-mile lower river section, particularly in years with delayed fall rains.

A minimum flow of 20 cubic feet per second (cfs) through this area in October and November has been proposed by the U. S. Fish and Wildlife Service (Tualatin Project, Oregon, 1963) to provide upstream passage for silver salmon. In conjunction with other field surveys, detailed studies of river flows below the dam were made by Oregon Game Commission personnel at two flow volumes (obtained from a U.S. Geological Survey gage 1.8 miles above the mouth) in the summer of 1963. The entire area was inspected either on foot or from a rubber boat. From these studies it was determined that a flow of 20 cfs through this river section would be an absolute minimum for coho salmon or steelhead passage and that 30 cfs would be more desirable (Figure 2).

A 20-foot natural falls is located directly below a 20-foot dam at the outlet of Lake Oswego. The dam and falls provide head for a powerplant which receives the lake outflow at a point a short distance below the falls. Since Tualatin River water passes through the lake, adult coho salmon of Tualatin system origin are attracted each fall from the Willamette River into the lake outlet (Sucker Creek). Some of these fish have been salvaged in several past

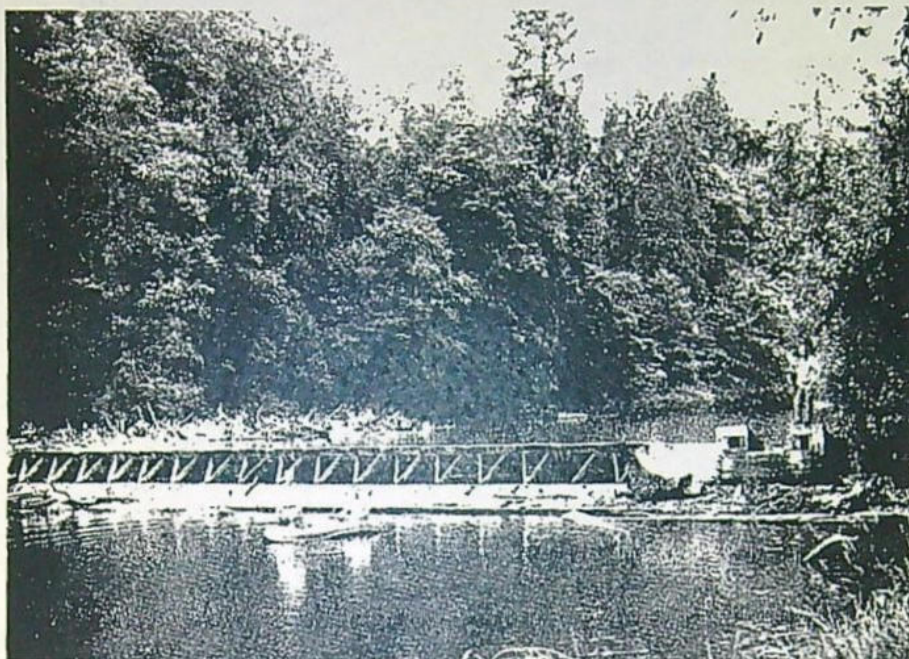


Figure 1. Lake Oswego diversion dam on Tualatin River, river mile 3.8. August 5, 1963.

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Figure 2. Tualatin River at river mile 0.25 showing conditions at low flow (approximately 31 c.f.s.). August 5, 1963.

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years by Oregon Fish Commission personnel.

If salmon, and occasional steelhead, continue to concentrate below the falls, possible solutions to the problem are: more intensive harvest by sport anglers; continued salvaging; construction of a barrier at the mouth of Sucker Creek to prevent fish entry; construction of fish passage facilities at the lake outlet. Attainment of proposed improvements to lower Tualatin River passage flows and to passage facilities over Willamette Falls could assist in alleviating the fish concentration problem in Sucker Creek.

Lee Falls forms another major barrier to anadromous fish. This 12-foot natural falls is in the Tualatin River near river mile 75. Provision of passage facilities is not considered feasible because another impassable barrier, Haines Falls, is located two miles farther upstream. No other barriers of major significance to anadromous fish exist in the subbasin.

Water Quantity Severe water shortages which limit salmonid survival exist in many Tualatin drainage streams. Only headwater streams normally possess acceptable summer water quantities. The flow deficiencies are typical of those found in other Willamette tributaries from the west.

In the Tualatin system consumptive water uses critically deplete summer and fall flows. Consumptive surface water rights currently exist for approximately 400 cubic feet per second. Over 80 per cent of this water is for irrigation purposes.^{1/} Heaviest withdrawal of irrigation water is from the main stem Tualatin River. This water is most commonly removed from the river channel with electric or gasoline driven pumps. Extensive sections of the river from Gaston (river mile 65) downstream become dry or intermittent every summer.

Low, warm rearing flows in the river and several of its tributaries create one of the greatest known limiting factors on anadromous fish numbers. It has been mentioned previously that poor summer conditions are suspected to have been

^{1/} From State Water Resources Board records.

a major cause for spring chinook salmon extinction in the drainage. Coho (silver) salmon and steelhead have maintained runs largely because the adults do not require summer residency, and a number of their progeny, either by adaptation or necessity, rear in headwater streams.

Water Quality High water temperatures in summer months are more predominant in lower portions of Tualatin subbasin streams than in most other Willamette River tributary systems originating in the Coast Range. These temperatures are a direct result of depleted flows and low stream gradients within the Willamette Valley floor. The low gradients and flows cause reduced water velocities and subsequent extended exposure of flows to warm weather conditions.

Tualatin River temperatures frequently exceed 70° F. A maximum temperature of 76° F. was recorded by a thermograph installed at river mile 69.5 in August 1963 by the Oregon Fish Commission. Temperatures near this extreme have been known to cause mortalities to young coho salmon in other Oregon streams. Stream temperatures and flows measured in numerous subbasin streams in 1962 and 1963 are included in Appendix II.

Dissolved oxygen levels below 5 parts per million are common in lower portions of the Tualatin River during summer and fall months. Although these levels are often below salmonid tolerance limits, warm-water game fish have been able to maintain substantial populations in this river area. Reduced, warm, slow-moving flows are the principal causes for these low dissolved oxygen concentrations. Pollution sources are few; however, any pollution coupled with existing poor quality flows could be seriously detrimental to all fish life. The State Sanitary Authority has conducted rather extensive water quality studies in the Tualatin River for several years.

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CLACKAMAS SUBBASIN

Species Occurrence and Distribution

The Clackamas River supports substantial runs of steelhead trout and coho and spring chinook salmon. Numbers of adults of these species counted over the North Fork Dam (river mile 30) since November 1957 are presented in Table 8. Timing of these runs is shown in Figure 3.

TABLE 8

Upstream Migrant Fish Counts, North Fork Dam
Clackamas River

Year ^{1/}	Coho (silver) salmon	Chinook Salmon	Steelhead
1958	620	475	1,648
1959	522	578	556
1960	1,330	287	1,148
1961	2,185	370	2,204
1962	2,189	666	4,365
1963	3,121	616	2,242

^{1/} Runs are listed in the year they terminate.

The coho run is estimated by the Fish Commission to average 14,000 fish annually. These fish spawn mainly in the river system below River Mill Dam (river mile 23.4). The average count over North Fork Dam since 1957 is 1,661 adults. Much larger proportions of the spring chinook and steelhead runs spawn in the river system above North Fork Dam. A run of fall chinook spawns primarily in the lower river and Eagle Creek. Although of undetermined magnitude, this run is presently considered to be small. Figure 4 illustrates when adult anadromous fish are present or spawning in Lower Willamette Basin streams.

Resident cutthroat trout and whitefish exist in moderate numbers throughout the watershed. Cutthroat numbers are highest in headwater areas. Sea-run cutthroat trout are common in the lower river system. Limited numbers of Dolly Varden, eastern brook and brown trout are widely scattered in the drainage. Dolly Varden are indigenous, while brown trout remain from early plantings. Eastern brook trout

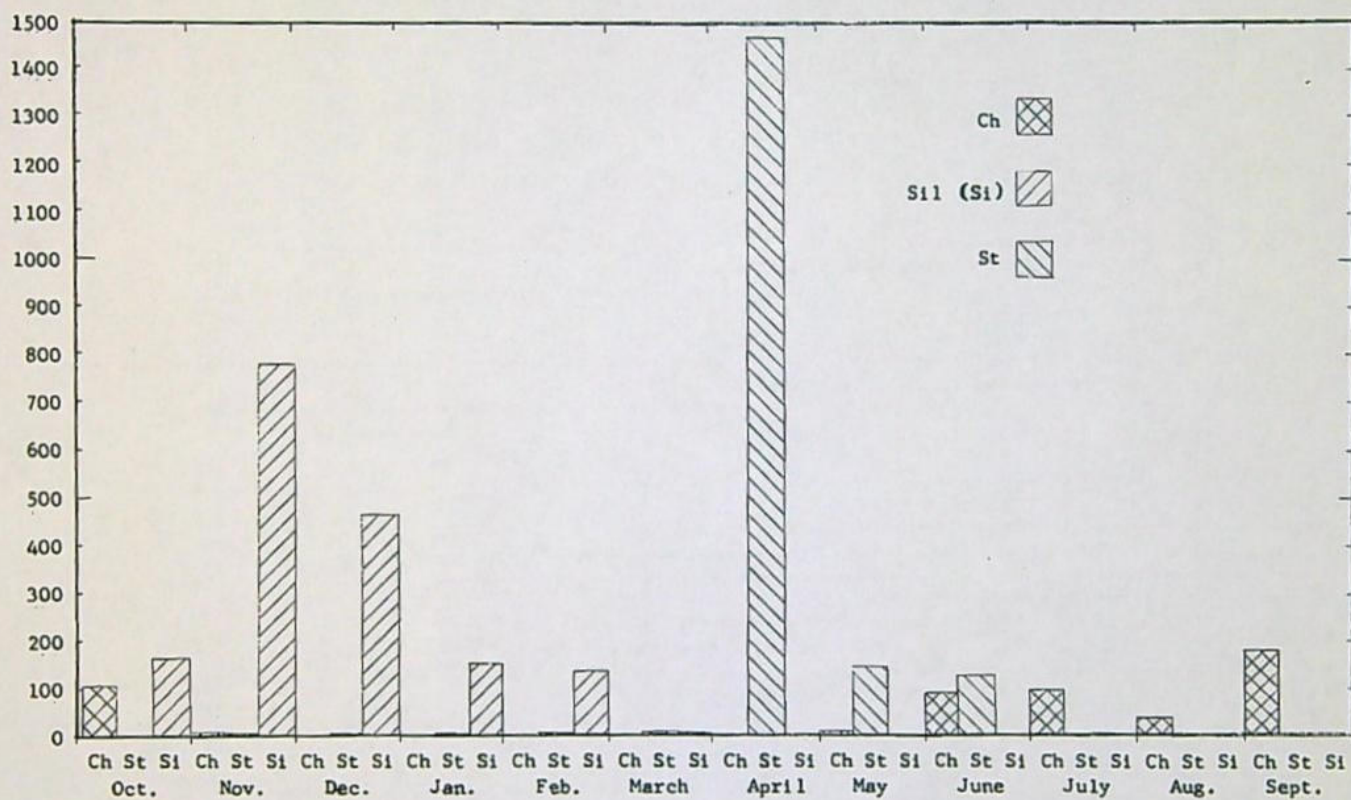


Figure 3. Average numbers and timing of adult anadromous fish runs; North Fork Dam, Clackamas River, 1957 through the 1962-63 migratory season.

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PERIODICITY CHART, ANADROMOUS FISH SPAWNING

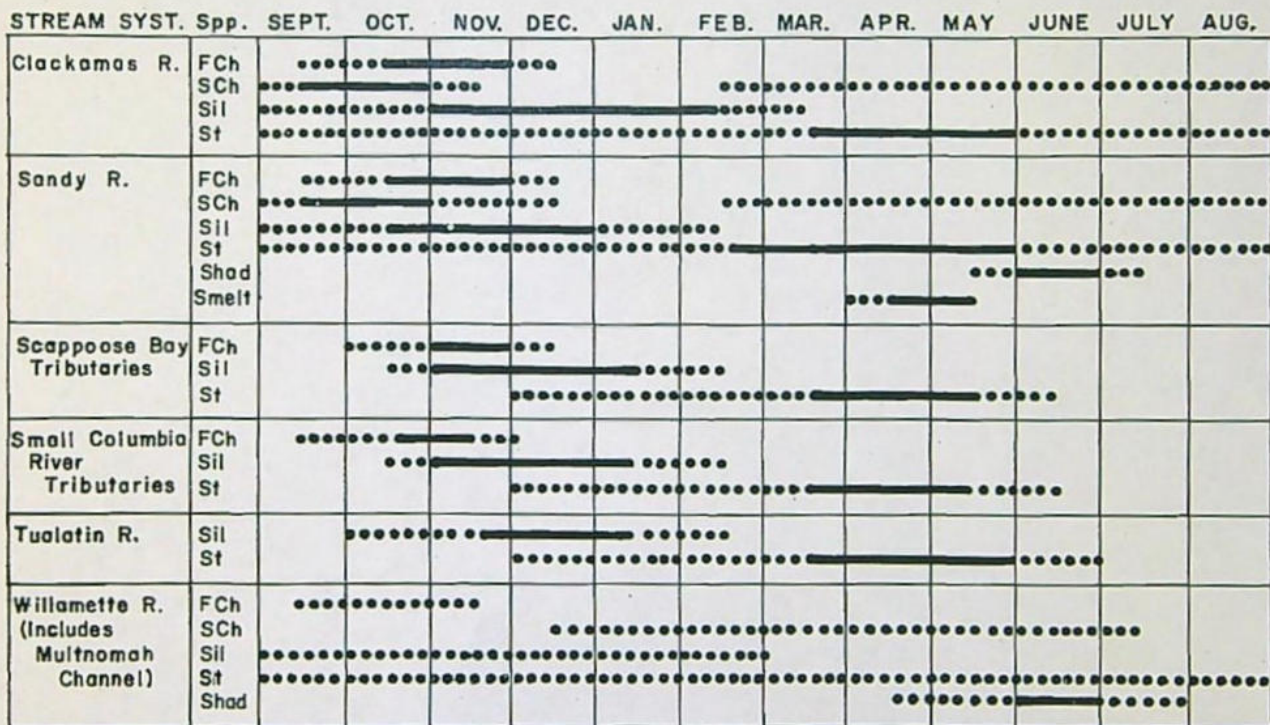


Figure 4. Periodicity chart showing when adult anadromous fish are present or spawning in Lower Willamette Basin streams. The dotted line indicates presence of adults in the streams, and the solid line indicates periods of heaviest spawning.

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occur largely as the result of escapements from plantings in Cascade lakes.

Cool stream temperatures create unfavorable habitat for most warm-water game fish, consequently their numbers are low. Temperatures have the same effect on most rough fish, although suckers are able to exist in rather high numbers. Suckers are plentiful in North Fork Reservoir and the river downstream. Carp and squawfish are common in the river below River Mill Dam.

Angler Effort and Catch

Highly popular fisheries for steelhead trout and coho and spring chinook salmon extend from the mouth of the Clackamas River upstream to Cazadero Dam. Of the three, the steelhead fishery is the fastest-growing. Angling for this species is conducted generally from December into May.

Coho fishing takes place from October through December, and chinook fishing in spring months concurrent with the Willamette River chinook fishery. The heavy chinook angling pressure occurring at the mouth of the Clackamas has previously been mentioned. Both boat and bank fishing for salmon and steelhead is employed in the main stem. Boat angling for spring chinook and steelhead is becoming an increasingly popular method.

Stream trout fishing is concentrated mainly upon hatchery-reared rainbow trout. The Clackamas River system receives greater numbers of legal-sized trout than any other Oregon stream exclusive of the McKenzie River. In excess of 100,000 rainbow are stocked each year, most of these in the system above North Fork Reservoir (Appendix III). Resultant angling pressure is extremely high. Moderate angling for resident cutthroat trout takes place in upper portions of most streams.

Timothy Lake, Harriet Lake and many smaller high Cascade lakes also receive considerable angling pressure. Rainbow trout make up the bulk of the Timothy Lake catch. Some cutthroat trout and kokanee are taken there as well. Rainbow and brown trout are the most commonly caught species in Harriet Lake. Eastern

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brook trout is the predominant species in the other Cascade lakes. Data concerning the high elevation lakes, including fish present, are given in Appendix IV. Basin creel census data are presented in Appendixes V and VI.

Factors Influencing the Resource

Water Quantity Stream and lake water quantities are generally acceptable for fish life. This is fortunate considering the many water use requirements normally associated with an area of such high human population. Consumptive use of Clackamas system water is minimal. Most of this is for municipal purposes.

Extensive nonconsumptive water use exists for power generation. Portland General Electric Company has hydroelectric plants at four locations along the main stem Clackamas River between river miles 23.4 and 47.8. With one exception, this use does not now adversely affect fish life to a large degree. This exception is the extreme daily fluctuation of Clackamas River flows below river mile 47.8, and particularly downstream from River Mill Dam (river mile 23.4). Several detrimental effects result, the most important of which are the retarding of food production, the fluctuating of flow conditions on spawning fish and their redds, the stranding of some fish, and the endangering of anglers and other recreationists.

One of the most apparent effects on fish is the subjection of spawning spring chinook salmon to highly fluctuating water depths and velocities. These extreme flow variations not only discourage spawning but, by lowering intragravel water permeability and dissolved oxygen concentrations, can also result in poor egg survival. At times, redds dug on a gravel bar a short distance below River Mill Dam have actually been exposed.

Whenever possible it would be desirable to establish minimum flow regimens compatible with power use in the river below River Mill Dam, especially during fish spawning periods. In the 1960 water year, momentary flow extremes recorded by a U. S. Geological Survey gage located just below the dam were 55,200 cfs on

November 24 and 55 cfs on March 10. Both extremes occurred in periods of anadromous fish spawning. Daily flow fluctuations of several hundred cubic feet per second are common in the lower river solely as the result of River Mill power-peaking operations.

A cursory fish and redd count conducted from the mouth to River Mill Dam in the fall of 1963 revealed that substantial numbers of spring chinook salmon spawn throughout this area. Heaviest spawning was within a short distance of the dam. This information is presented in Table 9.

TABLE 9

Cursory Counts of Spring Chinook Salmon and Redds,
Clackamas River from River Mill Dam to the Mouth, October 1963 ^{1/}

Number of Chinook			No. of Redds	Location
Alive	Dead	Total		
17	37	54 ^{2/}	10	0.1 mile below River Mill Dam.
6	0	6	1	0.3 mile below River Mill Dam.
0	2	2	0	1.0 mile below River Mill Dam.
1	0	1	0	River mile 19.5
0	1	1	0	River mile 19.0
0	9 (1) ^{3/}	9	0	From river mile 14.5 to 19.0
5	0	5	2	0.3 mile above Barton Park.
9	1	10	3	First riffle above Barton Park
2	0	2	1	1.0 mile below Carver bridge.
0	1	1	0	River mile 2.0
Totals				
40	51	91	17	

^{1/} An unknown, though probably small, percentage of the total fish and redds present was observed.

^{2/} Most of these fish were counted using SCUBA gear. Remainder of counts were made from a boat.

^{3/} Number in parenthesis is a jack salmon included in total.

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Water Quality Water quality problems affecting fish are few. As a rule, good water qualities accompany the prevalently acceptable water quantities.

Water temperatures, except in an occasional low elevation stream, are within proper limits for salmonid production. Summer stream temperatures and flows measured in many subbasin streams in 1962 and 1963 are included in Appendix II.

Pollution is at a minimum. When pollution does occur, effluents are usually dissipated by stream flows of good quantity and quality. Active and past logging and road building activities in the upper watershed have not substantially altered water qualities. A few gravel washing operations along the lower Clackamas River periodically cause increased river turbidities which are not conducive to best salmonid production or angling.

Dams and Barriers Three large hydroelectric dams exist in the main stem Clackamas River between river miles 23.4 and 30.0. The structures, River Mill, Cazadero and North Fork, are operated by Portland General Electric Company.

Of the three dams, North Fork is the largest and most recently constructed. The 206-foot concrete structure was completed in 1958. Located at river mile 30, it is the uppermost of the three dams. Its fish passage facilities are integrated with those of Cazadero and River Mill Dams situated 1.7 and 6.6 miles downstream, respectively. Upstream migrant fish enter a collection system below Cazadero Dam and are passed above it and North Fork Dam by way of a 1.7-mile ladder. Downstream migrants leave North Fork Reservoir either by the spillway, the penstocks or a special collection system at the head of the ladder. Migrants utilizing the latter exit are transported by the ladder to Cazadero Dam where they are bypassed into a pipeline and returned to the river below River Mill Dam. Those fish emigrating via the spillway or penstocks must pass over the spillways or through the penstocks of the two dams downstream.

Cazadero Dam, built in 1904, was completely impassable for nearly 35 years until a fish ladder was constructed in 1939. This obstruction was probably

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responsible for the complete elimination of upper Clackamas River anadromous fish runs (Willis, Collins and Sams, 1960). The new ladder, which bypasses both Cazadero and North Fork Dams, appears to be successful in passing salmon and steelhead. A company financed evaluation study directed by the Federal Power Commission is currently under way.

River Mill, lowermost of the three dams, was completed in 1911. It is approximately 80 feet high. The original concrete ladder, except for the entrance, remains almost unchanged, being extremely steep, narrow and winding (Figures 5 and 6). The ladder by present fish passage standards is quite inadequate for anadromous fish use.

The dam and ladder particularly hinder spring chinook salmon runs. During spring months spring chinook in western Oregon normally ascend to cooler water areas in the upper portions of streams. There they reside in deep pools throughout the summer before spawning in September and October. A majority of the Clackamas spring chinook spend summer months in the river below River Mill Dam and do not ascend the ladder until just prior to spawning. Many reside in the large pool beneath the dam where they must ripen in unaccustomed water temperatures and are subject to poaching which has become a problem. A number of these fish never do ascend the ladder since maturation is completed prior to favorable passage conditions. They are forced to drop downstream to spawn within a short distance of the dam. A high percentage of dead female chinook examined during the 1963 spawning count (Talbe 9) possessed full, unspawned egg skeins. This may have been a direct or indirect result of excessive delay at River Mill Dam. It is regrettable that such a poor fish ladder is located just downstream from another of modern design. The effects of severe daily flow fluctuation upon salmon in this river section have been described.

A few other small dams exist in some Clackamas River tributaries. Fish passage facilities are not adequate in all cases. At least one dam which



Figure 5. Fish ladder at River Mill Dam.
April 1963.

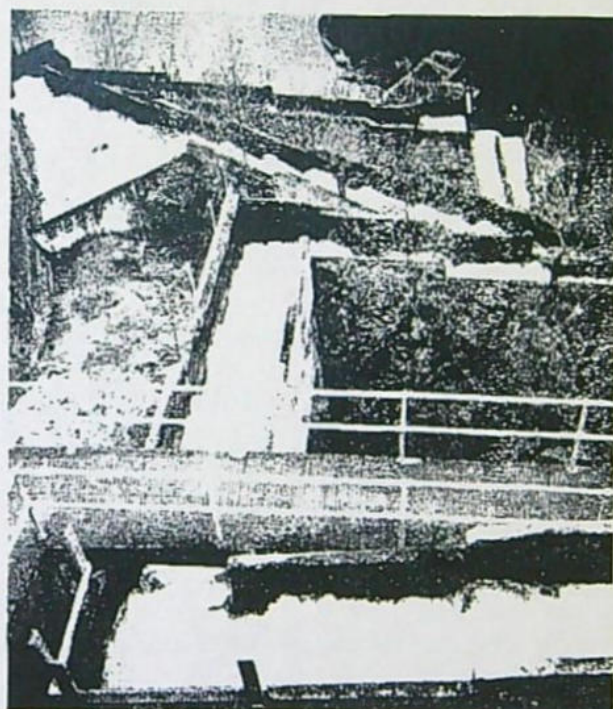


Figure 6. View of River Mill ladder from top of
dam showing narrow, steep, circuitous
route. April 1963.

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influenced anadromous fish passage existed in the lower Clackamas River prior to 1900.

Two Portland General Electric Company dams on Oak Grove Fork are located above the range of anadromous fish. The lower dam forms a 23-acre impoundment, Harriet Lake, from which water is diverted to Oak Grove powerhouse on the Clackamas River. The upper dam creates Timothy Lake, a highly popular trout fishing impoundment approximately 1,200 acres in size. Water from Timothy Lake is released to augment Harriet Lake.

Natural barriers to fish are present in several Clackamas tributaries. Major falls impassable to anadromous fish are located in the South Fork Clackamas River near river mile 0.6, North Fork Clackamas River near river mile 2.5, Roaring River near river mile 1.0, Collawash River near river mile 7.0, Oak Grove Fork Clackamas River near river mile 4.0, Eagle Creek just above Eagle Creek Fish Hatchery, Fish Creek about 1.0 mile above Wash Creek, Hot Springs Fork Collawash River near river mile 6.0, and Clear Creek just above Little Clear Creek. Provision of fish passage facilities over two of the falls, on Collawash River and its tributary Hot Springs Fork, may be feasible.

COLUMBIA SUBBASIN

Species Occurrence and Distribution

Important anadromous fish streams of this subbasin, excluding the Columbia and Willamette Rivers, are Johnson, Milton and Scappoose Creeks. Coho salmon and steelhead are common in these three stream systems. Fall chinook maintain a light to moderate run in Scappoose Creek. Chum salmon have been recorded in Milton Creek, and small numbers may spawn in other streams.

Nonmigratory cutthroat trout occur in upper sections of most streams which maintain adequate summer flows. In addition, legal-sized cutthroat or rainbow trout

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are stocked each year in Johnson, Milton and Scappoose Creeks to supplement natural production and increase the angler catch.

Rough fish and warm-water game fish numbers are high in Multnomah Channel and in the lakes and sloughs associated with Sauvie Island and the Columbia and Willamette Rivers. Rough fish are also common in the lower portions of the larger creeks.

Angler Effort and Catch

Trout angling is generally moderate and directed mainly toward hatchery trout stocked in Johnson, Milton and Scappoose Creeks. Lower portions of these three streams are open to salmon and steelhead fishing and receive some pressure.

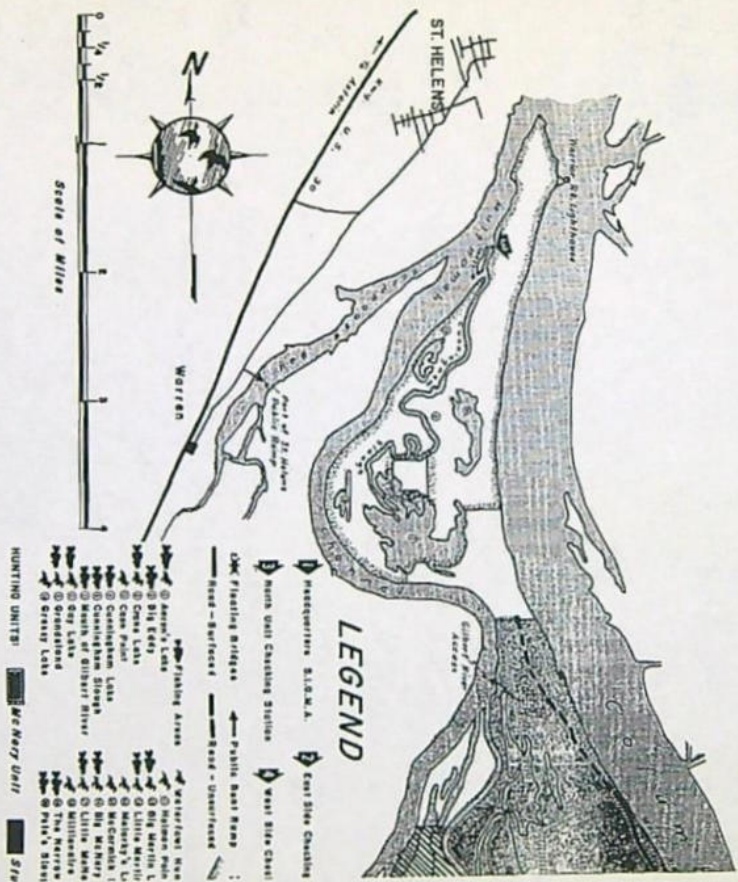
Heavy angling pressure is exerted upon warm-water game fish. Sauvie Island receives the greatest numbers of these anglers. Popular fishing areas on Sauvie Island are shown in Figure 7.

Factors Influencing the Resource

Most subbasin streams experience summer flows of inadequate water quantity and/or quality for salmonid production. The conditions prevail because drainage areas are rather small and in low-elevation, highly populated areas. Consumptive water uses are frequently heavy. Of these, municipal and irrigation uses are the largest. Anadromous fish populations are maintained largely because summer rearing conditions are more favorable in upper areas of some streams.

Water quality problems affecting fish are severe in Scappoose Bay. This large bay at the mouth of Scappoose Creek enters the lower Multnomah Channel near St. Helens. Two large industries, Kaiser Gypsum softboard plant and Crown Zellerbach Pulp and Paper Company, are located in the vicinity of the bay. Both are significant sources of organic wastes. A critical dissolved oxygen depletion problem exists in Scappoose Bay during summer and fall months, which is caused primarily by organic effluents from the Kaiser Gypsum plant. Low dissolved oxygen levels and toxic materials have caused several past fish kills in Scappoose Bay.

**Figure 7. SAUVIE ISLAND
GAME MANAGEMENT AREA**



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Large portions of the Willamette River's anadromous fish runs enter the system via Multnomah Channel. The channel has poor water qualities in late summer months because of several pollution sources--the most severe being around Scappoose Bay--and because it receives Willamette River flows during this period. When the Columbia is in flood its waters join the Willamette flows in Multnomah Channel. This markedly improves the channel's water quality.

SANDY SUBBASIN

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Species Occurrence and Distribution

The Sandy River system ranks close to the Clackamas drainage in numbers of anadromous fish produced. Coho salmon and steelhead trout possess the largest runs. Substantial runs of spring and fall chinook salmon also exist.

Counts of all salmon and steelhead ascending Marmot (Big Sandy) Dam are obtained by the Oregon Game Commission with a combination trap and electronic counter in the fish ladder. Steelhead and spring chinook have been enumerated since 1954 and coho since 1958. These counts are presented in Table 10.

TABLE 10

Adult Fish Counts Over Marmot Dam Ladder
Sandy River

Year ^{1/}	Spring Chinook Salmon	Coho (Silver) Salmon	Steelhead
1954	400	-	2,200
1955	5	-	1,581
1956	0	-	2,240
1957	10	-	2,054
1958	78	264 (222) ^{2/}	3,166
1959	304	330 (247)	2,359
1960	23	68 (34)	1,612
1961	37	1,670 (568)	3,124
1962	65	1,769 (212)	4,045
1963	122	1,458 (452)	3,326

^{1/} Runs are listed in the year they terminate.

^{2/} Numbers in parentheses are jacks included in total.

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Greater than half of the river system's steelhead spawn above Marmot Dam (river mile 30). Less than half of the coho salmon spawn above the dam. Probably more spring chinook spawn below the dam than above it. Nearly all fall chinook spawn in the larger streams of the system below Marmot Dam. An occasional adult is counted through the ladder. Little information is available regarding size of the fall chinook run, although observations of spawning salmon made in the lower 13 miles of Sandy River during flow studies in October and November 1963 revealed substantial numbers of this race.

A remnant run of summer steelhead exists in the system. For the past several years adult summer steelhead have been recorded in the pool beneath the City of Portland's headworks dam on the Bull Run River.

A small run of chum salmon was recorded in Beaver Creek, a lower Sandy River tributary, in 1952 (Pirtle, 1953).

The Sandy River has long been Oregon's largest producer of eulachon or Columbia River smelt. However, the river is subject to years or periods of several years without smelt runs. There has been no recorded run since 1957. Table 11 lists smelt run information compiled since 1919. When runs occur the fish enter the river to spawn from mid-March to mid-April and are most concentrated in the lower few miles.

Large numbers of shad enter the lower Sandy River during the spawning migration each spring. They, like smelt, do not normally swim far up the river although both shad and smelt have been recorded as high as nine miles above the mouth (Pirtle, 1953).

Resident cutthroat trout and whitefish exist throughout the Sandy drainage in moderate numbers. Highest cutthroat populations are located in headwater streams. Sea-run cutthroat trout enter the system in unknown numbers. Large plants of rainbow trout are made in streams above Brightwood (river mile 38) during each trout angling season. A few brown trout are scattered throughout the system.

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TABLE 11

Sandy River Smelt Run Data, 1908-1963

Year	Run Started	Run Ended	Remarks
1908-1916	-	-	No records of runs.
1919	March 29	-	Large run of fish taken for hatchery food.
1920	No run	-	
1921	No run	-	
1922	April 11	-	Second run began on April 17.
1923	April 4	-	Very light because of obstruction in Sandy River.
1924	March 28	-	Channel still blocked.
1925	March 14	April 4	One of longest runs. Fish Commission transferred some smelt to Clackamas River.
1926	March 12	-	50,000 people out.
1927	March 28	-	Poor run.
1928	March 12	-	
			Number of Licenses Sold
			License Funds <u>Received</u>
1929	April 9	-	793 \$ 396.00
1930	March 18	-	5,786 1,893.00
1931	No run	-	- -
1932	March 26	-	193 96.50
1933	No run	-	- -
1934	March 4	-	1,860 930.00
1935	No run	-	- -
1936	March 27	April 8	2,536 1,268.00
			Also ran heavily in Columbia R. at mouth of Tanner and Eagle Creeks.
1937-1939	No runs	-	-
1940	March 6	March 18	2,760 1,380.00
1941	March 14	March 24	2,775 1,398.50
1942	March 19	April 1	7,699 3,849.50
1943	March 25	April 1	6,596 3,298.00
1944	No run	-	- -
1945	April 1	April 15	17,754 8,876.00
1946	March 28	April 8	19,725 9,862.50
1947	No run	-	- -
1948	March 27	April 11	32,422 16,211.00
1949	March 24	April 9	42,612 21,306.00
1950	No run	-	- -
1951	April 5	April 10	25,650 12,825.00
1952	-	-	1,960 980.00
			To railroad bridge and out.
1953	April 19	April 29	59,503 29,751.00
1954	April 1	April 7	11,662 5,831.00
1955	No run	-	- -
1956	March 29	April 10	34,288 17,194.00
1957	March 26	April 1	26,690 13,345.00
1958-1963	No runs	-	-

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Warm-water game fish are limited mainly to a few slough and lake areas along the Columbia River. Rough fish numbers in streams of the subbasin are low. Fish distribution work conducted in several Sandy system streams in 1963 (Appendix VII) revealed cottids and lampreys to be the nongame species of most frequent occurrence. Cool water temperatures undoubtedly contribute to low rough fish numbers much as they do in streams of the Clackamas subbasin.

Several small Columbia River tributaries between the mouth of the Sandy River and Bonneville Dam are included in the Sandy subbasin. These are all characterized by high, impassable falls near their mouths with steep gradients above the fall areas. Anadromous fish use is frequently heavy in the short, accessible sections below the falls. Coho salmon and steelhead trout are known to utilize at least nine of these streams. Fall chinook and chum salmon enter Tanner Creek. Resident cutthroat and/or rainbow trout exist in stream areas above most of the falls.

Angler Effort and Catch

Steelhead presently receive more angling pressure than other anadromous species. Total Sandy River steelhead angler effort and catch is calculated each year as part of an Oregon Game Commission steelhead research program. Condensed catch data are given in Table 12. This study was initiated in the 1954-55 angling season to evaluate and enhance the river's winter steelhead run. Large annual releases of marked yearling steelhead have been included as part of the program. The percentage of these marked fish recorded as adults in angler catches and at the Marmot Dam trap during the 1963-64 run was very encouraging.

Moderate angling takes place for coho salmon. Fishing for this species is conducted up to Marmot Dam and to Brightwood for steelhead. Boat angling is allowed only below Viking Bridge (river mile 5.8). One tributary, lower Bull Run River, is open to salmon and steelhead angling. It receives moderate pressure from steelhead anglers. Chinook salmon angling is minor and confined to the lower Sandy River.

Stream angling is popular for both native cutthroat and stocked rainbow trout. Most stocking and resultant angling are concentrated in the Sandy River system above

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TABLE 12

Sandy River Steelhead Sport Fishery Statistics

Angling Season	No. of Angler Days	Total Catch	Per cent in Catch		Hrs. per Fish	Fish per Angler
			Wild	Hatchery		
1954-1955	16,000	958	100	None expected	-	0.06
1955-1956	10,413	1,157	100	None expected	39.5	0.07
1956-1957	17,027	972	76	24	51.0	0.05
1957-1958	24,485	1,892	83	17	36.8	0.08
1958-1959	27,934	1,306	93	7	62.0	0.05
1959-1960	13,374	2,074	88	12	45.3	0.06
1960-1961	15,244	1,494	87	13	88.9	0.04
1961-1962	20,354	1,071	99	1	72.2	0.05
1962-1963	25,097	1,302	85	15	73.2	0.05

Brightwood. The main stem below this point is closed to summer trout angling because of its high value as a juvenile steelhead and salmon rearing area. Some angling for native rainbow and cutthroat trout occurs in portions of the Columbia River tributaries above the falls.

Benson, Roslyn and Trillium Lakes receive annual trout stocking and experience considerable angling pressure. A few small Cascade lakes accessible by trail are also fished (Appendix IV).

An extensive sport fishery exists for shad in the Sandy River each spring. Angling, most concentrated near the mouth, is conducted as shad enter to spawn when Columbia water floods the area. Most fishing is done with lures from boats.

When smelt enter the Sandy, throngs of people vie with one another for favorable fishing spots. Fishing is conducted primarily in the lower three miles of the river. Dip nets are most commonly used to catch this highly valued food fish. The legal limit per person is 25 pounds a day.

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Factors Influencing the Resource

Water Quantity Most subbasin streams possess high elevation, well-forested upper watersheds. Consumptive use of surface water in the Sandy River drainage is low, presently totaling about 60 cfs. excluding the Bull Run system. All of these rights are for withdrawals from tributaries; none are from the river itself.^{1/} Consequently, flows for salmonid production are generally adequate throughout the year.

Flows from the river and its tributaries, with a few exceptions, have been withdrawn by legislative act from further appropriation except for stock, domestic, municipal and public park or recreational purposes. Flows in most of the small Columbia River tributaries in the subbasin also have been withdrawn from all uses other than fish culture. The Bull Run watershed has been reserved for exclusive municipal use by the City of Portland. To protect water quality, most of this watershed is closed to public entry. This eliminates all fishing and hunting in a large portion of the subbasin.

Water quantity problems which affect fish are of much importance and concern. These result primarily from the nonconsumptive use of Sandy River system flows for power generation. The most critical problems result from extreme daily fluctuations of the Sandy River below the mouth of the Bull Run River in summer and fall months caused by the Bull Run powerhouse. This Portland General Electric Company installation is located on the lower Bull Run River. Problems created closely parallel those which occur on the Clackamas River below River Mill Dam. They will be described in more detail in the Spawning Flow section of this report.

Another problem from use of Sandy River flows for power generation arises as substantial water volumes are diverted at Marmot Dam into a canal for eventual use at Bull Run powerhouse. In summer and fall months, the amount of water diverted commonly exceeds that permitted to pass over the dam. Resulting flows between Marmot Dam and the mouth of the Bull Run River 11.5 miles downstream sometimes drop

^{1/} From records of the State Water Resources Board.

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below desirable volumes for rearing, spawning and upstream passage of salmonids. This river section is an important rearing area for juvenile salmon and steelhead, and contains many of the river's best summer resting pools for adult spring chinook salmon.

Study in 1963 revealed that a minimum release of 50 cfs at Marmot Dam during summer and fall months would be adequate for rearing in this river section. This is assuming that water appropriations and flows of tributary streams in the area concerned remain relatively unchanged. The minimum flow recorded by a U. S. Geological Survey recorder located one-quarter mile below Marmot Dam from 1916 to 1919 was 4 cfs during September 17-29, 1918, and probably resulted from diversion at the dam. It is believed that flows of this extreme no longer occur although volumes less than the recommended 50 cfs are known to occur.

Water Quality Adequate water qualities for salmonid production exist in nearly all streams. Pollution sources detrimental to fish are few. A woolen mill at Troutdale discharges effluents into the Sandy River which may be harmful to aquatic life. Moderate to high natural siltation of the Sandy and some of its upper tributaries occurs during summer and fall months resulting from snow and glacier runoff. These silt loads may have detrimental effects upon stream productivity, fish health and production.

Stream temperatures are predominantly favorable for salmonids. The Oregon Game Commission maintained a thermograph in the Marmot Dam fish ladder from February to June 1961, and September 1961 to April 1962 to correlate upstream fish movement with water temperatures. Another thermograph was installed at the same location in the summer of 1963 to obtain records during the rearing period. From January to June 1953 the Game Commission collected temperature data in the river near river mile 2.0 in an effort to correlate water temperatures with the smelt runs. These records are presented in Tables 13 and 14. The Oregon Fish Commission maintained a thermograph in the Sandy River near Troutdale in the summer of 1963. The maximum temperature recorded was 71° F. in early August.

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TABLE 13

WATER TEMPERATURES IN DEGREES FAHRENHEIT OF SANDY RIVER NEAR THE MOUTH

Type of Instrument Thermograph Stream or Impoundment Sandy R. Location 0.5 mile below Highway 30
 Dates covered January 29 to June 4, 1953 Source OSGC Pirtle

Day	January		February		March		April		May		June	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1			42	40	40	35	48	40	46	43	52	49
2			41	40	36	34	-	-	47	44	51	50
3			43	40	40	35	-	-	52	45	52	48
4			42	42	46	39	-	-	54	49	52	50 ^{1/}
5			43	41	45	41	-	-	55	51		
6			43	40	44	38	-	-	47	46		
7			44	43	47	39	44	41	52	49		
8			43	40	49	40	42	41	48	46		
9			40	37	46	41	44	40	50	48		
10			40	36	45	43	46	41	48	46		
11			42	40	44	42	45	43	48	46		
12			41	39	45	41	44	42	49	46		
13			42	40	43	39	44	42	48	47		
14			42	40	41	37	47	42	50	47		
15			40	38	41	40	46	42	47	46		
16			40	38	41	39	45	44	47	45		
17			39	37	41	37	47	43	47	46		
18			40	37	41	39	48	43	47	47		
19			40	38	46	40	51	46	48	46		
20			41	38	44	40	51	47	49	39		
21			41	37	42	40	49	47	48	46		
22			41	37	41	40	46	45	48	45		
23			39	35	46	40	47	44	47	45		
24			40	33	45	41	49	43	47	44		
25			41	35	44	41	49	47	50	45		
26			41	35	45	40	47	46	48	47		
27			43	38	44	42	47	45	47	45		
28			42	37	47	44	45	43	48	47		
29	42	41			47	42	44	42	48	47		
30	42	41			44	41	46	42	49	46		
31	42	41			43	39			50	45		
Averages	42.0	41.0	41.3	38.2	43.6	39.6	46.4	43.2	48.7	45.9	51.7	49.2

1/ Thermograph was removed in June when Columbia River water backed up the Sandy River and covered the recording area

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TABLE 14

WATER TEMPERATURES IN DEGREES FAHRENHEIT OF SANDY RIVER AT MARMOT DAM

Thermograph

Type of Instrument (Taylor) Stream or Impoundment Sandy Location Marmot Dam, river mile 30.

Dates covered February 24 to June 19, 1961; Sept. 20, 1961 to April 22, 1962 and May 9 to October 10, 1963

Day	February		March		April		May		June		Source
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	
1			43	41	48	43	47	45	60	50	OSGC, W. Stout
2			42	40	46	44	47	44	59	51	
3			41	39	46	42	45	43	60	52	
4			42	40	46	40	43	41	61	52	
5			41	40	46	40	44	41	56	53	
6			41	39	47	41	45	43	54	50	
7			44	40	48	41	47	43	56	47	
8			43	41	44	43	48	44	54	49	
9			44	41	44	42	47	45	51	49	
10			42	40	45	42	47	44	56	47	
11			43	41	47	43	46	43	55	50	
12			43	40	46	43	47	44	59	49	
13			43	42	44	42	47	44	61	50	
14			44	42	47	41	48	45	63	53	
15			44	42	50	43	49	45	65	54	
16			45	42	49	44	54	46	66	56	
17			44	43	46	44	52	46	65	55	
18			46	41	44	41	55	46	64	55	
19			44	42	42	39	56	47	-	55	
20			43	42	44	39	53	47			
21			46	41	45	42	51	46			
22			44	43	41	39	50	46			
23			45	42	42	40	49	46			
24	44	-	45	42	46	42	54	45			
25	42	40	44	42	45	42	55	47			
26	43	40	43	41	50	43	53	49			
27	43	40	44	39	49	42	54	47			
28	43	41	47	40	50	44	53	47			
29			47	40	46	45	53	48			
30			47	42	48	44	52	49			
31			45	44			56	47			
Averages	43.0	40.2	43.8	41.1	46.0	42.0	49.9	45.3	59.2	51.4	

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Table 14 (continued)

Thermograph
 Type of Instrument (Taylor) Stream or Impoundment Sandy R. Location Marmot Dam, river mile 30.
 Dates covered 9-20-61 to 4-22-62 Source OSGC

Day	September		October		November		December		January		February	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1			55	48	45	43	44	43	42	40	43	40
2			55	49	44	42	44	43	43	40	44	40
3			56	49	46	44	43	42	44	41	42	40
4			56	50	44	41	44	42	42	41	43	41
5			55	49	43	40	44	42	44	41	43	40
6			55	50	44	41	42	41	44	43	42	41
7			50	47	44	41	41	40	44	43	42	41
8			49	43	45	42	42	40	44	42	44	42
9			49	46	45	41	40	38	42	39	44	42
10			50	48	47	44	38	33	38	37	44	42
11			48	47	44	43	36	33	40	37	43	40
12			50	48	43	41	38	36	40	39	43	41
13			54	49	43	40	40	37	40	39	44	42
14			56	52	45	42	39	37	39	39	44	42
15			55	51	40	38	41	39	41	39	44	42
16			53	49	39	36	41	40	40	39	43	42
17			49	45	40	37	40	39	40	38	43	42
18			51	45	42	39	40	39	38	36	43	40
19			49	46	41	40	41	40	36	33	43	41
20	54	-	46	45	41	39	43	41	33	33	44	40
21	53	50	45	43	42	39	43	41	34	33	42	38
22	54	47	-	44	44	42	43	42	33	33	40	39
23	54	47	Not changed this week.		44	43	43	43	34	33	39	37
24	53	46			43	42	43	42	37	34	37	34
25	54	48			41	39	42	41	40	38	37	34
26	53	47			41	39	42	41	41	39	36	33
27	54	46			43	41	42	40	41	40	36	33
28	53	51	45	-	44	43	44	41	41	38	35	33
29	51	48	45	41	44	43	44	43	42	39		
30	50	47	46	41	44	43	43	41	43	40		
31			46	42			42	41	42	39		
Averages	53.0	47.7	50.7	46.4	43.2	40.9	41.7	40.3	40.6	38.2	42.4	39.4

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Table 14 (continued)

Type of Instrument Thermograph
(Taylor) Stream or Impoundment Sandy R. Location Marmot Dam, river mile 30.
Dates covered 9-20-61 to 4-22-62 Source OSGC

Day	March		April	
	Max.	Min.	Max.	Min.
1	36	35	44	41
2	36	34	44	42
3	36	34	46	40
4	39	36	44	42
5	40	38	45	42
6	41	39	44	42
7	41	39	43	41
8	41	39	43	41
9	40	37	43	41
10	40	38	46	41
11	41	38	48	40
12	43	37	49	42
13	44	37	49	43
14	44	38	49	43
15	44	38	46	43
16	44	40	49	41
17	46	39	50	43
18	45	39	51	44
19	45	41	48	45
20	44	40	45	43
21	40	39	50	43
22	43	40	-	43
23	43	40		
24	42	41		
25	43	41		
26	43	41		
27	42	40		
28	45	39		
29	47	40		
30	47	40		
31	48	40		
Averages	42.4	38.6	46.5	42.1

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Table 14 (continued)

Thermograph
 Type of Instrument (Partlow) Stream or Impoundment Sandy River Location Marmot Dam ladder, left bank in
 the top pool of the ladder. River mile 30 Dates covered 5-9-63 to 10-10-63 Source OSGC, Basins

Day	May				June				July				August			
	Water		Air		Water		Air		Water		Air		Water		Air	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1					53	50	57	50	56	47	59	43	59	53	72	49
2					51	47	51	44	55	51	59	49	58	54	70	47
3					47	45	48	43	59	49	65	46	58	57	64	52
4					48	46	48	45	57	52	60	50	59	57	68	55
5					48	46	48	46	58	51	65	49	59	58	58	53
6					47	45	48	43	57	52	58	52	59	58	66	54
7					47	45	48	44	53	51	53	50	59	57	70	49
8					48	47	49	46	54	50	56	48	59	57	72	50
9	44	44			49	46	50	43	63	51	54	50	59	57	61	57
10	45	44	43	34	56	45	60	42	52	50	52	49	59	56	71	54
11	44	43	42	38	57	49	63	46	56	48	54	49	60	57	73	53
12	43	42	44	39	56	52	64	53	60	50	63	51	61	59	69	58
13	47	42	54	34	60	50	68	50	63	54	67	53	60	58	61	57
14	50	43	59	38	62	51	73	50	61	54	59	54	58	57	64	54
15	48	46	52	43	64	54	76	54	55	52	58	51	58	55	68	49
16	52	43	59	39	63	55	74	55	57	50	61	48	59	56	69	49
17	56	45	74	42	63	53	73	52	56	52	59	51	59	57	67	50
18	57	48	73	50	62	54	79	52	61	53	66	49	58	57	62	51
19	58	48	79	38	60	54	64	54	61	53	60	49	58	57	60	53
20	60	39	83	56	58	52	59	51	60	55	62	55	57	56	59	52
21	59	39	71	51	52	49	51	46	62	55	67	54	56	55	57	52
22	59	49	56	50	51	48	51	46	62	54	60	50	57	55	63	53
23	52	47	56	46	50	48	50	47	59	50	66	46	55	54	57	52
24	52	47	54	46	50	48	50	47	58	45	60	53	54	53	52	46
25	54	46	58	45	54	49	54	43	59	53	61	50	54	53	55	46
26	52	46	54	42	56	48	55	40	61	53	66	47	56	53	62	47
27	56	46	63	44	53	49	54	43	63	56	72	51	57	55	63	47
28	56	47	70	44	50	48	50	46	61	57	65	54	57	55	63	47
29	59	50	66	48	50	47	59	45	60	56	59	53	58	55	65	49
30	56	50	56	50	53	48	54	45	57	55	59	53	58	56	56	53
31									57	54	57	49	56	56	56	54
Averages	52.8	45.4	60.3	43.9	53.9	48.9	57.6	47.0	58.3	52.0	60.7	50.2	57.9	55.9	63.6	51.3

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Table 14 (continued)

Thermograph
Type of Instrument (Partlow) Stream or Impoundment Sandy River Location Marmot Dam ladder, left bank in the
top pool of the ladder. River mile 30. Dates covered 5-9-63 to 10-10-63 Source OSGC Basins

Day	September				October			
	Water		Air		Water		Air	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	56	55	57	53				
2	58	56	63	54				
3	59	56	70	48	55	-	56	-
4	60	57	70	52	55	52	50	48
5	60	58	65	52	52	50	52	48
6	60	57	65	50	52	50	51	44
7	59	57	64	54	52	48	53	42
8	62	55	69	52	53	50	54	44
9	62	58	70	55	53	52	57	49
10	62	57	61	57	53	52	56	48
11	57	54	61	50				
12	60	55	63	53				
13	60	56	55	57				
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
25								
26								
27								
28								
29								
30								
31								
Averages	59.6	56.2	64.1	52.8	53.1	50.6	53.6	46.1

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Dams and Barriers Major artificial barriers affecting anadromous fish are

Marmot Dam, the Portland municipal water supply dam on the Bull Run River, and a dam on the Little Sandy River.

Marmot Dam is located on the Sandy River at river mile 30 (Figure 8). The approximately 30-foot structure, although laddered, is believed to cause some delay to upstream migration of salmon and steelhead. Additional ladder steps, plus attraction water facilities, were constructed by Portland General Electric Company in 1956.

Link-belt screens were installed in the Marmot diversion canal just below the dam in 1951 to prevent fish losses. After installation, efficiency was considered good, but repairs were made in 1963 to prevent fish losses which first became evident in 1961. Efficiency will be reassessed in 1964. Downstream migrant fish were trapped in the screen bypass in the spring of 1963 as part of the Game Commission's steelhead research program. Table 15 lists fish numbers and species which were collected at the screen during this period.

TABLE 15

Downstream Migrant Fish Diverted into Bypass Trap at
Marmot Dam Canal Screen, Sandy River, March 21 to June 27, 1963

Dates	Steelhead	Coho (Silver) Salmon	Chinook Salmon	Other Game Species	Nongame Species
March 21-31	51 (6) ^{1/}	165	-	Rb 1 Ct 26	Cot 8 L 4
April	634 (47)	381	5	Rb 14 Ct 75 Br 2 Wf 1	Cot 2 L 1
May	16,502 (133)	5,166	124	Rb 123 Ct 240 Br 1	Cot 1 L 7
June 1-27 ^{2/}	8,062 (22)	3,372	40	Rb 53 Ct 289	-
Totals	25,249 (208)	9,084	169	825	23

^{1/} Numbers in parentheses are spawned-out adults included in total.

^{2/} Trap did not operate on June 15, 16, 17, 22, 23 and 24. Only steelhead numbers for these days were calculated and are included in the total of steelhead for June.

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The Bull Run River dam (Headworks dam) is a low, uncladded concrete structure located at river mile 6.2, or 0.2 mile below Bull Run Reservoir #2. This dam, which diverts Portland municipal water, forms the upper limit of anadromous fish in that river. The pool beneath the dam is where adult summer steelhead are observed each summer.

A 15-foot uncladded concrete dam is located in the Little Sandy River at river mile 1.7 (Figure 9). This structure intercepts flows of both the Little Sandy River and Marmot Canal and diverts them to the Bull Run powerhouse via Roslyn Lake. Total diversion is made except during high flow periods when some spill occurs. As a result, few anadromous fish are attracted into the stream. Occasionally adult steelhead are observed below the dam in spring months. Coho spawning was recorded in the lower mile in 1963. With adequate flows this section could provide spawning and rearing for numerous salmon and steelhead. Also, provision of a ladder at the dam would make several additional miles of good spawning area available. If this were done, screening of the canal would be necessary to prevent fish losses.

Natural barriers to anadromous fish exist in a few streams. The foremost is a series of high falls on Salmon River near river mile 14. All of the Columbia Gorge tributaries have high falls near their mouths which form the upper limits of anadromous fish use. In most other subbasin streams, particularly those of the upper Sandy River system, steep gradients rather than falls prevent further fish access

FISH DISTRIBUTION STUDY

In the summer of 1963, a fish distribution study was conducted in the Lower Willamette Basin similar to that made in the Middle Willamette Basin in 1962. The primary purpose was to obtain more detailed information on distribution of anadromous salmonids. Other objectives were to obtain rough fish and game fish distribution data for application to the concurrent stream flow study, for application in future water developments or uses, and to indicate relative fish

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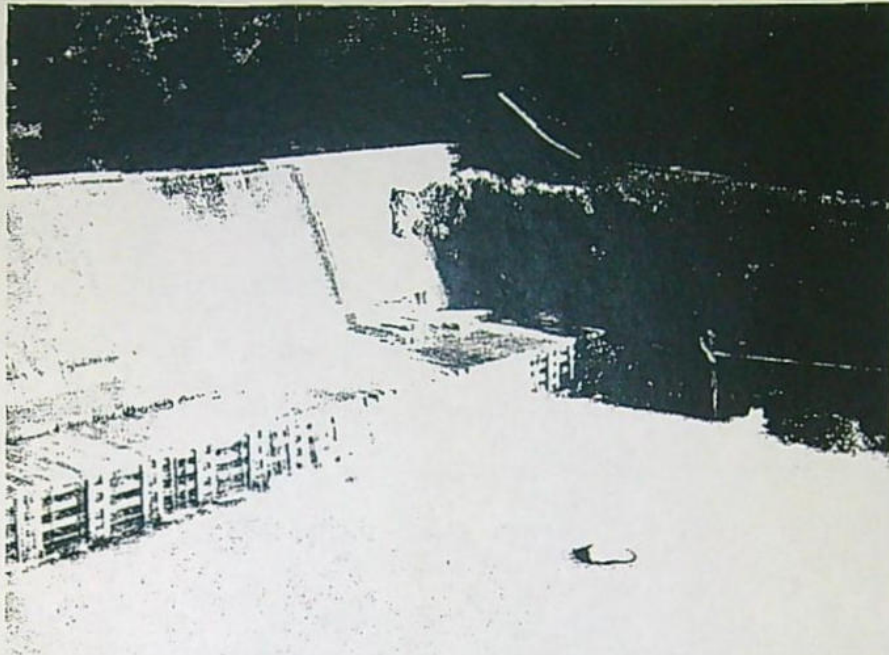


Figure 8. Marmot Dam showing fish ladder on south bank, river mile 30. July 1963.



Figure 9. Little Sandy River Dam with diversion canal in foreground, river mile 1.7. November 21, 1963.

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numbers and stream values for individual fish species.

Sufficient time was not available to study all basin drainage systems. Streams selected were those in which fish distribution information was most lacking.

Electrofishing gear was used for most fish collection. This consisted primarily of a 115-volt A.C. gasoline generator connected to a pulsator capable of emitting A.C. or D.C. at various voltage settings. The gear proved to be highly successful for collection in all except the larger streams. Some use of seines was made in areas difficult to reach with the electric equipment.

As in previous studies, the numbers of sampling stations on each stream were dictated by stream lengths. A number of stations were sampled in areas above falls to check on types of fish present and the possibility that anadromous fish might have negotiated the falls.

Study results assisted in construction of the anadromous fish plates in the appendix. Detailed results of the fish distribution study are presented in Appendix VII.

STREAM FLOW STUDY

Flows affecting fish were studied in major streams of the basin from March 1962 to February 1964. Study emphasis was placed on determining minimum flow volumes for both rearing and spawning of anadromous species. The most important result was the formulation of recommended minimum flows for game fish maintenance. These are presented by semimonthly periods for individual streams in Appendix I.

Insufficient time occasionally did not permit adequate studies to formulate complete flow requirements for all portions of the year. This shortage of time, plus the high number of streams in the basin, likewise prohibited study in every stream possessing important or potentially important fish populations or habitat.

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Recommended volumes are based primarily upon biological requirements of salmonids. These requirements were described in a prior report ^{1/} and will be discussed briefly in the rearing and spawning flow sections of this report. Present water uses and existing stream flows were also considered in forming the recommendation. Water uses were determined from field observations and State Water Resources Board records. Flow information was obtained from field measurements conducted during the study period and from U. S. Geological Survey records.

Most recommended flows are below the average stream discharges for the periods listed, with the possible exceptions expected to occur in lower elevation streams in late summer and early fall. The recommendations are intended to protect the normally existent waters from excessive appropriations which would result in lesser amounts being available for anadromous fish production needs. While the listed flows are primarily those for anadromous species, generally they will adequately accommodate resident game species as well. Also, though not necessarily the best volumes for angling, these flows if present would provide sufficient water for this purpose.

Recommendations for flows which would provide for the development of each stream's full potential (optimum flows) were not made. Neither are these volumes intended to represent the most desirable amounts for release from present or future impoundments. If the probability occurs for provision of flows above the listed minimums in any stream, additional study should be conducted to determine best volumes for fish life.

Wherever possible the flow locations shown in Appendix I have been designated at mouths or confluences of streams, U. S. Geological gage sites or some easily recognizable landmark. The flows listed for each location are those which should always arrive at and depart from the designated point and do so without regulation which would cause drastic variations from the recommended volumes in portions of

^{1/} "The Fish and Wildlife Resources of the South Coast Basin, Oregon, and Their Water Use Requirements, December 1962."

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the stream. It is realized that such variations occur below powerhouses in sections of the Clackamas and Sandy Rivers and would be difficult to minimize.

Water quantities in the portions of the Columbia and Willamette Rivers within the basin, excluding associated water quality problems, are generally considered adequate for salmonid production. Due to the large size and complexity of water quality problems in these two rivers, no flow recommendations are included in this report. Unless pollution in the Willamette River is lessened, greater summer and fall releases of good quality water from upstream storage will be necessary to provide acceptable flows for fish and other aquatic organisms in this river.

Rearing and spawning flows in the lower Clackamas River and rearing flows in the lower Sandy River will require further study before recommendations for fish can be made. Tentative study of these flows is planned during 1964.

REARING FLOWS

Streams important and potentially important to anadromous fish were examined periodically throughout the summer rearing period in 1963. During these visits existing stream flows and temperatures were measured and sections of the streams were studied to determine minimum volumes necessary for rearing. Recommended minimum rearing flows derived from the studies are included in Appendix I. Although stream rearing of most anadromous fish juveniles occurs throughout the entire year, summer and early fall months are those usually considered in "rearing flow" discussions. The existing rearing flow volumes and accompanying temperatures measured during the 1963 investigations, plus a few in 1962, are presented in Appendix II. Current meters were employed in making many of the flow measurements. Modified versions of standard U. S. Geological Survey techniques were often employed; however, accuracy was considered relatively high.

The size and health of a population of young salmon or steelhead during stream residency is dependent upon certain essential rearing conditions. Adequate food,

shelter and a suitable medium in which to live are the three basic environmental conditions required for successful rearing. These requirements rely upon stream flows of proper quantity and quality. Without flows of proper quantity and quality, any or all of the basic requirements may not be satisfied. The exclusion of but one necessary requirement can be sufficient to have limiting effects upon a fish population.

It was determined during rearing flow studies conducted in the South Coast Basin in 1961 and 1962 that certain minimum volumes normally fulfill food, shelter and suitable medium requirements. To satisfy these basic rearing requirements it was determined that each stream must possess a particular "live" flow over its entire length. This live flow should have a minimum depth of between one and two tenths of a foot over a substantial portion of each riffle regardless of stream size. Such a flow satisfies one basic requirement, i.e. food, and at the same time normally satisfies the other two, i.e. shelter and a suitable medium in which to live, with possible exceptions created by undesirable water qualities. A flow of this depth enables juvenile salmonids to move between pool areas, to avoid predation and/or crowded conditions, and provides adequate flow for downstream migration (Hutchison, 1962). It is not necessary to provide this minimum depth over the entire area of every riffle as long as sufficient flow is present to provide the needed passage and food production conditions. This concept was incorporated in Lower Willamette Basin rearing flow studies.

The type of flow described in the previous paragraph is not always adequate to provide acceptable water quality; however, no effort was made to include such consideration in the flow recommendations. To attempt to do so would be difficult and would create a lack of uniformity in selection of the recommended minimum volumes. With few exceptions, adequate water qualities would be expected to accompany the recommended quantities. Streams which experience water quality problems with existent flows have been mentioned.

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Methods for measurement of stream rearing requirements for salmonids are still largely in the formulative stages. It is probable that actual measurement of some of the integrated factors concerned with rearing will never be attainable and that flow analysis relevant to fish needs will of necessity continue to rely upon indices and judgment based on knowledge of fish, their environmental requirements and familiarity with each stream. Studies of factors related to rearing are presently being conducted by several groups directed from Oregon State University and by the Water Resources Section of the Oregon Fish Commission. The latter agency is specifically investigating effects of stream flows upon rearing.

SPAWNING FLOWS

To determine stream flows necessary for anadromous fish spawning, sections of major spawning areas were examined in each stream studied. Investigations were conducted whenever possible at times of actual spawning. More than one investigation on an individual stream was often necessary due to presence of more than one fish species and to varying winter flow conditions.

Measurements of the two primary criteria considered--water depth and velocity over available spawning gravel--were obtained with current meters. Minimum water depth for chinook salmon spawning was considered to be 0.8 of a foot, while coho (silver) salmon and steelhead require at least 0.6 of a foot of water. Proper spawning velocities for all three species were considered to range between 1.0 and 2.5 feet per second as measured 0.4 of a foot from the stream bottom. These criteria were selected as the result of measurements of numerous redds of the species concerned by Oregon Game Commission personnel and other fishery workers.

In determining recommended minimum spawning flows included in Appendix I, the desirable depths and velocities described above were required over substantial portions of each stream's spawning areas. Fish species for which the spawning

flows are recommended may be ascertained by referring to the salmon and steelhead distribution plates in the appendix. Spawning periods for the anadromous species present in each major stream system were shown in Figure 4.

In three streams, upper Clackamas River, lower Sandy River and Gales Creek, detailed studies utilizing gravel transects were undertaken to determine desirable spawning flows for salmon and/or steelhead. It may have been more desirable to base all spawning flow recommendations on data developed with transects; however, to do so much more time and effort would have been required than was available. Discussion of the studies conducted on the three streams follows.

Clackamas River Spawning Flow Study

A technique known as the "average velocity analysis" (Sams and Pearson, 1963) was used in the upper Clackamas River in 1963 to determine optimum spawning flows for spring chinook. Ten transects were established on representative gravel bars in or near the "Big Bottom" area between river miles 57.4 and 65.3. The average velocity method employs the following formula:

$$V = \frac{F}{WD}$$

V = Average water velocity in feet per second over the entire transect at a given flow.

F = Total flow in cubic feet per second.

W = Width of the transect in feet at a given flow.

D = Average depth in feet of the transect at a given flow.

Stream width and average depth over each transect were measured at four different volume flows. These four flows were obtained from U.S. Geological Survey gage #2080 at river mile 64.8. Average water velocities over individual transects were then computed using the above formula. The means of the average velocities over all transects at each flow were plotted with the total flows to form a curve (Figure 10). This curve illustrates the average velocity-volume flow relationship. The optimum spawning flow is determined from the point where the

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SPAWNING FLOW DETERMINATION, UPPER CLACKAMAS RIVER
SPRING CHINOOK SALMON

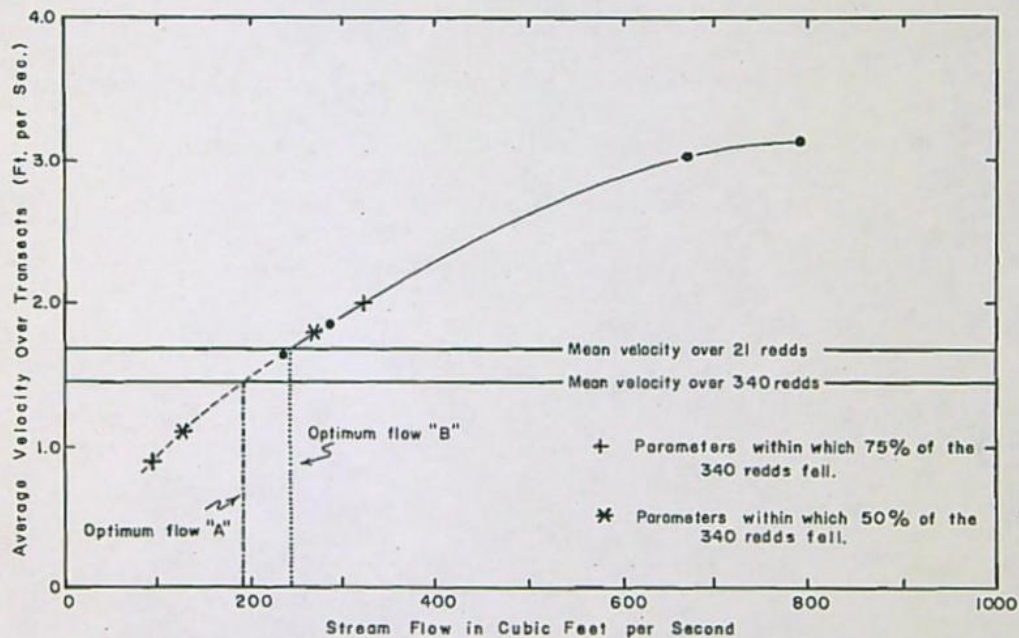


Figure 10. Spawning flow determination for spring chinook salmon in the upper Clackamas River using average velocity analysis. Optimum flows at U.S.G.S. gage 14-2080. Optimum flow "A" based upon measurement of 340 spring chinook redds in Willamette Valley streams (see Table 16); optimum flow "B" based upon measurement of 21 spring chinook redds in the Clackamas River system (Table 17).

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curve intercepts the average water velocity at which spring chinook spawn.

The average velocity at which spring chinook spawn was determined by measuring water velocities over 340 redds in several streams of the Willamette River system (Table 16). It might be most desirable to use velocities from the Clackamas River system only. For this reason velocities over the 21 redds measured in this system above the uppermost flow regulation (Three Lynx powerhouse) were plotted in Figure 10 separately from the 340 redds. The Clackamas system redd measurements are presented in Table 17. Average water velocities over the Clackamas redds were higher than those over the 340 redds mainly because Clackamas system flows are greater during the time of spring chinook spawning than flows in most of the other streams, enabling the salmon to select deeper, faster-moving water in which to spawn.

In using the average velocity method, assumption is made that water depths over the gravel bars for fish spawning and upstream passage will be adequate at the projected flow. This assumption is valid if the transects are carefully selected. Several spring chinook were observed on three of the Clackamas River transects during transect measurements conducted at a flow of 235 cfs. This volume afforded adequate water depth for both passage and spawning. The 240 cfs flow projected from the 21 redds is considered to be a truer optimum spawning flow than the projected 190 cfs flow from the 340 redds (see Figure 10).

The Big Bottom area has been considered as a potential damsite. If a dam is constructed, the data included here would be valuable in establishing proper flow releases for anadromous fish spawning. However, the Big Bottom area contains much of the river system's best spawning gravel for anadromous fish. Construction of such an impoundment would inundate large quantities of excellent spawning gravel.

Sandy River Spawning Flow Study

There are extensive gravel bars for anadromous fish spawning in the lower Sandy River. This river section experiences considerable use by spawning spring

TABLE 16

Water Depths and Velocities Measured over 340 Spring Chinook
Salmon Redds in Willamette River System Streams, 1961-1963^{1/}

Water Depth ^{2/} (feet)	No. of Redds	Average Velocity ^{2/} (feet per second)	No. of Redds
0.3	7	0.45	3
0.4	9	0.5	1
0.5	11	0.6	4
0.6	26	0.7	10
0.7	32	0.8	15
0.8	30	0.9	21
0.9	47	1.0	23
1.0	45	1.1	25
1.1	29	1.2	25
1.2	24	1.3	29
1.3	9	1.4	24
1.4	22	1.5	15
1.5	10	1.6	24
1.6	8	1.7	27
1.7	8	1.8	23
1.8	8	1.9	20
1.9	7	2.0	14
2.0	5	2.1	5
2.1	0	2.2	14
2.2	0	2.3	3
2.3	1	2.4	5
2.4	1	2.5	3
2.5	1	2.6	3
		2.7	1
		2.8	1
		2.9	0
		3.0	1
		3.1	1
Means 1.03		1.46	

^{1/} Of the 340 total redds, Fish Commission personnel measured 270 and Game Commission personnel 70. Measurements were obtained from Clackamas, Little North Santiam, McKenzie, Molalla and South Santiam River systems.

^{2/} Measured one foot upstream from each redd.

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TABLE 17

Water Depths and Velocities Measured over 21 Spring Chinook
Salmon Redds in Upper Clackamas River System, 1963 ^{1/}

Stream	Date	Redd Number	Water Depth (feet)	Average Velocity (feet per second)
Clackamas River	9-25-63	1	1.4	1.99
above Three Lynx	9-26-63	2	1.9	1.95
powerhouse	"	3	1.9	2.18
	"	4	1.1	3.04
	9-30-63	5	1.1	1.32
	"	6	1.2	1.50
	"	7	1.2	1.25
	10-1-63	8	1.4	1.29
	"	9	1.4	1.27
	"	10	0.9	1.38
	"	11	0.8	1.16
	"	12	2.4	1.83
Collawash River	10-2-63	13	1.2	3.11
	"	14	1.0	2.38
	"	15	1.2	1.41
	"	16	1.7	1.27
	"	17	1.7	1.38
	"	18	0.8	1.21
	"	19	0.6	1.07
	"	20	0.9	0.72
Hot Springs Fork Collawash River	10-2-63	21	1.0	2.71
Means			1.28	1.69

^{1/} These 21 redds are included in the 340 redds in Table 16. Measurements made one foot upstream from each redd.

and fall chinook salmon. Some coho (silver) salmon and steelhead trout also utilize this area.

A spawning flow study was conducted between river miles 6 and 11 in the fall of 1963. Objectives were to determine optimum flows for chinook salmon spawning and to investigate effects of severe river fluctuations upon reproduction. Optimum flow was determined by the "average velocity analysis" method as used in the upper Clackamas River. Seven gravel transects were established. One was later discarded because high flows bypassed it via another channel. Total flows

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were determined by adding volumes recorded by U. S. Geological Survey gage #1425 at river mile 17.7 to measured flows of tributaries entering the river below the gage.

Transect measurement was complicated by extreme diurnal river fluctuations caused by the Bull Run powerhouse. Crest travel time of water releases from the powerhouse was determined by use of temporary staff gages placed just above and below the section of river containing the transects. In this way it was possible to measure the transects early in the morning before releases reached the study area or after the release crests reached the area and stabilized.

Figure 11 shows the average velocity-volume flow relationship curve constructed from measurement of the transects at three volume flows. An optimum flow of 510 cfs was projected using the 340 spring chinook redd measurements obtained from Willamette Valley streams (Table 16). Numerous water depths and velocities were measured over lower Sandy River chinook redds, but few were representative due to rapid river fluctuations. Figures 12, 13 and 14 show one of the transects at each of the three flows at which transect measurements were made.

On October 11, 1963, flow extremes in the transect area were approximately 100 cfs and 855 cfs. Maximum water depth fluctuations between these two extremes determined with staff gages placed on riffles were 1.43 feet at Buck Creek (river mile 12.7) and 1.20 feet at Dabney Park (river mile 5.9). Crest travel time of the releases, beginning at 6 a.m. at the Bull Run powerhouse, took 3 hours 50 minutes to reach Buck Creek and 6 hours 20 minutes to reach Dabney Park. Rise time from start to crest was from 20 to 30 minutes at both locations.

Water velocities and/or depths over spring chinook redds were measured at both flow extremes. Water measured over a redd near Buck Creek was 0.4 foot deep with an average velocity of approximately 0.50 foot per second at 100 cfs and 1.3 feet deep with an average velocity of 3.04 feet per second at 855 cfs. An adult female chinook was observed on the redd at each flow extreme but was not seen digging at either flow. Water depth over a redd at river mile 4.5 varied

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SPAWNING FLOW DETERMINATION, LOWER SANDY RIVER
SPRING CHINOOK SALMON

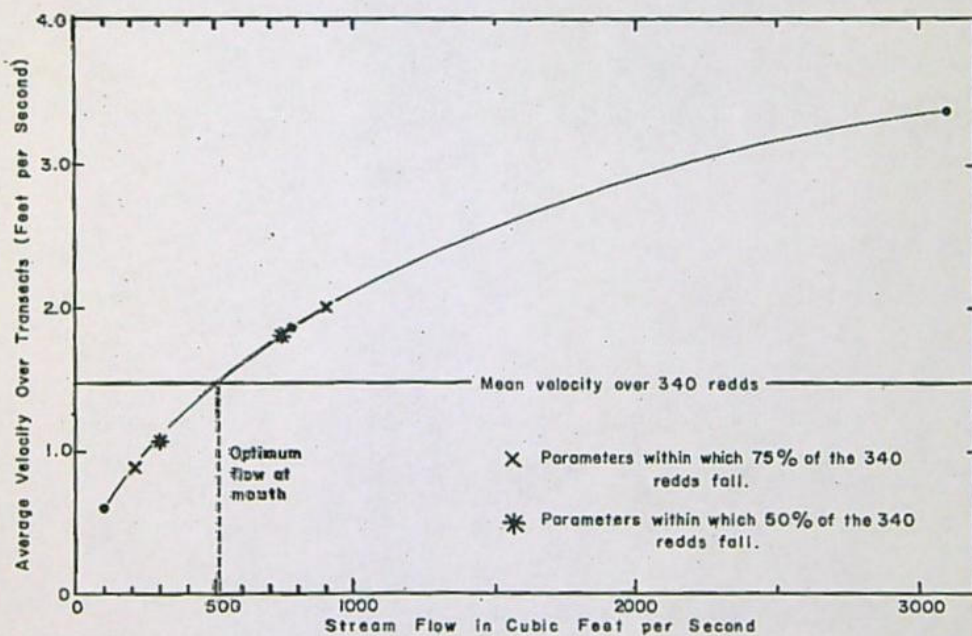


Figure 11. Spawning flow determination for spring chinook salmon in the lower Sandy River using average velocity analysis. Optimum flow at mouth is based upon measurements of 340 spring chinook redds in Willamette Valley streams (see Table 16).



Figure 12. Lower Sandy River spawning gravel transect at flow of 100 c.f.s. Oct. 11, 1963.



Figure 13. Same transect at flow of 775 c.f.s. October 17, 1963.



Figure 14. Same transect at flow of 3,100 c.f.s. November 21, 1963.

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from 0.5 to 1.2 feet on October 17 at similar flow extremes. Of 25 chinook salmon redds measured once at varying flow stages in the study area in October, the lowest average water velocity was approximately 0.5 foot per second and the highest was 4.14 feet per second. Water depths varied from 0.5 to 2.7 feet. A few other redds were seen in deeper water at high flows, but excessive velocities prohibited measurement.

Two chinook were observed in the river near Buck Creek at a flow of 100 cfs attempting to swim upstream over a riffle. Both fish finally gave up and returned to a shallow pool below. Water over the entire riffle was shallow and it is doubtful if the fish could have passed upstream without increased flow.

As a result of the extreme diurnal river fluctuations, many of the redds observed had long, narrow shapes and were situated near the upper breaks of riffles. Spawning females had apparently moved either upstream or downstream on the same riffle to compensate for the high water fluctuations which resulted in the unusual configuration of the redds. It would be desirable to make a more definitive study in this area to determine effects of these fluctuations upon the success of salmon and steelhead spawning and egg and fry survival.

Gales Creek Spawning Flow Study

The Gales Creek system possesses some of the Tualatin drainage's best spawning gravel. The stream bed is composed primarily of excellent spawning gravel above stream mile 4. Large numbers of coho salmon utilize the system. Fish distribution work conducted in the summer of 1963 showed that Gales Creek is one of the Tualatin River tributaries most heavily used by steelhead. Good spawning potential for chinook salmon, which were once present, also exists.

A study was conducted in the spring of 1962 to determine proper spawning flows for steelhead and coho salmon. The "usable width" method as used in several Middle Willamette Basin streams was employed.

Eleven spawning gravel transects were established in two sections of the creek. The two sections have different characteristics. The upper, between stream miles

12 and 13, is narrow and fast-moving. The lower section between stream miles 9 and 10.5 is wider and generally slower. Iller Creek and Clear Creek, two important tributaries, enter Gales Creek in the lower section. Six transects were established in the upper section and five in the lower.

Water depths and velocities were measured across each transect at four different flow levels. The criteria used in making flow recommendations for most other basin streams were employed. Any parts of the transects not covered by at least 0.6 foot of water flowing at a velocity between 1.0 and 2.5 feet per second were not considered usable for coho salmon or steelhead spawning. The velocity measurements were taken 0.4 foot from the stream bottom, the area in which fish swim while constructing a redd. Widths of usable gravel thus determined were plotted with the measured total flows to form two curves (Figure 15). These curves illustrate the flow-usable spawning gravel relationship in the two study sections.

Because of the narrow conformation of the upper section, flows larger than approximately 85 cfs resulted in a reduction of usable gravel area due to excessive water velocities. Stream volumes in the lower section, being less confined, were favorable for spawning over a greater flow range.

As a result of the study, flows of 70 cfs and 100 cfs in the upper and lower sections, respectively, were selected as proper amounts for coho salmon and steelhead spawning. Iller and Clear Creeks were determined to require 13 cfs and 15 cfs, respectively, for spawning (see Appendix I) by the regular, less detailed flow analysis method used on most basin streams. These volumes added to the recommended 70 cfs of the upper section produce a flow in the lower section which approximates the 100 cfs recommended there.

On April 25, 1962 measured flows were 75 cfs in the upper section and 98 cfs in the lower section. A few steelhead were observed spawning in both stream sections, further indicating that such flows were suitable for spawning.

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PER CENT UTILIZABLE SPAWNING GRAVEL, GALES CREEK
STEELHEAD AND SILVER SALMON

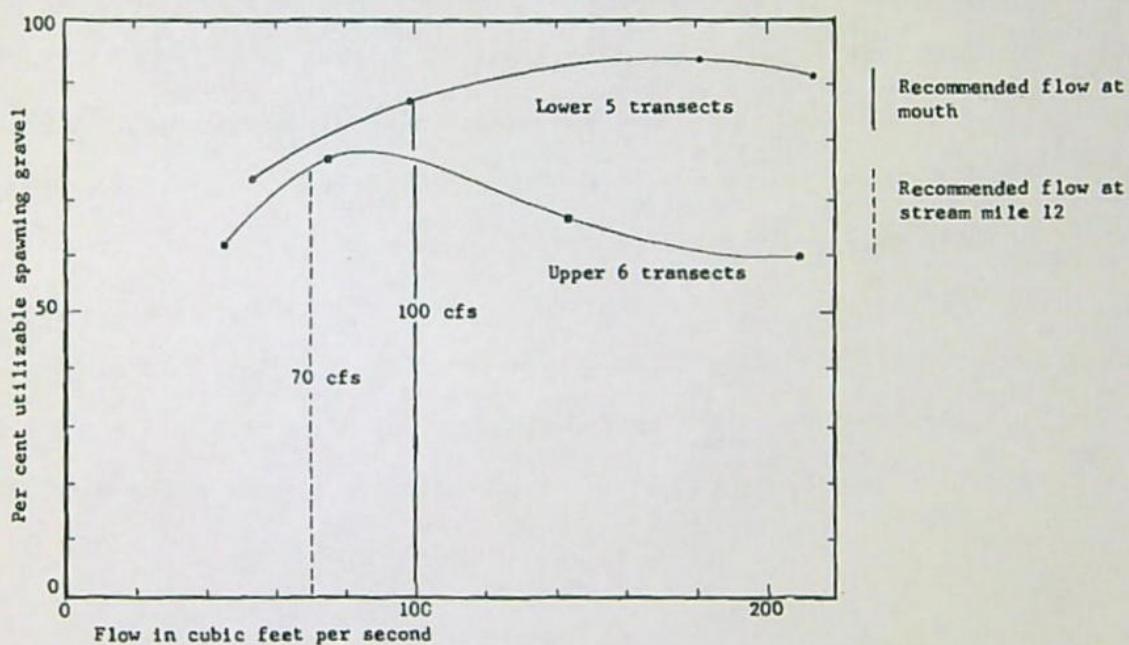


Figure 15. Per cent of gravel utilizable for steelhead trout and silver salmon spawning in Gales Creek as measured at 11 transects (usable width method).

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GAME RESOURCES OF THE LOWER WILLAMETTE BASIN

GENERAL

The land use pattern of the Lower Willamette Basin ranges from that of the densely populated metropolitan-industrial area of the City of Portland to the virgin timber and nearly inaccessible wilderness of the Bull Run Reserve only a few miles distant. As far as game is concerned, however, the most important land areas are the many acres of valley bottom, mixed crop lands, marginal farm lands, and cutover or burnt-over timberlands. Waterfowl and upland game are the most important game products of the valley lands of this basin and deer are of greatest importance in the timbered areas.

The Bull Run Reserve, Portland's municipal water supply, encompasses over 100,000 acres of forested land (Figure 16). Game present include deer, grouse and mountain quail. No public access is permitted.

Foreseeable population growth in this basin would greatly increase public requirements for harvestable quantities of game. More intensive management of the land and water areas for upland game, big game and waterfowl production so as to offset the constant decline in habitat land available can do much to satisfy these needs.

BIG GAME

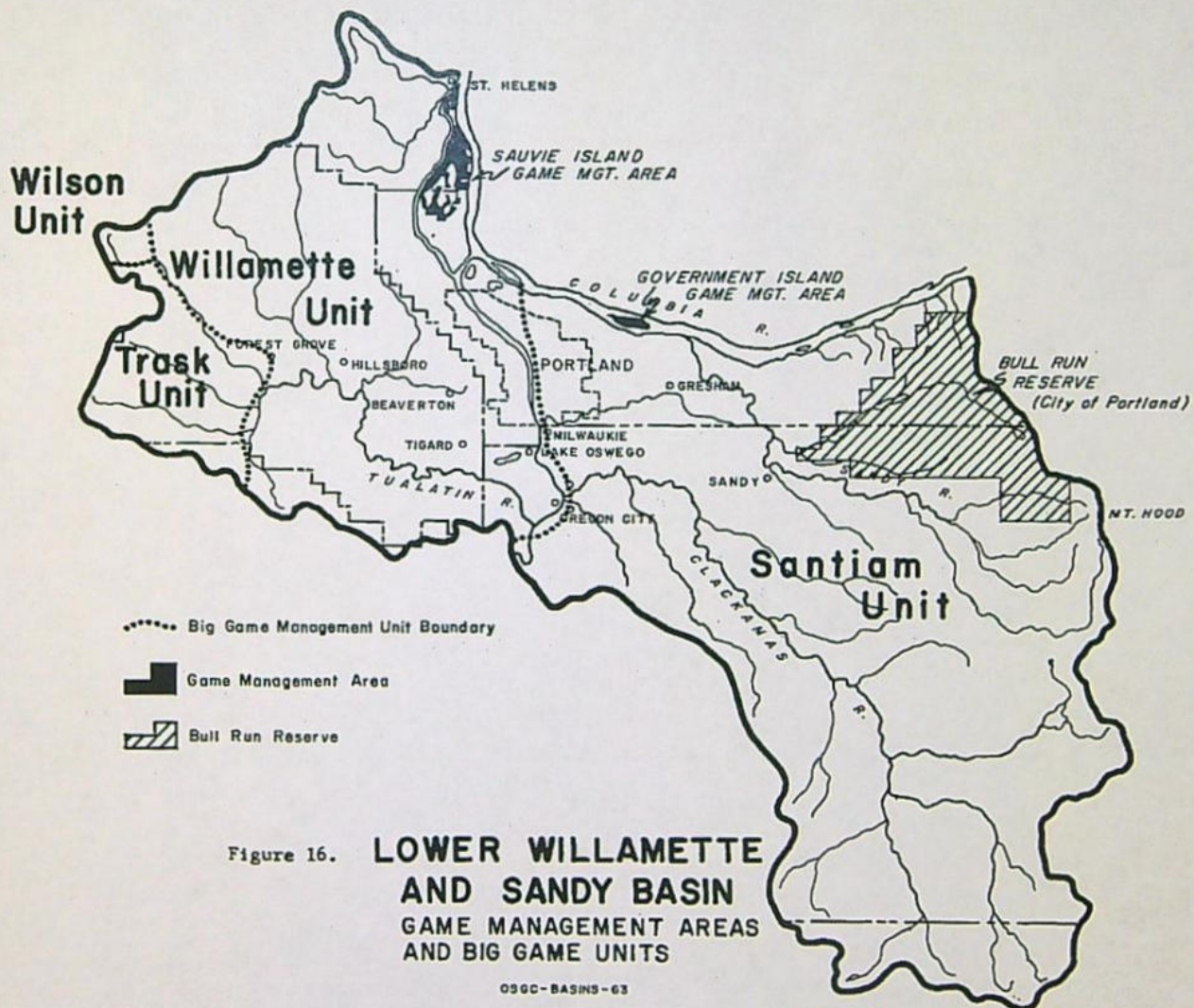
Forest edges, scattered wood lots and timber regrowth area are the primary producing lands for the important blacktail deer populations of the Lower Willamette Basin. These deer populations have provided over 60,000 man-days of recreation annually (Table 18) with an annual harvest of about 4,000 animals. Hunting pressure is partially manipulated through use of four management units involved in the Lower Willamette Basin (Table 19). Hunter pressure, deer harvest and percentage of success for a portion of the basin is shown in Figure 17.

Coastal or Roosevelt elk are found primarily along the western edge of the basin and in the headwaters of the Clackamas drainage. Their numbers are relatively few

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TABLE 18

1962 and 1963 Deer Seasons, Lower Willamette Basin

Game Management Unit	Estimated Hunters*		Estimated Harvest*		Days Hunted per Deer Killed		Estimated Hunter-days	
	1962	1963	1962	1963	1962	1963	1962	1963
Santiam	3,460	3,290	1,950	1,420	15	18	29,250	25,560
Willamette	2,500	2,420	2,040	1,520	14	17	28,560	25,840
Trask	1,500	1,640	920	850	9	12	8,280	10,200
Wilson	100	130	60	60	9	10	540	600
Totals	7,560	7,480	4,970	3,850	-	-	66,630	62,200

*1962 and 1963 random hunter survey returns by game management unit prorated according to estimated hunting pressure in basin.

TABLE 19

Big Game Management Units, Lower Willamette Basin

Game Management Unit	Total Unit Area (sq.mi.)	Unit Area in Basin		Hunting Pressure in Basin	
		Sq. Miles	Per Cent	Deer (%)	Elk (%)
Santiam	4,180	1,640	39	25	40
Willamette	1,730	800	46	65	0
Trask	1,000	130	13	20	5
Wilson	510	30	6	2	0
Total	-	2,600	-	-	-

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GENERAL DEER SEASON DATA, WASHINGTON COUNTY AND WILLAMETTE GAME MANAGEMENT UNIT

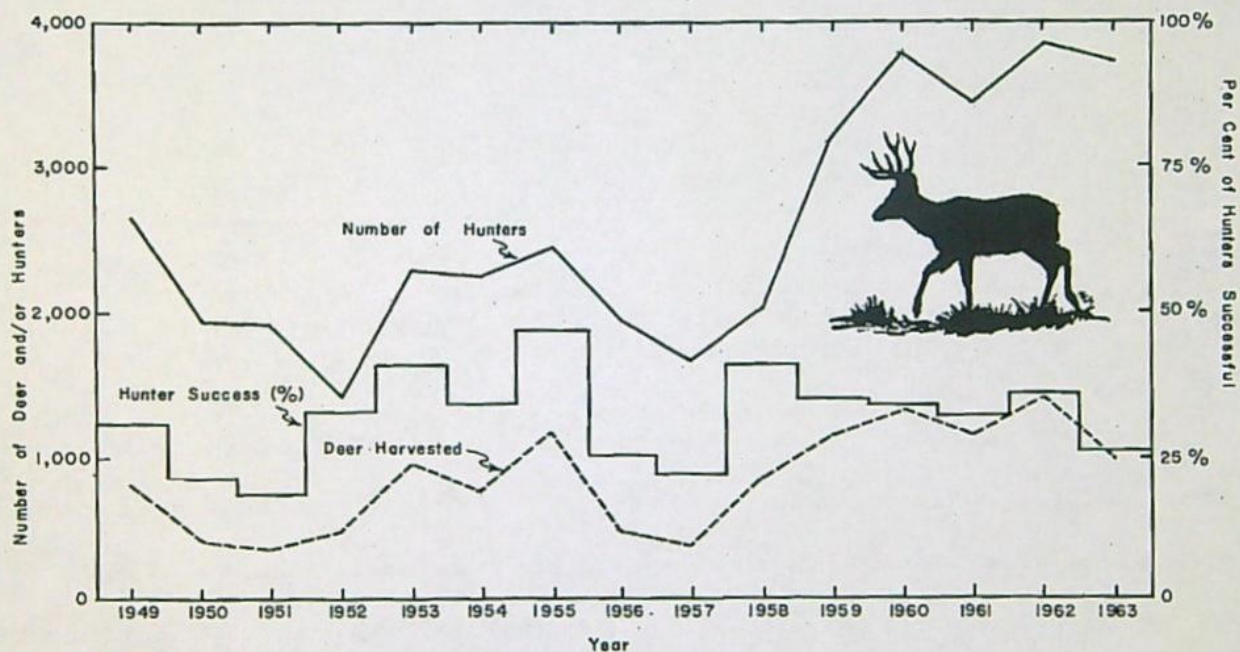


Figure 17. General Deer Season Data, Washington County (1949-1959) and Willamette Game Management Unit (1960-1963). Based on hunter report card returns (1949-1959) and random hunter survey (1959-1963). Prior to 1952 bucks only season. The figures from the Willamette Game Management Unit are generally comparable to the Washington County data since nearly the same geographical hunting area is included in both subdivisions. This area is quite representative of the Lower Willamette Basin as a whole.

15-year total harvest:	12,431 deer
15-year average harvest:	829 deer
15-year average number of hunters:	2,573
15-year average hunter success:	31%

and scattered, however, with an estimated annual harvest of less than 10 animals (Table 20).

Whitetail deer are occasionally seen in a few scattered areas primarily along the Columbia River.

TABLE 20

1962 and 1963 Elk Seasons, Lower Willamette Basin

Game Management Unit	Estimated Hunters*		Estimated Harvest*	
	1962	1963	1962	1963
Santiam	44	42	3	3
Willamette	0	0	0	0
Trask	2	3	1	2
Wilson	0	0	0	0
Totals	46	45	4	5

*1962 and 1963 random hunter survey returns by game management unit prorated according to estimated hunting pressure in basin.

Since big game are frequently dependent upon the limited areas of habitat in stream valleys, particularly during the winter, there is a potential conflict between some water resource developments and big game populations. When water storage project inundate many acres of valley floor, there is often an irreplaceable loss of important winter big game habitat. During severe weather with heavy snows these valley areas are used by wintering game from many miles of surrounding higher country. Elimination of a small amount of productive winter range can adversely affect big game populations over a much wider area. Even with these western Oregon herds the quality of habitat in lower elevation ranges frequently is the factor limiting populations.

The greatest potential for future big game production appears to exist in the Clackamas River drainage. Present and proposed timber clear cuttings will provide highly productive though short-term deer habitat. The outlook is that increasing rates of timber cutting and associated road construction will greatly increase the

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big game production and hunter utilization of this area. Nevertheless, these increased game populations will be highly dependent upon lowland and valley floor forage supplies during severe winters. Large water storage impoundments can and will seriously reduce low elevation big game winter range in the Clackamas drainage.

UPLAND GAME

Upland game species of the Lower Willamette Basin fall into three broad groups-- farm land game, woodland game and migratory game. The farm land game species are the most important with the ringneck pheasant being the leader of this group. Upland game production on the basin's farm lands is very high with a correspondingly high hunter pressure.

The pheasant is the most popular upland game bird of the basin, but there are also important populations of valley quail, mourning doves and band-tailed pigeons available for the hunter (Figure 18). Mourning doves and band-tailed pigeons are migratory but are well utilized by the hunter during the September seasons. Doves and pigeons provide some of the most productive hunting in the basin in terms of numbers of birds available.

Woodland game species include ruffed grouse, blue grouse and mountain quail. Hunting pressure is relatively light despite periodically high populations.

WATERFOWL

Waterfowl hunting is popular in the Lower Willamette Basin primarily due to the presence of attractive waterfowl habitat on Sauvie Island in close proximity to the state's center of population. Since 1949, when acquisition of the Sauvie Island Game Management Area began, the area has steadily increased in popularity. Over 9,000 hunter-days were recorded in 1963, with the average since 1949 exceeding 7,800. Average success during the period was over 1.7 birds per man-day (Figure 7, page 30, and Figure 19, page 68).

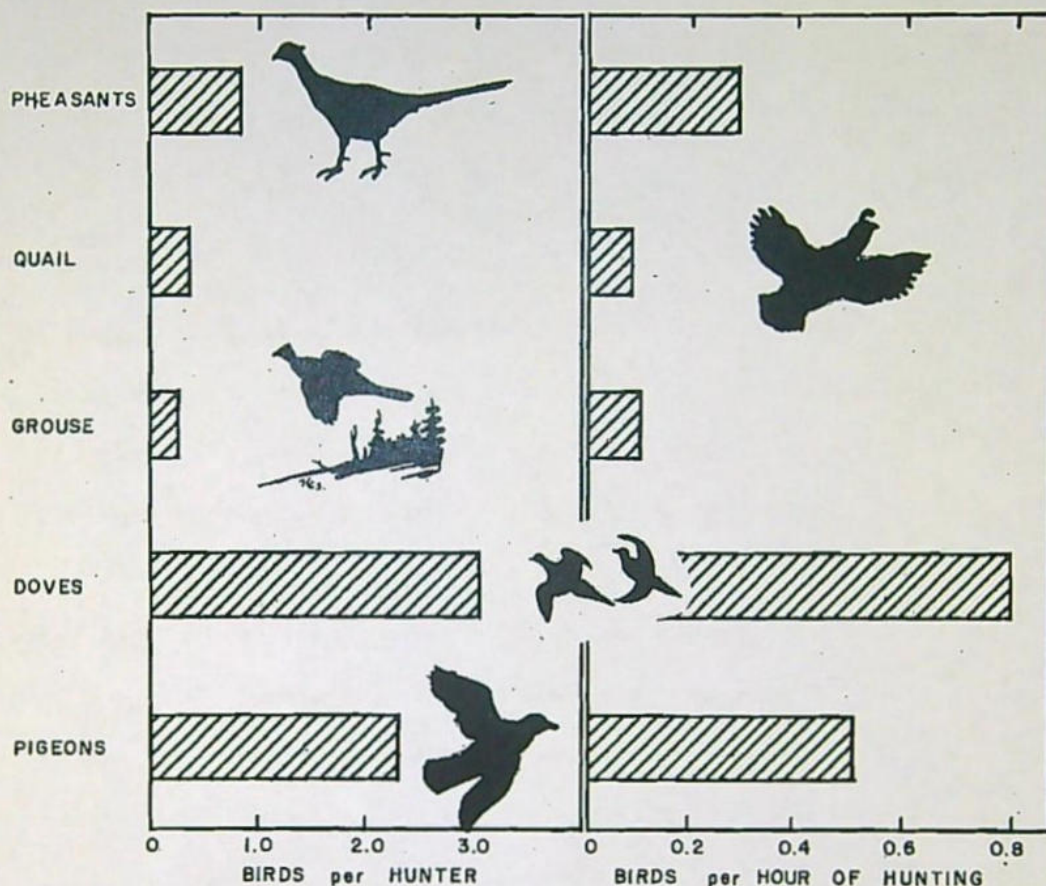
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UPLAND GAME HUNTER SUCCESS
LOWER WILLAMETTE BASIN



	1962	1961	1960	1959	1958	1957	Mean
Ringneck Pheasant							
Hunters Checked	39	75	75	53	89	-	
Birds per Hunter	1.0	0.8	0.9	0.9	0.8	-	0.88
Birds per Hour	0.2	0.3	0.5	0.4	0.1	-	0.3
Valley and Mountain Quail							
Hunters Checked	39	52	-	-	-	-	
Birds per Hunter	0.5	0.2	-	-	-	-	0.35
Birds per Hour	0.1	-	-	-	-	-	0.1
Ruffed and Blue Grouse							
Hunters Checked	5	23	13	11	34	-	
Birds per Hunter	0.2	0.3	0.1	0.2	0.5	0.8	0.35
Birds per Hour	0.1	0.2	0.04	0.1	0.1	-	0.11
Mourning Dove							
Hunters Checked	4	33	-	-	-	-	
Birds per Hunter	1.0	3.6	3.3	4.6	2.8	-	3.06
Birds per Hour	0.3	1.3	-	-	-	-	0.8
Band-tailed Pigeon							
Hunters Checked	136	44	62	130	90	-	
Birds per Hunter	2.3	1.4	2.9	2.9	2.2	-	2.34
Birds per Hour	0.4	0.3	0.6	0.9	0.6	-	0.56

Figure 18. Upland game hunter success in the Lower Willamette Basin, averages of opening week and hunter-check data from 1958 to 1962. Pheasant hunters were the most numerous in the basin as a whole even though more individual pigeon hunters were checked due to the concentrated nature of this hunting.

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WATERFOWL SHOOTING GROUND SUCCESS, SAUVIE ISLAND GAME MANAGEMENT AREA

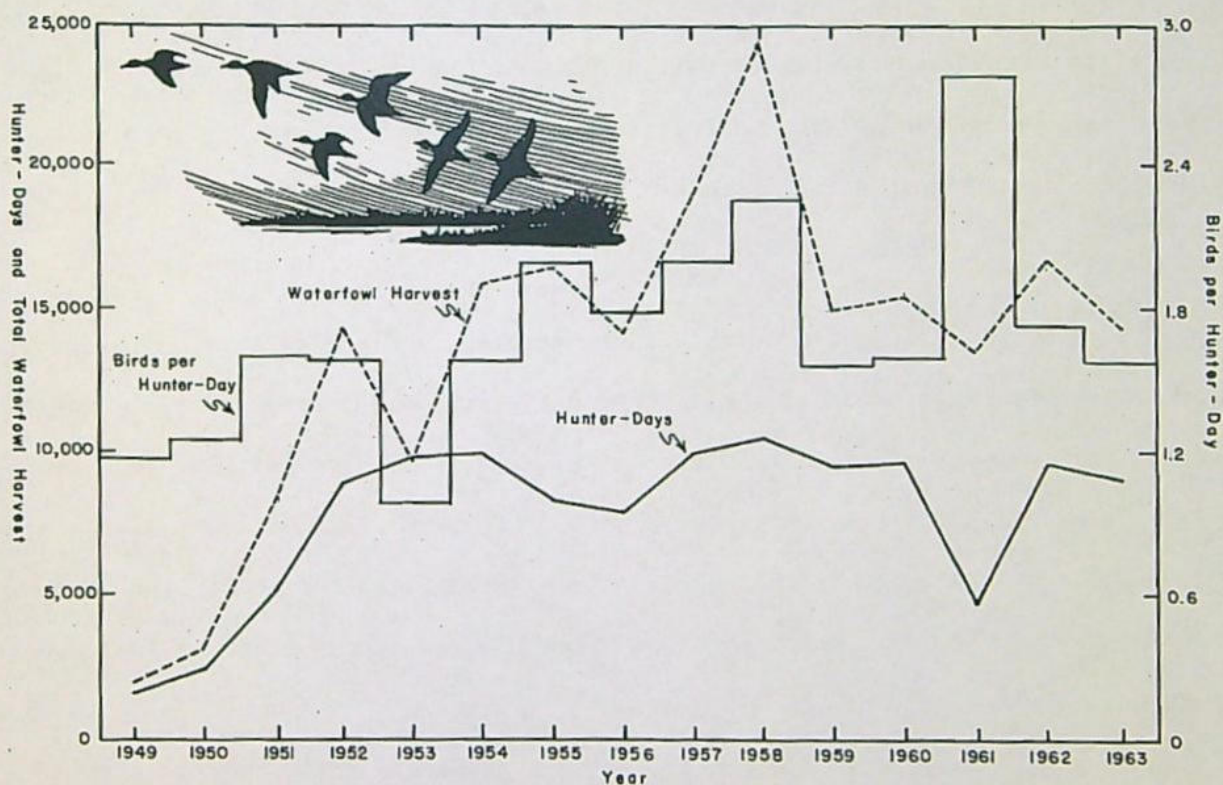


Figure 19. Summary of shooting ground success at Sauvie Island Game Management Area, 1949-1963.
 15-year total: 117,088 hunter days 202,480 total harvest
 15-year average: 7,806 hunter days 13,480 total harvest 1.73 birds per hunter day

Between 100,000 and 400,000 wintering waterfowl are found in this basin each year during the annual nation-wide waterfowl inventory (Figure 20). Mallards, widgeons and pintails are the most prevalent species though substantial numbers of snow geese, Canada geese and greenwing teal are also counted (Figure 21 and Tables 21 and 22).

Generally waterfowl require a dependable supply of relatively clean water in the form of rivers, sloughs, marshland and ponds. Presently these requirements appear to be adequately met in the basin except in certain areas of excessive pollution. Future water developments, such as lowland storage projects, can effectively increase available waterfowl habitat. Conversely, certain practices such as stream bank revetment, channel straightening and wetland drainage can reduce or eliminate productive bird habitat.

FURBEARERS

Though of relatively minor importance, furbearers are a recognized resource of the Lower Willamette Basin. Based on the 1962-63 season trapper catch reports, beaver were the most valuable furbearer with around 800 pelts bringing in over \$8,000. Other animals trapped included otter, mink, muskrat, raccoon, skunk, weasel, opossum, fox, bobcat, coyote and nutria. Total pelt value for the 1962-63 season is estimated at \$11,600. This represents the reported catch of around 70 trappers in the area.

Water pollution, wetland drainage, water storage projects, poor watershed management and habitat destruction through stream channel work all tend to reduce furbearer production. Furbearer habitat is frequently enhanced through reduction of pollution, stabilizing of stream flows and construction of small impoundments.

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ANNUAL WINTER WATERFOWL INVENTORY
LOWER WILLAMETTE BASIN

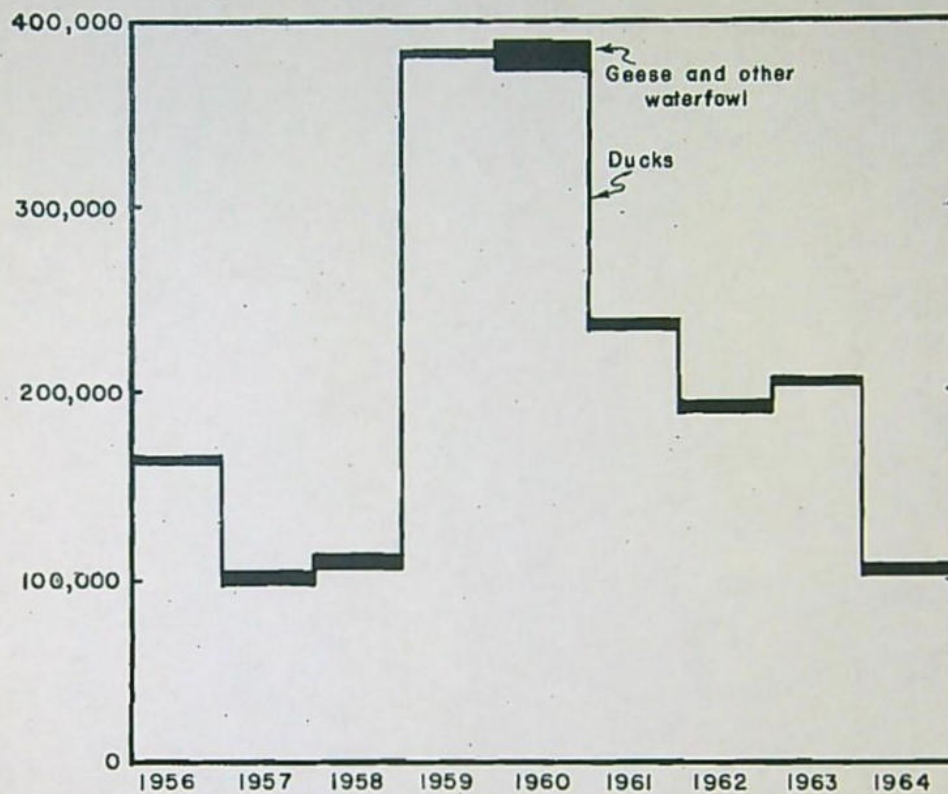


Figure 20. Annual winter inventories of waterfowl in Clackamas, Columbia, Multnomah and Washington Counties.

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PERIODIC COUNTS OF WATERFOWL, SAUVIE ISLAND GAME MANAGEMENT AREA

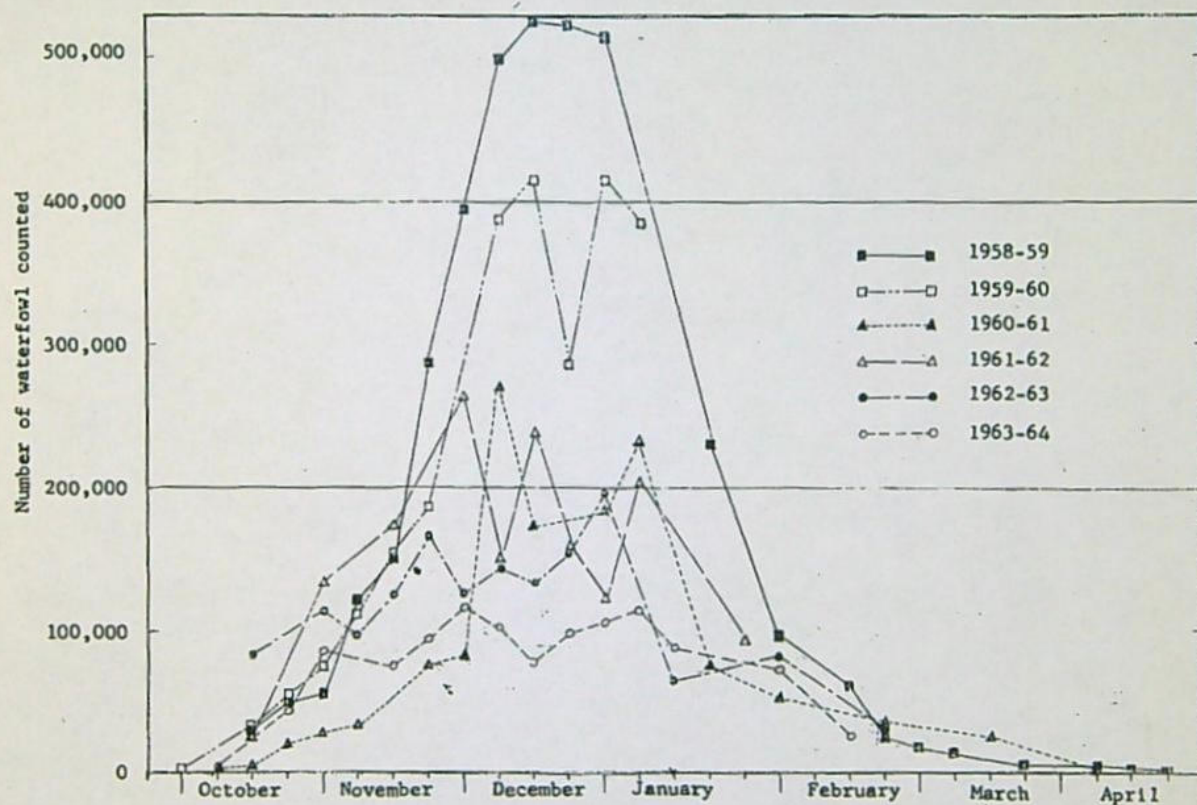


Figure 21. Regular counts of all waterfowl on the Sauvie Island Game Management Area were made during the winter months of 1958-1964. Hunting is permitted on parts of the area usually from October through December. (See also Table 22.)

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TABLE 21

Lower Willamette Basin Waterfowl Population
Annual Winter Waterfowl Survey, Clackamas, Columbia,
Multnomah and Washington Counties, 1956-1964

Species	1964	1963	1962	1961	1960	1959	1958	1957	1956
<u>Ducks</u>									
Mallard	30,706	61,789	78,506	145,455	125,375	201,010	23,452	18,200	39,080
Gadwall	35	-	-	-	-	3	-	4	-
Widgeon	18,528	72,113	32,557	48,527	121,675	137,120	51,551	55,920	55,575
GW teal	1,385	700	2,475	10	2,513	-	2,967	1,130	685
Shoveller	17	100	-	126	6	-	53	165	-
Pintail	50,735	67,409	68,675	25,011	125,525	44,020	27,573	15,845	43,505
Wood duck	-	6	-	-	-	-	-	-	-
Redhead	-	2	-	-	-	-	-	-	-
Canvasback	180	48	55	31	-	-	-	40	-
Scaup	12	100	6	-	1	32	-	216	101
Ringneck	55	-	-	21	19	-	-	120	-
Bufflehead	46	19	41	40	30	1	-	37	10
Goldeneye	6	5	-	-	-	-	-	8	1
Ruddy duck	181	27	9	35	30	28	-	15	11
Scoter	-	-	-	-	-	-	-	430	-
Merganser	69	75	12	-	45	45	88	634	6
Unidentified	1,065	3,103	8,008	16,000	2,270	-	1,800	3,200	23,550
Total									
Ducks	103,020	205,496	190,344	235,256	377,489	382,259	107,484	95,964	162,524
<u>Geese</u>									
Snow	-	-	50	-	175	125	120	150	150
Canada	1,445	2,160	1,150	1,625	4,825	415	3,151	2,640	1,735
L. Canada	-	-	1,000	-	5,300	-	-	-	-
Cackling	1,335	2	-	-	250	-	909	110	325
Whitefront	-	-	-	-	-	-	-	74	-
Total									
Geese	2,780	2,162	2,200	1,625	10,550	540	4,180	3,964	2,210
Wh. swan	534	613	920	620	284	55	98	100	78
Coot	1,234	401	475	1,188	1,215	200	471	4,250	534
Total									
Waterfowl	107,568	208,672	193,939	238,689	389,538	383,054	112,233	103,288	165,346

TABLE 22

Periodic Counts of Waterfowl, Sauvie Island Game Management Area

Month	Week	Year					
		1963-64	1962-63	1961-62	1960-61	1959-60	1958-59
September	4					1,675	
October	1	3,540			1,225		
"	2		81,750	25,202	4,549	31,224	34,796
"	3	43,592			20,123	57,830	51,517
"	4	85,204	113,895	133,494	29,427	76,940	57,051
November	1		98,490		33,640	110,137	121,773
"	2	74,252	123,775	170,666		157,420	154,083
"	3	93,225	166,315		76,910	187,725	277,971
"	4	116,907	125,550	263,472	82,182		395,970
December	1	102,025	141,723	150,665	270,044	388,270	498,675
"	2	78,797	133,070	238,138	172,914	413,916	528,079
"	3	97,866	153,880	159,017		286,515	522,285
"	4	106,080	196,910	122,031	184,160	415,675	514,295
January	1	113,380		202,625	232,345	385,005	
"	2	88,966	65,055				
"	3				78,409		230,423
"	4			93,075			
"	5	71,180	83,742		52,769		97,963
February	1						
"	2	25,600					62,253
"	3		29,617				26,210
"	4				36,850		19,382
March	1						13,432
"	2						
"	3				28,840		6,264
"	4						
April	1				1,506		3,671
"	2						2,314
"	3						1,212

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CONCLUSIONS

Major conclusions and recommendations considered necessary for the maintenance, enhancement and utilization of the basin's fish and wildlife resources relevant to water uses and developments are summarized below.

WILLAMETTE RIVER

1. Increased intensity of pollution abatement and treatment measures are necessary to improve water quality for fish life and recreational use.
2. Provision of good quality flows in the summer and fall from upstream impoundment releases should be encouraged to assist in reduction of pollution and high water temperatures in the lower Willamette River.
3. Improved passage and protection facilities at Willamette Falls for both upstream and downstream migrant fish are needed to promote anadromous fish runs.
4. Applications for future use of Willamette River water should be carefully analyzed to determine expected effects upon river quality and quantity.
5. Attempts to establish runs of such fish species as summer steelhead trout and fall chinook salmon should follow favorable advancements with items 1, 2 and 3 above.

TUALATIN SUBBASIN

1. Minimum stream flows, particularly in summer and fall months, should be established. Achievement of proper minimum volumes would depend to a large extent upon releases from future impoundments.
2. Further water appropriations from streams presently flowing less than the listed minimums in Appendix I should be discouraged wherever possible.
3. Fish passage facilities should be provided at the Tualatin River dam, river mile 3.8. Minimum flows for fish rearing and upstream passage should be established in the river below the dam.

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4. The effects of the Lake Oswego inlet canal and the falls in the lake's outlet on anadromous fish should be investigated by the fishery management agencies and proper corrections made if necessary.

CLACKAMAS SUBBASIN

1. Minimum stream flows for fish life and recreational use should be established. This is of particular importance because adequate flows presently exist in most streams, but without protection, will probably not exist in the future.
2. Clackamas River water fluctuations resulting from power generation should be further studied to determine effects on fish life. The fluctuations should be minimized whenever possible, especially during periods that they are most detrimental to fish life and recreational water use.
3. Improved upstream fish passage facilities over River Mill Dam should be provided.
4. Future water storage projects should be planned so as to minimize damage to critical big game winter range.

COLUMBIA SUBBASIN

1. Further water appropriations from streams presently flowing less than the listed minimums in Appendix I should be discouraged wherever possible.
2. Pollution abatement should be intensified in Scappoose Bay and Multnomah Channel.

SANDY SUBBASIN

1. Minimum stream flows for fish life and recreational use should be established. As in the Clackamas subbasin, adequate flows presently exist in many streams but may not in future years if not given adequate protection.

2. Additional study should be conducted in the Sandy River to determine effects of fluctuations caused by Bull Run powerhouse on fish life. Fluctuations should be minimized whenever possible, particularly at times found to be most detrimental to fish and recreational use.
3. Minimum flows in the 11.5-mile Sandy River section between Marmot Dam and the mouth of the Bull Run River should be established for anadromous fish rearing, spawning and upstream movement.
4. The possibility of providing fish passage facilities over the Little Sandy River Dam and minimum flows below the dam should be investigated.

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Appendix 1

Recommended Minimum Flows for Fish Life, Lower Willamette Basin

Stream	Location	Dec-May	June	July	Aug.	Sept.	Oct.	Nov.
- Clackamas River	Below River Mill Dam	800	650	650	650	650 800	800	800
- " "	USGS gage 2095 (Three Lynx)	640	640	400	400	400 640	640	640
- " "	Below Collawash River	500	500	300	300	300 500	500	500
- " /1	USGS gage 2080 (Big Bottom)	240	240	150	150	150 240	240	240
- Clear Creek	Mouth	110	40	40	20	20	40 110	110
- " "	Viola	70	25	20 15	15	15	25 40	70
- Collawash River	Mouth	250	200	150 100	75	75 250	250	250
- E.Fk. Collawash R.	"	30	30	20 15	10	10	15 20	30
- Elk Lake Creek	"	40	40	30 20	20 15	15	20 30	40
- Hot Springs FK.	"	75	75	75 30	20	20 75	75	75
- Deep Creek	"	35	20	10	10	10	12	35
- N. Fk. Deep Creek	"	20	3	3	1	1	1 3	20
- Tickle Creek	"	30	6	4	4	4	4 6	30
- Eagle Creek	"	125	100	100 50	40	40	40	125
- N. Fk. Eagle Creek	"	45	35 30	30	10	10	10	45
- Fish Creek	"	60	60	25 15	12	12	12 15	60
- " "	Confl. of Wash Creek	30	16 12	8 5	3	3	8 16	30
- Wash Creek	Mouth	25	25 10	10 5	3	3	10 20	25
- Lowe Creek	"	8	8 8	3 2	2	2	2	8
- Oak Grove Fk.	"	60	50 30	20 10	10	10	25 40	60
- Pinhead Creek	"	75	50	50	50	50	50	75
- Roaring River	"	100	100	40	40	40	40 100	100
- S. Fk. Clackamas River	"	75	50 30	25 20	15	15	15 20	75
- Sandy River /1	"	510	--	--	--	-- 510	510	510
- " "	Release from Marmot Dam	--	--	50	50	50 --	--	--
- " "	USGS gage 1370 (Marmot)	--	--	--	300	300 --	--	--
- " "	Confl. of Zigzag River	250	200	150 100	100	100 250	250	250
- Alder Creek	Mouth	25	15 10	8 5	4	4	4 25	25
- Beaver Creek	"	14	3 2	1	1	1	1 14	14
- Bull Run River	USGS gage 1400	--	--	--	12	12 --	--	--
- Little Sandy R.	USGS gage 1415	--	--	25 20	15	15	--	--
- N.Fk. Bull Run R.	Mouth	--	--	--	10	10	--	--
- S.Fk. Bull Run R.	"	--	--	--	12	12	--	--
- Cedar Creek	"	60	40 20	10	10	10 20	40 60	60
- Cedar Creek	"	45	30 20	15 8	8 6	6	6 45	45
- Clear Fk. Sandy R.	"	25	20 15	12	8	8	8 25	25

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Appendix I (continued)

Snow R (continued)

Stream	Location	Dec-May	June	July	Aug.	Sept.	Oct.	Nov.
• Gordon Creek	Mouth	50	30 20	15	15	15	20 50	50
• Lost Creek	Confl. of East Cr.	20	15	15 12	12	12	12 20	20
• Salmon River	Mouth	250	250	150 125	100 80	80 250	250	250
• " "	Confl. of South Fk.	150	150	120 90	60	60 100	150	150
• Boulder Creek	Mouth	30	20 10	8	5 4	3	3 30	30
• Cheoney Creek	"	35	20 10	8	5 4	3	3 35	35
• S. Fk. Salmon R.	"	35	20 10	8	5	5 8	15 35	35
• Trout Creek	"	35	20 5	4 3	3	3	5 20	35
• Zigzag River	"	200	150	100	75	75 200	200	200
• Camp Creek	"	25	20	20	15	15	15 25	25
• Henry Creek	"	18	10 7	4 3	2	2	2 18	18
• Still Creek	"	60	50 40	30 25	25	25 60	60	60
<u>Small streams tributary to Seappoose Bay</u>								
- Milton Creek	Confl. of Salmon Cr.	25	10 8	5 4	3	3	3 5	25
- Cox Creek	Mouth	6	3 2	1 0.5	0.5	0.5	0.5 1	6
- Salmon Creek	"	5	1 0.5	0.5	0.5	0.5	0.5	5
- N. Fk. Seappoose Cr.	"	40	25 20	20 8	5	5	5 7	40
- Alder Creek	"	8	3	1	1	1	1	8
- Cedar Creek	"	6	3	1	1	1	1	6
- Chapman Cr. (Lizzie Cr.)	"	6	4 3	2	1	1	1	6
- N. Fk. of N. Fk.	" (Joins S. Fk. of N. Fk. 0.2 mi. above Mollenhoar Cr.)	7	4 3	3 1	1	1	1 2	7
- Sierkes Cr. (Deep Cr.)	Mouth	7	7 0.5	0.5	0.5	0.5	0.5	7
- S. Fk. of N. Fk.	"	8	4 3	2 1	1	1	1 2	8
- S. Fk. Seappoose Cr.	Confl. of Raymond Cr.	25	15 12	5	5	5	5 6	25
- Gourlay Cr.	Mouth	10	3 2	2 0.5	0.5	0.5	0.5 1	10
- Raymond Cr.	"	8	2 1	1 0.5	0.5	0.5	0.5 1	8
<u>Small streams tributary to Columbia River</u>								
Bridal Veil Cr.	Mouth	-	-	-	5	4	-	-
Horsetail Cr.	"	-	-	-	3	3	-	-
Latourell Cr.	"	-	-	-	3	3	-	-
McCord Cr.	"	-	-	-	1	1	-	-

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Appendix I (continued)

Stream	Location	Dec-May	June	July	Aug.	Sept.	Oct.	Nov.
Moffet Cr.	Mouth	-	-	-	1	1	-	-
Multnomah Cr.	"	-	-	-	4	4	-	-
Onsenta Cr.	"	-	-	-	3	3	-	-
Tanner Cr.	To arrive at hatchery dam	-	-	-	15	15	-	-
Wahkeena Cr.	Mouth	-	-	-	2	2	-	-
Small streams tributary to Willamette River								
Johnson Creek	USGS gage 2115	25	5 4	4	4	4	4 5	25
Crystal Springs	Mouth	15	10	10	10	10	10	15
Tualatin R.	USGS gage 2075 (West Lin)	30	25	20 15	15	15	30	30
" "	USGS gage 2035 (Dilley)	30	25	20 15	15	15	30	30
" " 2/	River mile 70	65	30 20	15 10	10	10	10 15	20 65
Dairy Creek	Mouth	15	15	12 10	10	12	15	15
- E. Fk. Dairy Cr. 2/	River mile 13	50	30 25	25 15	10	10	10 12	15 50
- Denny Cr. 2/	Mouth	15	4 3	3	2	2	2	4 15
- Plentywater Cr. 2/3/	"	5	2	2	1	1	1	2 5
- McKay Cr. 2/ 3/	River mile 15.5	36	18 9	4	4	4	10 18	36
- E. Fk. McKay Cr.	Mouth	10	9 5	2	2	2	5 9	18
- Gales Creek 1/	"	100	50 35	35 15	12	12	12 15	100
- " " 1/	River mile 12	70	40 25	15 8	8	8	8 20	40 70
- Beaver Creek 2/	Mouth	17	3 3	3 1	1	1	1	2 17
- Clear Creek 2/	"	17	10 6	3	3	3	3	5 17
- Iller Cr. 2/ 3/	"	23	5 3	2 1	1	1	1 2	2 23
- Little Beaver Cr.	"	10	7 4	2 1	1	1	4 7	10
- N.Yk. Gales Cr.	"	25	4 3	3 2	2	2	2	3 25
- S.Fk. Gales Cr.	"	20	3 2	2 1	1	1	1	2 20
- McFee Cr.	Confl. of Gulf Canyon Cr.	12	12 10	7 4	2	2	4 7	10 12
- Scoggin Cr.	Mouth	40	25 15	12 6	6	6	15 30	40
- Seine Cr. Sawd Cr.	"	25	10 6	3 2	2	2	2	3 25
- Tanner Cr.	"	9	6	3 2	1	1	1 3	6 9

1/ The optimum spawning flow listed is based on Oregon Game Commission studies utilizing transects.

2/ The optimum spawning flow listed is based on Oregon Fish Commission studies.

3/ The lowest summer flow listed is the recommended minimum rearing flow based on Oregon Fish Commission studies.

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APPENDIX II

Miscellaneous Flows and Temperatures Obtained in
Lower Willamette Basin Streams in 1962 and 1963

Stream	Date	Time	Temp. °F.		Flow Cfs	Location	Remarks
			Water	Air			
Clackamas R.	8-22-62	8:15 AM	58	65		USGS gage 14-2080	Big Bottom gage
"	7-10-63	9:25 AM	48	51		"	"
"	8-8-63	12:30 PM	55	70		"	"
"	9-5-63	3:20 PM	52	77		"	"
"	8-22-62	4:00 PM	54	70		USGS gage 14-2095	Three Lynx gage
"	6-5-63	6:40 PM	50	53		"	"
"	7-10-63	4:30 PM	53	60		"	"
"	8-8-63	5:35 PM	56	73		"	"
"	9-5-63	2:40 PM	53	79		"	"
"	7-11-63	5:10 PM	58	65		USGS gage	1.5 miles below Carver
"	8-6-63	10:45 AM	62	64		"	"
"	9-4-63	2:00 PM	64	88		"	"
Big Cr.	8-22-62	6:50 AM	51	65	3	1.25 miles above mouth	
Cabin Cr.	8-22-62	8:30 AM	50	65	0.5	0.75 mile above mouth	
Clear Cr.	8-21-62	9:45 AM	67	73	20	Mouth	
"	6-14-63	3:30 PM	69	86	55* ^{1/2}	"	C
"	7-11-63	5:00 PM	61	65	80	"	D
"	8-6-63	10:20 AM	63	66	32*	"	C
"	9-4-63	2:15 PM	69	89	20*	"	C
"	6-14-63	4:00 PM	68	88	36*	Viola	C
"	7-11-63	3:00 PM	60	67	60*	"	D
"	8-6-63	9:45 AM	62	60	25	"	C
"	9-4-63	10:40 AM	63	77	18*	"	C
Collawash R.	8-22-62	11:15 AM	58	70	105	Mouth	
"	6-5-63	2:00 PM	48	53	480*	"	D

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Appendix II continued

Stream	Date	Time	Temp. °F.		Flow Cfs	Location	Remarks
			Water	Air			
Collawash R.	7-10-63	2:35 PM	54	59	225*	Mouth	D
"	8-8-63	2:00 PM	63	88	108*	"	C
"	9-5-63	4:35 PM	65	78	58*	"	C
E. Fk. Collawash	6-5-63	3:45 PM	46	53	95	Mouth	D
"	7-10-63	12:00 N	50	53	32*	"	D
"	8-8-63	3:15 PM	57	71	21	"	C
"	9-5-63	5:55 PM	56	66	8*	"	C
Elk Lake Cr.	6-5-63	3:45 PM	47	53	98*	Mouth	D
"	7-10-63	12:15 PM	51	53	50*	"	D
"	8-8-63	3:00 PM	57	71	27*	"	C
"	9-5-63	6:00 PM	56	66	16*	"	C
Hot Springs Fork	8-22-62	11:30 AM	58	70	40	Mouth	
"	6-5-63	5:20 PM	48	55	196*	"	D
"	7-10-63	1:45 PM	54	54	112*	0.5 mile above mouth	D
"	8-8-63	4:15 PM	65	72	29*	"	C
"	9-5-63	5:05 PM	62	77	18.3*	"	C
Deep Cr.	8-21-62	10:30 AM	62	74	7	0.6 mile above mouth	
"	6-14-63	2:45 PM	68	72	25*	"	C
"	7-11-63	3:45 PM	59	64	23*	"	D
"	8-6-63	12:00 N	62	67	11*	"	C
"	9-4-63	1:40 PM	65	89	8.7*	"	C
N. Fk. Deep Cr.	8-21-62	11:00 AM	68	75	0.3	Boring	Just below mill pond ladder
"	6-14-63	2:15 PM	71	79	2.7*	"	4 dead silver fingerlings in ladder C
"	7-11-63	4:00 PM	64	67	4*	"	D
"	8-6-63	11:10 AM	66	66	0.4	"	C
"	9-4-63	1:20 PM	67	88	0.3	"	Some pollution C

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Appendix II continued

Stream	Date	Time	Temp. °F.		Flow Cfs	Location	Remarks
			Water	Air			
Noyer Cr.	8-21-62	10:45 AM	67	75	0.3	Mouth	
Tickle Cr.	8-21-62	11:15 AM	67	75	4	1.1 miles above mouth	
"	6-14-63	1:30 PM	61	77	7.1*	"	C
"	7-11-63	4:20 PM	58	67	10.6*	"	D
"	8-6-63	11:30 AM	58	66	5.6*	"	C
"	9-4-63	1:00 PM	59	87	5.6*	"	C
Eagle Cr.	8-21-62	11:45 AM	66	75	32	0.5 mile above mouth	
"	6-10-63	3:00 PM	56	79	273*	2.2 miles above mouth	Highway 211 D
"	7-11-63	12:10 PM	53	59	261*	"	D
"	8-6-63	1:15 PM	62	67	65*	"	C+
"	9-4-63	11:30 AM	65	81	33*	"	C
Curran Cr.	8-21-62	12:15 PM	65	70	0.2	Highway 211	Bridge at Heiple Jct.
N. Fk. Eagle Cr.	6-10-63	5:00 PM	60	70	49*	Mouth	D
"	7-11-63	1:45 PM	55	62	76*	"	D
"	8-6-63	12:40 PM	60	65	20*	"	C+
"	9-4-63	11:45 AM	60	84	8.8*	"	C
Fish Cr.	8-21-62	3:30 PM	62	70	10	Mouth	
"	6-10-63	12:45 PM	52	68	130*	"	D
"	7-11-63	9:20 AM	52	54	103*	"	D
"	8-6-63	3:35 PM	66	75	18	"	C+
"	9-5-63	1:00 PM	62	79	15.3*	"	C
"	6-10-63	12:00 N	48	65	31*	Just above Wash Cr.	D
"	7-11-63	10:35 AM	50	59	17.7*	"	D
"	8-6-63	3:20 PM	56	75	4	1.0 mile above Wash Cr.	C+
"	9-5-63	1:45 PM	56	78	4*	"	C
Wash Cr.	8-21-62	3:10 PM	58	70	2.5	1.0 mile above mouth	

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Appendix II continued

Stream	Date	Time	Temp. °F.		Flow Cfs	Location	Remarks
			Water	Air			
Wash Cr.	6-10-63	11:30 AM	46	63	53*	0.5 mile above mouth	D
"	7-11-63	10:15 AM	50	56	35*	0.5 mile above mouth	D
"	8-6-63	3:00 PM	59	74	6	"	C+
"	9-5-63	1:30 PM	58	77	3.7*	"	C
Lowe Cr.	6-5-63	11:30 AM	43	53	23*	0.1 mile above mouth	Poor passage thru culvert near mouth D
"	7-10-63	10:00 AM	48	51	6.9*	"	" D
"	8-8-63	12:40 PM	54	85	2.9*	"	" C+
"	9-5-63	3:40 PM	54	72	2.2*	"	" C
N. Fk. Clackamas R.	8-21-62	2:15 PM	60	70	10	Mouth	
Oak Grove Fk.	8-21-62	5:20 PM	46	68		USGS gage 14-2087	Just below Timothy Lk.
"	8-21-62	4:40 PM	48	68		USGS gage 14-2090	Just above Harriet Lk.
"	6-5-63	6:00 PM	46	53		"	"
"	7-10-63	3:40 PM	47	60		"	"
"	8-8-63	5:00 PM	50	70		"	"
"	9-5-63	7:15 PM	49	68		"	"
"	9-5-63	8:00 PM	51	64	6	1.0 mile above Timothy Lake	
Olallie Cr.	8-22-62	10:05 AM	42	70	42	1.0 mile above mouth	
Pinhead Cr.	8-22-62	9:00 AM	44	68	80	0.2 mile above mouth	
"	6-5-63	12:10 PM	45	53	118*	"	D
"	7-10-63	10:25 AM	48	51	110*	"	D
"	8-8-63	1:00 PM	47	77	110*	"	C+
"	9-5-63	3:55 PM	47	81	102*	"	C
Last Cr.	8-22-62	10:45 AM	45	70	16	0.1 mile above mouth	
Pot Cr.	8-22-62	8:25 AM	46	65	2.5	0.25 mile above mouth	
Roaring R.	8-21-62	3:45 PM	54	70	40+	Mouth	
"	6-10-63	10:20 AM	46	62	221*	"	D

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Appendix II continued

Stream	Date	Time	Temp. °F.		Flow Cfs	Location	Remarks
			Water	Air			
Roaring R.	7-11-63	9:00 AM	49	54	131*	Mouth	D
"	8-8-63	6:00 PM	57	68	68*	"	C
"	9-5-63	2:15 PM	54	80	52*	"	C
Rock Cr.	8-21-62	10:00 AM	58	73	0.4	0.25 mile above mouth	
Sandstone Cr.	8-22-62	6:30 AM	50	65	3	0.75 mile above mouth	
S. Fk. Clackamas R.	8-8-63	11:00 AM	55	63	30*	Mouth	C
"	9-5-63	11:45 AM	56	69	21*	"	C
Squirrel Cr.	8-22-62	9:50 AM	43	70	3.5	1.0 mile above mouth	
Columbia R. Small Tributaries							
Bridal Veil Cr.	7-3-63	1:15 PM	54	65	18.3*	80 yds. below falls	1 spawned-out St C
"	8-7-63	11:00 AM	53	63	9*	"	C
"	9-3-63	3:30 PM	58	89	5.2	"	C
Horsetail Cr.	7-3-63	3:00 PM	54	74	6.9*	Old highway bridge	C
"	8-7-63	1:20 PM	56	72	4.4*	"	C
"	9-3-63	5:15 PM	56	76	4*	"	C
Latourell Cr.	7-3-63	11:45 AM	55	62	7.9*	Latourell Falls State Park	C
"	8-7-63	11:25 AM	55	64	4	"	C
"	9-3-63	4:00 PM	60	83	3.5	"	C
McCord Cr.	7-3-63	3:30 PM	57	77	5.3	Highway 30	C
"	8-7-63	1:35 PM	58	74	2	"	C
"	9-3-63	5:30 PM	59	78	1.2	"	C
Moffet Cr.	7-3-63	4:30 PM	57	78	1.9*	Highway 30 near mouth	C
"	8-7-63	2:30 PM	61	78	1	"	C
"	9-3-63	5:40 PM	59	70	1.1	"	C
Multnomah Cr.	7-3-63	2:15 PM	58	73	9.5*	200 yds. below falls	C
"	8-7-63	12:30 PM	56	70	5.3*	"	C
"	9-3-63	4:35 PM	60	78	4.3*	"	C

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Appendix II continued

Stream	Date	Time	Temp. °F.		Flow Cfs	Location	Remarks
			Water	Air			
Oneonta Cr.	7-3-63	2:30 PM	57	74	9.3*	Old highway bridge	C
"	8-7-63	1:00 PM	58	71	3.7*	"	C
"	9-3-63	4:50 PM	59	76	2.7*	"	C
Tanner Cr.	7-3-63	4:15 PM	54	78	5.9*	Highway 30	Many juvenile salmonids C
"	8-7-63	1:45 PM	60	76	1.5	"	Dry below highway br. C
"	9-3-63	5:50 PM	55	67	1.5	Just below hatchery dam	C
"	8-7-63	2:00 PM	54	77	20	Just above hatchery dam	C
"	9-3-63	6:00 PM	53	67	30	Just above hatchery dam	C
Wahkeena Cr.	7-3-63	2:00 PM	50	74	5.8*	R.R. bridge at Wahkeena Falls picnic grounds	C
"	8-7-63	12:00 N	50	67	4	"	C
"	9-3-63	4:20 PM	52	78	4*	"	C
Sandy R.	6-6-63	5:45 PM	44	54	130*	1.0 mile below Clear Fork	D
"	7-11-63	12:15 PM	49	55	130	"	D
"	8-7-63	1:20 PM	58	70	75	"	C
"	9-6-63	10:45 AM	48	64	65	"	Turbid C
"	6-6-63	6:30 PM	-	54	350	0.7 mile above Zigzag R.	D
"	7-11-63	11:30 AM	50	57	250	"	Moderately turbid D
"	8-7-63	2:00 PM	59	77	130	"	C
"	9-6-63	10:05 AM	49	59	130	"	Turbid C
"	7-11-63	2:00 PM	53	62		USGS Gage 14-1370	Marmot gage
"	8-8-63	4:10 PM	62	76		"	"
"	7-9-63	9:15 AM	57	63		River mile 6.3	Dabney State Park
"	8-8-63	6:05 PM	71	90		"	"
"	6-11-63	10:45 AM	56	68		USGS Gage 14-1425	0.9 mile below Bull Run R.
"	7-9-63	11:45 AM	56	68		"	"
"	8-8-63	11:00 AM	63	67		USGS Gage 14-1425	0.9 mile below Bull Run R.
"	9-6-63	6:30 PM	63	72		"	0.9 mile below Bull Run R. Turbid.

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Appendix II continued

Stream	Date	Time	Temp. °F.		Flow Cfs	Location	Remarks
			Water	Air			
Alder Cr.	9-12-62	10:30 AM	51	63	5	0.2 mile above mouth	Highway 26
"	6-6-63	10:15 AM	46	52	26*	"	"
"	7-9-63	1:30 PM	51	62	17.6*	"	Small diversion beneath br. (taking no water)
"	8-7-63	10:20 AM	55	64	6.1*	"	Highway 26
"	9-6-63	3:00 PM	62	75	6*	"	"
Badger Cr.	6-11-63	12:00 N	56	70	15	0.3 mile above mouth	
Beaver Cr.	9-12-62	10:15 AM	51	63	2.4	0.3 mile above mouth	
"	6-11-63	3:30 PM	66	73	3.2*	"	
"	7-9-63	8:45 AM	56	63	2.8*	"	
"	8-8-63	6:25 PM	63	86	1.2*	"	
"	9-6-63	2:10 PM	63	81	1	"	
Bull Run R.	8-22-62	2:30 PM	61	71		USGS Gage 14-1400	
"	9-12-62	9:45 AM	55	62		Just above PGE powerhouse	River mile 1.5
"	9-5-63	3:30 PM	67	82		USGS Gage 14-1400	
Little Sandy R.	6-6-63	8:00 PM	49	54		USGS Gage 14-1415	
"	7-11-63	3:00 PM	55	63		"	Approx. 20 c.f.s. over PGE dam
"	8-8-63	4:55 PM	64	75		"	Dry below dam
"	9-6-63	3:30 PM	61	76		"	"
N. Fk. Bull Run R.	9-5-63	1:45 PM	53	82	15	Mouth	
S. Fk. Bull Run R.	9-5-63	3:00 PM	56	82	18	"	
Cedar Cr.	9-12-62	10:00 AM	52	62	6	1.3 mile above mouth	First road crossing above hatchery
"	6-11-63	1:25 PM	57	71	43*	"	"
"	7-9-63	10:45 AM	56	61	29*	"	"
"	8-8-63	11:30 AM	60	68	15.8*	"	"
Clear Cr.	9-12-62	12:00 N	51	63	5	Mouth	
"	6-6-63	5:00 PM	47	54	41*	"	

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Appendix II continued

Stream	Date	Time	Temp. °F.		Flow Cfs	Location	Remarks
			Water	Air			
Clear Cr.	7-11-63	12:30 PM	50	55	30*	Mouth	I
"	8-7-63	1:35 PM	60	72	9.4*	"	C
"	9-6-63	10:15 AM	54	62	6.3*	"	C
Clear Fork Sandy R.	7-11-63	12:00 N	50	55	30*	0.2 mile above mouth	I
"	8-7-63	1:05 PM	55	68	11.5*	"	C
"	9-6-63	10:55 AM	52	67	8.1*	"	C
Gordon Cr.	6-11-63	2:50 PM	58	73	43*	Mouth	C
"	7-9-63	9:45 AM	54	62	32*	"	I
"	8-8-63	5:55 PM	66	85	20*	"	C
"	9-6-63	2:30 PM	62	75	19.5*	"	C
Lost Cr.	6-6-63	6:00 PM	44	54	38	0.5 mile above Cast Cr.	E
"	7-11-63	11:45 AM	49	57	38	"	D
"	8-7-63	12:30 PM	53	65	17.5*	"	C
"	9-6-63	10:35 AM	49	63	13.4*	"	C
Salmon R.	9-12-62	11:20 AM	50	63	80	0.3 mile above mouth	Highway 26 bridge
"	6-6-63	11:40 AM	47	52	500*	0.5 mile above mouth	D
"	7-9-63	2:00 PM	53	62	215*	"	D
"	8-8-63	3:40 PM	65	80	180*	"	C
"	9-6-63	1:50 PM	60	73	120*	"	C
"	6-6-63	2:00 PM	45	53	300	0.5 mile above S. Fk. Salmon R.	D
"	7-9-63	3:15 PM	50	60	100	"	D
"	8-8-63	1:35 PM	54	74	97*	Just above S. Fk. Salmon R.	C
"	9-6-63	12:35 PM	52	72	98*	"	C
Boulder Cr.	9-12-62	11:40 AM	54	63		Mouth	
"	6-6-63	11:00 AM	45	52	63*	"	D
"	7-9-63	1:45 PM	51	62	19*	"	D

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Appendix II continued

Stream	Date	Time	Temp. °F.		Flow Cfs	Location	Remarks
			Water	Air			
Boulder Cr.	8-8-63	3:05 PM	60	79	6.4*	Mouth	
"	9-6-63	2:30 PM	59	73	3.5*	"	
Cheaney Cr.	6-6-63	12:30 PM	47	52	50*	Mouth	I
"	7-9-63	4:00 PM	52	60	15*	"	I
"	8-8-63	12:30 PM	60	82	7.1*	"	
"	9-6-63	11:25 AM	58	70	3.8*	"	
S. Fk. Salmon R.	6-6-63	2:30 PM	-	53	60	Mouth	I
"	7-9-63	3:30 PM	50	60	14	"	I
"	8-8-63	1:30 PM	55	74	7.5*	"	
"	9-6-63	12:30 PM	53	72	5.7*	"	C
Trout Cr.	6-11-63	2:20 PM	56	72	13	0.7 mile above mouth	C
"	7-9-63	10:00 AM	53	63	7.2*	"	E
"	8-8-63	5:40 PM	62	80	5.7*	"	C
"	9-6-63	2:50 PM	58	73	5.6*	"	C
Whiskey Cr.	9-12-62	10:25 AM	50	63	0.7	0.5 mile above mouth	
Wildcat Cr.	9-12-62	10:40 AM	52	63	1.5	0.2 mile above mouth	
Zigzag R.	9-12-62	12:20 PM	48	63	90	0.3 mile above mouth	
"	6-6-63	4:40 PM	46	54	350	"	D
"	7-11-63	11:15 AM	51	57	250	"	D
"	8-7-63	2:20 PM	58	77	130*		C
"	9-6-63	9:50 AM	51	59	130*		C
Camp Cr.	9-12-62	1:05 PM	47	63	8	Approx. 0.7 mile above mouth	Camp Cr. Forest Camp
"	6-6-63	3:50 PM	45	53	55*	"	" D
"	7-11-63	10:45 AM	49	55	46*	Approx. 0.7 mile above mouth	Camp Cr. Forest Camp D
"	8-7-63	11:10 AM	51	62	25*	"	" C
"	9-6-63	8:30 AM	50	59	18*	"	" C

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Appendix II continued

Stream	Date	Time	Temp. °F.		Flow Cfs	Location	Remarks
			Water	Air			
Henry Cr.	9-12-62	12:50 PM	47	63	2	0.1 mile above mouth	
"	6-6-63	4:15 PM	45	54	14	0.5 mile above mouth	I
"	7-11-63	11:10 AM	48	56	8	"	I
"	8-7-63	10:50 AM	49	66	4.4*	"	C
"	9-6-63	8:55 AM	49	51	2.7*	"	C
Still Cr.	9-12-62	12:45 PM	50	63	16	Mouth	
"	6-6-63	3:35 PM	46	53	115*	1.3 miles above mouth	I
"	7-11-63	10:15 AM	51	57	62*	"	I
"	8-7-63	11:50 AM	55	64	33*	"	C
"	9-6-63	9:15 AM	52	52	32*	"	C
Scappoose Bay Tributaries							
Milton Cr.	9-11-62	11:00 AM	57	63	4	1.0 mile above mouth	
"	"	11:20 AM	57	63	3	1.0 mile above Yankton	
"	6-4-63	5:30 PM	52	54	14*	Yankton	Just below Salmon Cr. C
"	7-10-63	1:45 PM	57	65	7.6*	"	Just below Salmon Cr. Slightly turbid I
"	8-6-63	2:05 PM	64	74	4.6*	"	" C
"	9-4-63	3:45 PM	65	85	4*	"	" C
"	"	4:10 PM	64	85	3	3.0 miles above Yankton	C
Cox Cr.	9-11-62	11:40 AM	54	63	1	0.3 mile above mouth	
"	6-4-63	5:10 PM	52	54	3*	"	C
"	7-10-63	1:30 PM	57	65	1.5*	"	I
"	8-6-63	1:50 PM	65	73	0.8*	"	C
"	9-4-63	3:30 PM	66	85	0.6	"	C
Salmon Cr.	9-11-62	11:30 AM	54	63	0.3	0.3 mile above mouth	
"	7-10-63	1:40 PM	-	65	0.7	0.1 mile above mouth	D
"	8-6-63	2:15 PM	65	73	0.5*	"	C

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Appendix II continued

Stream	Date	Time	Temp. °F.		Flow Cfs	Location	Remarks
			Water	Air			
Salmon Cr.	9-4-63	3:35 PM	65	85	0.4	0.1 mile above mouth	C-
N. Fk. Scappoose Cr.	9-11-62	10:35 AM	58	62	5	Highway 30 bridge	
"	9-4-63	4:30 PM	70	85	6	"	C+
"	9-4-63	3:05 PM	63	85	2.6	Just above Chapman Cr.	C+
"	6-4-63	3:10 PM	52	54	32*	1.5 mile above mouth	C
"	7-10-63	11:15 AM	57	65	22*	"	D
"	8-6-63	11:20 AM	62	65	5.6*	"	C
"	9-4-63	2:20 PM	69	85	6*	"	C+
Alder Cr.	9-11-62	12:00 N	55	64	1	0.2 mile above mouth	
"	6-4-63	4:55 PM	52	54	3.2	"	C
"	7-10-63	12:30 PM	57	65	1.6*	"	D
"	8-6-63	12:55 PM	63	72	0.8*	"	C
"	9-4-63	3:15 PM	66	85	0.8	"	C+
Cedar Cr.	9-11-62	1:15 PM	55	65	0.7	Mouth	
"	7-10-63	12:15 PM	55	64	1.6*	"	D
"	8-6-63	12:30 PM	60	70	0.4	"	C
"	9-4-63	3:00 PM	61	85	0.4	"	C+
Chapman Cr.	6-4-63	4:45 PM	50	54	4.4*	Mouth	Lizzie Cr. on SWRB map C
"	7-10-63	11:40 AM	53	63	2.3*	"	D
"	8-6-63	12:45 PM	57	71	1.1*	"	C
"	9-4-63	3:05 PM	59	85	1*	"	C+
N. Fk. of N. Fk.	6-4-63	4:00 PM	50	54	5.4	Mouth	C
"	7-10-63	12:00 N	54	63	2.7*	"	D
"	8-6-63	12:05 PM	59	69	0.8*	"	C
"	9-4-63	2:45 PM	61	85	0.9*	"	C+
Sierkes Cr.	6-4-63	3:30 PM	52	54	1.9	"	Deep Cr. on SWRB map C

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Appendix II continued

Stream	Date	Time	Temp. °F.		Flow Cfs	Location	Remarks
			Water	Air			
Sierkes Cr.	7-10-63	11:30 AM	55	65	0.8	Mouth	D
"	8-6-63	11:30 AM	57	66	0.5	"	C
"	9-4-63	2:30 PM	58	85	0.4	"	C
S. Fk. of N. Fk.	6-4-63	4:10 PM	50	54	4.2*	Mouth	C
"	7-10-63	11:50 AM	53	63	3*	"	D
"	8-6-63	12:00 N	60	68	1.2	"	C
"	9-4-63	2:55 PM	59	85	1.2	"	C
S. Fk. Scap- poose Cr.	9-11-62	10:00 AM	57	62	3	Watts Rd. bridge	Near mouth
"	6-4-63	1:45 PM	52	54	19*	Just above Raymond Cr.	C
"	7-10-63	10:00 AM	56	63	11*	"	D
"	8-6-63	10:40 AM	61	62	5.9*	"	C
"	9-4-63	1:40 PM	71	85	4.6*	"	C
"	9-4-63	2:05 PM	63	85	4	100 yds. below Gourlay Cr.	C
"	9-4-63	4:35 PM	70	85	-	Highway 30 bridge	Moderately turbid Smells like sewage C
Gourlay Cr.	9-11-62	2:10 PM	55	64	1.5	Mouth	
"	6-4-63	2:45 PM	51	54	3	"	C
"	7-10-63	10:35 AM	56	65	1.3*	"	D
"	8-6-63	10:45 AM	59	63	0.8	"	C
"	9-4-63	2:00 PM	65	85	1.2*	"	C+
Raymond Cr.	9-11-62	1:40 PM	58	64	1.5	0.25 mile above mouth	
"	6-4-63	1:45 PM	52	54	2.8*	Mouth	C
"	7-10-63	10:15 AM	57	63	1.6*	"	D
"	8-6-63	10:30 AM	61	62	0.9*	"	C
"	9-4-63	1:50 PM	68	85	0.7*	Mouth	C+
Tualatin R.	6-7-63	10:30 AM	51	55	38*	River mile 69.5	2.0 miles below Cherry Grove C
"	7-9-63	10:20 AM	55	60	40*	"	" D
"	8-5-63	4:30 PM	67	84	11*	"	" C

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Appendix II continued

Stream	Date	Time	Temp. °F.		Flow Cfs	Location	Remarks
			Water	Air			
Tualatin R.	8-30-63	6:00 PM	65	65	13.6*	River mile 69.5	2.0 miles below Cherry Grove C
"	6-7-63	12:45 PM	55	59		USGS Gage 14-2035	Near Dilley
"	7-9-63	11:30 AM	60	61		"	"
"	8-5-63	5:30 PM	72	78		"	"
"	8-30-63	5:10 PM	66	68		"	"
"	6-13-63	9:25 AM	68	63		USGS Gage 14-2075	Near West Linn
"	7-2-63	9:45 AM	64	64		"	"
"	7-9-63	4:15 PM	64	60		"	"
"	8-5-63	11:15 AM	69	67		"	"
"	8-6-63	3:45 PM	72	74		"	Dissolved oxygen - 9.7 ppm
"	8-5-63	4:15 PM	73	80	8	Lee Falls	C
Cedar Cr.	9-11-62	4:40 PM	60	64	1.0	1.0 mile above mouth	
Chicken Cr.	"	4:30 PM	57	64	0.7	2.0 miles above mouth	
Dairy Cr.	8-5-63	2:45 PM	69	78	18	2.0 miles above mouth	Highway 8 bridge C
"	8-30-63	4:25 PM	67	70	28*	"	" C+
E. Fk. Dairy Cr.	8-20-62	5:00 PM	63	72	13	River mile 13	
"	6-7-63	4:45 PM	53	59	46*	"	C
"	7-8-63	12:30 PM	54	57	35*	"	Raining heavily D
"	8-5-63	1:35 PM	63	78	15.5	"	Slightly turbid C
"	8-30-63	1:50 PM	60	67	14.2*	"	" C+
Denny Cr.	8-20-62	5:30 PM	57	70	4	Mouth	
"	6-7-63	5:15 PM	50	59	5.5	"	C
"	7-8-63	1:05 PM	53	56	7.7*	Mouth	D
"	8-5-63	2:00 PM	55	79	2.4*	"	C
"	8-30-63	1:15 PM	56	67	2.5*	"	C+
Panther Cr.	8-20-62	5:45 PM	54	70	3	Mouth	

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Appendix II continued

Stream	Date	Time	Temp. °F.		Flow Cfs	Location	Remarks
			Water	Air			
Plenty-water Cr.	8-20-62	5:25 PM	57	70	0.8	Mouth	
"	6-7-63	5:00 PM	51	59	2.5	"	C
"	7-8-63	1:20 PM	54	56	2.5*	"	D
"	8-5-63	2:15 PM	58	79	3.0	"	C
"	8-30-63	1:30 PM	57	67	1.3*	"	C
McKay Cr.	8-20-62	7:00 PM	64	70	4	1.0 mile below E. Fk.	
"	6-7-63	6:15 PM	52	59	8.2	0.5 mile above E. Fk.	C
"	7-8-63	11:45 AM	55	57	7.9*	"	D
"	8-5-63	12:50 PM	60	77	1.9*	"	C
"	8-30-63	12:00 N	59	64	3*	"	C
E. Fk. McKay Cr.	8-20-62	6:50 PM	60	70	0.4	0.5 mile above mouth	
"	6-7-63	6:30 PM	52	56	2.5*	"	C
"	7-8-63	11:00 AM	54	57	2.3*	"	D
"	8-5-63	12:30 PM	59	77	0.5	"	Many juvenile silvers observed C
"	8-30-63	11:45 AM	59	64	0.5*	"	C
Jackson Cr.	8-20-62	7:20 PM	68	70	0.8	0.25 mile above mouth	Irrigation use
W. Fk. Dairy Cr.							
Cedar Canyon Cr.	8-20-62	4:10 PM	68	75	1	0.75 mile above mouth	
Sadd Cr.	8-20-62	4:00 PM	63	75	1.5	1.0 mile above mouth	
Witcher Cr.	8-20-62	4:30 PM	64	72	0.7	0.5 mile above mouth	
Fanno Cr.	9-11-62	5:20 PM	60	64	4	0.5 mile above mouth	
Gales Cr.	8-20-62	2:00 PM	67	78	-	Forest Grove	
"	6-7-63	1:00 PM	57	59	70*	"	C
"	7-9-63	11:45 AM	59	63	47*	"	D
"	8-5-63	5:00 PM	70	79	14.1*	"	C
"	8-30-63	4:50 PM	67	68	15.4*	"	C
Beaver Cr.	6-7-63	3:15 PM	50	59	4*	1.0 mile above mouth	C

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Appendix II continued

Stream	Date	Time	Temp. °F.		Flow Cfs	Location	Remarks
			Water	Air			
Beaver Cr.	7-8-63	2:30 PM	53	58	3.5*	1.0 mile above mouth	D
"	8-5-63	3:00 PM	59	80	0.7*	"	C
"	8-30-63	2:30 PM	59	71	1.1*	"	C
Clear Cr.	8-20-62	2:45 PM	62	78	2.0	1 mile above mouth	
"	6-7-63	2:15 PM	51	59	13*	0.2 mile above mouth	C
"	7-9-63	12:45 PM	54	59	8.8*	"	D
"	8-5-63	4:30 PM	63	79	3.9*	"	C
"	8-30-63	3:40 PM	60	71	2.7*	"	C
Iller Cr.	8-20-62	2:30 PM	65	78	0.5	0.2 mile above mouth	
"	6-7-63	2:30 PM	53	59	5.5*	"	C
"	7-9-63	12:30 PM	55	61	4.5*	"	D
"	8-5-63	4:15 PM	66	80	1.1*	"	C
"	8-30-63	3:30 PM	63	71	1.0*	"	C
Little Beaver Cr.	6-7-63	2:45 PM	57	59	1.8	0.5 mile above mouth	C
"	7-8-63	1:45 PM	56	58	2.3*	"	D
"	8-5-63	2:40 PM	65	80	0.5	"	C
"	8-30-63	2:15 PM	64	68	0.7*	"	C
N. Fk. Gales Cr.	6-7-63	4:00 PM	51	59	4.5	0.1 mile above mouth	C
"	7-9-63	2:20 PM	53	60	2.6*	"	Turbid D
"	8-5-63	3:30 PM	64	80	1.3*	"	C
"	8-30-63	3:10 PM	63	72	1.7*	0.1 mile above mouth	C
S. Fk. Gales Cr.	6-7-63	3:30 PM	50	59	3.8*	Mouth	C
"	7-9-63	1:45 PM	53	59	2.7*	"	D
"	8-5-63	4:00 PM	58	80	0.8*	"	C
"	8-30-63	2:50 PM	59	72	1*	"	C
McFee Cr.	9-11-62	4:10 PM	58	64		0.75 mile above mouth	Highway 219

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Appendix II continued

Stream	Date	Time	Temp. °F.		Flow Cfs	Location	Remarks
			Water	Air			
McFee Cr.	8-20-62	3:50 PM	58	64	1.5	Just above Gulf Canyon Cr.	
"	8-5-63	6:15 PM	64	80	2.2*	"	C
"	8-30-63	7:00 PM	63	64	1.9*	"	C
Baker Cr.	9-11-62	3:30 PM	55	64	1.2	0.2 mile above confluence with McFee Cr.	
Gulf Canyon Cr.	9-11-62	3:50 PM	61	64	0.2	Mouth	Large marshy area near mouth
Heaton Cr.	9-11-62	4:00 PM	58	64	1.5	0.25 mile above mouth	
Rock Cr.	9-11-62	5:00 PM	55	64	1.5	0.25 mile above mouth	
Scoggin Cr.	8-20-62	12:00 N	64	75		USGS Gage 14-2030	
"	6-7-63	12:30 PM	55	59		"	
"	7-9-63	10:50 AM	58	60		"	
"	8-5-63	3:00 PM	65	78		"	
"	8-30-63	6:30 PM	64	65		"	
Seine Cr.	8-20-62	12:25 PM	64	75	0.8	0.3 mile above mouth	
"	6-7-63	12:10 PM	51	59	12*	"	C
"	7-9-63	11:00 AM	54	61	8.4*	"	D
"	8-5-63	3:20 PM	68	80	1.6*	"	C
"	8-30-63	5:40 PM	62	66	1.4*	"	C
Tanner Cr.	8-20-62	12:30 PM	57	75	0.5	1 mile above mouth	
"	8-5-63	3:30 PM	57	80	1.2	0.2 mile above mouth	C
"	8-30-63	5:30 PM	57	67	1	"	C
Willamette R. Small Tributaries							
Johnson Cr.	6-11-63	4:20 PM	66	74	3	1.0 mile above Gresham	Regner Rd. C
"	7-10-63	9:15 AM	58	64	4.5	"	D
"	8-7-63	3:15 PM	66	80	0.5	"	C
"	6-11-63	6:30 PM	70	74	20	0.3 mile below Crystal Spgs. Cr.	C
"	7-10-63	3:15 PM	62	64	31*	"	D

Appendix II continued

Stream	Date	Time	Temp. °F.		Flow Cfs	Location	Remarks
			Water	Air			
Johnson Cr.	8-7-63	4:15 PM	-	82	-	0.3 mile below Crystal Spgs. Cr.	Dissolved oxygen - 10.9 ppm C
"	8-7-63	4:30 PM	71	84	3	Just above Crystal Spgs. Cr.	Dissolved oxygen - 11.0 ppm C
Crystal Springs Cr.	6-11-63	6:15 PM	62	74	13.6*	30 yds upstream from 99E	C
"	7-10-63	3:45 PM	58	63	16*	"	D
"	8-7-63	3:50 PM	62	82	19*	"	C

1/ * : Measured with a current meter.

2/ B : Appears somewhat below (to 20 per cent) average flow for this period.

C : Appears about average flow for this period.

D : Appears somewhat above (to 20 per cent) average flow for this period.

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APPENDIX III

Oregon State Game Commission Fish Releases in the
Lower Willamette Basin, 1958-1963 ^{1/}

Stream	Species	Sizes	1958	1959	1960	1961	1962	1963
Abernethy Cr.	Rb	8" & over	1,000	2,020	1,001	2,004	-	-
Camp Cr.	Rb	"	6,419	9,288	7,287	5,970	5,449	7,538
Clackamas R.	Rb	"	152,103	67,892	76,034	92,308	88,874	83,570
	Ct	"	8,175	3,959	-	-	-	-
Clackamas R., North Fork	Rb	"	-	-	2,015	-	2,998	8,007
	Ct	"	-	-	-	2,003	-	-
Clackamas R., Oak Grove Fk.	Rb	"	3,750	3,006	3,001	3,006	6,208	7,902
	Rb	2-4"	-	-	144,000	-	-	-
	Ct	8" & over	-	-	-	3,002	-	-
Clear Cr. (Clackamas R.)	Rb	"	2,014	3,999	2,001	1,001	2,998	3,008
Clear Cr. (Sandy R.)	Rb	"	-	-	1,000	2,000	1,000	1,001
Clear Fk. (Sandy R.)	Rb	"	-	-	-	-	1,000	-
Collawash R.	Rb	"	4,998	5,011	6,769	7,006	10,005	19,289
	Ct	"	-	-	-	3,001	-	-
Dairy Cr., E. Fk.	Rb	"	6,032	5,004	6,831	-	-	-
	Ct	"	1,488	3,007	-	6,003	6,184	3,019
Dairy Cr., W. Fk.	Rb	"	2,011	-	1,530	-	-	-
	Ct	"	-	3,003	-	3,007	2,164	2,013
Deep Cr.	Rb	"	2,999	1,001	2,991	1,003	998	1,001
Eagle Cr. (Clackamas R.)	Rb	"	7,648	5,003	5,001	-	3,996	4,145
Gales Cr.	Rb	"	3,997	4,008	4,010	6,001	9,001	9,002
Johnson Cr.	Rb	"	2,000	2,000	992	2,000	2,001	2,026
	St	Yearling	14,993	10,030	19,975	16,960	-	-
McKay Cr.	Rb	8" & over	1,003	2,002	-	-	-	-
Milton Cr.	Rb	"	2,493	3,506	3,019	3,002	2,002	999
	Ct	"	-	-	-	-	4,900	4,013
	St	Yearling	-	-	-	-	10,260	5,008
Salmon R.	Rb	8" & over	4,002	5,662	4,930	7,402	9,676	10,107
	St	Yearling	-	-	-	-	7,984	-
Sandy R.	Rb	8" & over	12,502	8,963	9,823	9,380	12,874	17,952
	St	Yearling	57,623	83,462	76,907	162,992	168,861	214,176
Scappoose Cr.	Rb	8" & over	-	-	-	-	1,000	-
	St	Yearling	-	-	-	-	-	5,008
Scappoose Cr., North Fork	Rb	8" & over	5,002	4,038	5,002	-	-	1,000
	Ct	"	2,021	2,006	-	2,002	3,000	3,014
	St	Yearling	-	-	-	-	10,259	-
Scappoose Cr., South Fork	Rb	8" & over	1,000	1,000	1,998	1,003	2,004	-
	Ct	"	-	-	-	2,002	-	2,005
	St	2-4"	-	-	-	-	10,225	-

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Appendix III continued

Stream	Species	Size	1958	1959	1960	1961	1962	1963
		8" & over						
Scoggin Cr.	Rb	8" & over	-	2,005	2,010	2,000	2,004	1,999
Still Cr.	Rb	"	8,761	7,834	9,006	13,773	11,135	11,696
Tanner Cr.	Rb	"	1,000	1,000	1,001	399	1,000	1,000
Tualatin R.	Rb	"	2,006	2,042	2,010	2,002	2,008	1,999
Willamette R.	Ch	Yearling	-	-	-	5,144	-	-
Zigzag R.	Rb	8" & over	4,417	7,501	1,425	1,958	2,645	2,942
<u>Lake 2/ 3/</u>								
Benson	Rb	6" & over	1,004	2,002	4,000	7,479	4,008	6,001
Blue	LB	1"	-	-	-	4,286	35,000	50,720
		Adults	-	-	-	40	-	-
	BC	Adults	-	-	-	102	-	-
Elk	Rb	2-4"	-	-	14,800	-	9,982	-
	K	"	-	-	-	20,029	19,900	20,247
	Ct	"	15,682	41,500	-	-	-	30,680
Estacada	Rb	4-6"	-	-	-	32,530	-	-
Haldeman Pond	LB	1"	-	-	-	-	4,800	3,220
Harriet	Rb	8" & over	-	-	-	2,200	-	998
	Rb	4-6"	6,930	-	9,995	7,636	-	8,785
	Rb	2-4"	-	-	-	5,038	10,080	-
North Fork Reservoir (Clackamas R.)	Rb	8" & over	-	9,763	6,066	26,879	8,698	23,469
	Rb	4-6"	-	173,987	40,000	72,144	-	-
	Rb	2-4"	-	-	-	110,070	-	-
Roslyn	Rb	8" & over	-	-	5,836	1,050	9,436	8,004
	Rb	4-6"	-	-	-	-	7,992	23,080
	Rb	2-4"	-	-	-	-	-	14,999
Salmonberry	Rb	6" & over	1,501	1,026	-	-	-	-
	Rb	4-6"	3,040	-	-	-	-	-
Timothy	Rb	8" & over	-	-	31,109	-	4,988	-
	Rb	4-6"	125,246	279,805	19,800	-	-	84,826
	Rb	2-4"	-	-	306,374	250,352	330,099	15,540
	Ct	0-2"	-	-	60,346	-	108,800	109,615
	EB	2-4"	-	-	40,040	102,300	49,950	25,000
	K	2-4"	-	-	-	-	108,821	197,100

1/ Similar stocking rates were conducted in these waters prior to 1958.

2/ High Cascade lake stocking not shown in this table is included in Appendix IV.

3/ Warm-water game fish releases for years prior to 1961 were sporadic and are not included.

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APPENDIX IV

Lower Willamette Basin Cascade Lake Data ^{1/}

Lake	Location			Acres	Max. Depth (feet)	Species	Stocking	
	T.	R.	Sec.				Number	Frequency ^{2/}
Anvil	5S	8E	17	1.5	5	EB	500	Bi
						Ct	-	Nat
Averill	9S	8E	5-8	11.5	11	EB	1,500	Bi
Baldy	3S	6E	28	1.5	8	EB	-	Exp
Beth	8S	6E	8	4.5	35	EB	-	Nat
Big Slide	8S	6E	9	4	10	EB	-	Nat
Big Slide, Upper	8S	6E	10	1	11	EB	500	Tri
Brook	8S	8E	25	5	8	EB	1,000	Bi
Buck	5S	8E	30	9	26	EB	2,000	Bi
Bump	8S	8E	28	3	4	EB	500	Exp
Burnt	2S	8E	34	8	25	EB	1,000	Ann
Cachebox	8S	6E	18	1.5	15	GT	500	Exp
Cast	2S	8E	33	6.5	17	EB	1,000	Ann
Clackamas	5S	8E	35	2	20	-	-	Exp
Clear	5S	4E	14	1	5	EB	500	Exp
Collins	3S	8E	21	1	6	EB	1,000	Ann
						Rb	2,000	Ann
Cottonwood Meadows	5S	7E	28	6	4	EB	1,500	Bi
Cougar	6S	4E	24	7	6	EB	-	Nat
Cripple Creek	5S	7E	19	15	4	EB	3,000	Bi
Dinger	5S	8E	9	15	4	EB	1,000	Ann
						Ct	-	Nat
Double Peaks	9S	8E	9	4	13	EB	500	Bi
Dumbell	5S	8E	32	2.5	6	EB	-	Nat
Eena	3S	8E	13	1.5	3	EB	500	Bi
Elk ^{3/}	9S	6E	5	63	26	Rb	Variable	Ann
						K	"	Ann
						Ct	"	Ann
						EB	"	Ann
Emerald	6S	4E	29	4	25	Ct	-	Nat
Ercrama	8S	6E	20	1.5	15	GT	500	Exp
Faraday	3S	4E	33			Rb, K, Br, Wf, Sil, Ch, St	-	Nat
Finley	8S	8E	3	1.5	12	EB	1,000	Bi
First	9S	8E	2	3	19	EB	2,000	Bi
Fish	8S	8E	34	24	67	EB	1,500	Bi
						Ct	-	Nat
Gannok	3S	8E	28	4	6	EB	-	Nat
Gibson	9S	8E	24	30	-	EB	1,000	Bi
Gifford	9S	8E	3	9	56	EB	2,000	Bi
Gifford, lower	8S	8E	3	1	19	EB	-	Nat
Harriet ^{3/}	6S	7E	4	23	39	Rb	Variable	Ann
						Br	-	Nat
Head	9S	8E	2	6	9	EB	2,000	Bi
Hidden	3S	8E	12	1.5	13	EB	900	Nat
Hideaway	5S	7E	21	12	30	EB	1,000	Bi
High	6S	6E	6	2.5	11	EB	1,000	Tri
Huxley	4S	6E	28	8.5	6	EB	750	Exp
Jude	8S	8E	26	2	13.5	EB	1,500	Bi

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Appendix IV continued

Lake	Location			Acres	Max. Depth (feet)	Species	Stocking	
	T.	R.	Sec.				Number	Frequency
Kinzel	4S	8E	5	1.5	5	EB	500	Ann
						Rb	500	Ann
Lenore	8S	6E	10	5	11	EB	-	Nat
Lower	9S	8E	2	15.25	73	EB	1,500	Ann
Memaloose	5S	5E	31	8	5	EB	1,500	Bi
Mirror	3S	8E	23	7.5	15	EB	1,000	Ann
						Rb	1,000	Ann
Multipor	3S	8E	24	1.5	6	EB	3,000	Bi
Nekbobets	9S	8E	10	2.5	10	EB	500	Bi
North Fork Reser- voir ^{3/}	4S	4E	11,12,13	350		Rb, Wf, Br, Variable Ch, St, Sil		Ann
Pansy	8S	6E	18	8	4	EB	1,500	Bi
Pawnee	9S	8E	9	2.5	12	EB	1,000	Tri
Plaza	4S	7E	18	1	10	EB	1,000	Bi
Pyramid	5S	7E	11	4	5.5	EB	1,000	Ann
						Rb	1,000	Ann
Red	9S	8E	8	6	7	EB	1,500	Bi
Rimrock	9S	8E	10	3	14	EB	1,000	Bi
Rock, Lower	5S	7E	8	8.5	13	EB	1,000	Ann
Rock, Middle	5S	7E	8	15	34	EB	1,500	Ann
						Rb	1,500	Ann
Rock, Upper	5S	7E	17	3	22	EB or Rb	1,000	Bi
Round	8S	7E	17	9	20	EB	-	Nat
						Br	-	Nat
Roslyn ^{3/}	2S	5E	6	160	-	Rb	Variable	Ann
						Br	-	Nat
Russ	8S	8E	2	7	18	EB	1,000	Bi
Salmon	4S	7E	16	1.5	3	EB	500	Exp
Serene	5S	7E	7	20	46	EB	1,000	Bi
						Rb	1,000	Bi
Sheep	9S	8E	4	3.5	9.5	EB	1,500	Bi
Shellrock	5S	7E	17	20	8	EB	1,000	Ann
						Rb	1,000	Ann
Shining	4S	6E	36	12	24	EB	1,000	Ann
Si	8S	8E	33	3	10.5	EB	1,000	Bi
Silver King	8S	5E	24	4	7	EB	1,000	Tri
Skookum	6S	5E	35	4	14	EB	1,000	Bi
						Br	-	Nat
Squaw	4S	6E	14	7	5	EB	2,000	Bi
Surprise No. 1	5S	6E	27	3	15	EB	2,000	Bi
Surprise No. 2	6S	5E	27	5	3	EB	1,000	Bi
Surprise No. 3	8S	8E	22	4	2	Ct	-	Nat
Timothy ^{3/}	5S	8E	23	1,200	90	EB	Variable	-
						Rb	"	-
						K	"	-
						Ct	"	-
Trillium	3S	8E	36	60	18	Rb	2,000	Ann
						EB	5,000	Ann

Appendix IV continued

Lake	Location			Acres	Max. Depth (feet)	Species	Stocking	
	T.	R.	Sec.				Number	Frequency
Twin, Lower	8S	6E	29	15	40	EB	-	Nat
Twin, Upper	8S	6E	19	15	50	EB	-	Nat
Veda	4S	8E	2	3	14	EB	1,000	Ann
Wall	9S	8E	4	5	12	EB	2,000	Bi
Welcome	8S	8E	4	6	8	EB	1,000	Bi
Welcome, West	8S	6E	21	3.5	4	EB	-	Nat
Wendy Meadows	5S	8E	21	1	3	Ct	-	Nat
Williams	5S	4E	26	4	4	Ct	-	Nat
Wind	3S	8E	26	2.5	3	EB	500	Bi

1/ Table also includes Harriet and Roslyn lakes and Faraday and North Fork Clackamas Reservoirs, the basin's important lower elevation trout impoundments.

2/ Ann - stocked annually
 Bi - stocked biennially
 Exp - have been experimentally stocked
 Tri - stocked triennially
 Nat - natural reproduction

3/ Stocking rates are in Appendix III.

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APPENDIX V

Lake and Stream Random Creel Census Data
Lower Willamette Basin

Stream	1960		1961		1962		1963	
	Anglers Checked	Fish per Hour	Anglers Checked	Fish per Hour	Anglers Checked	Fish per Hour	Anglers Checked	Fish per Hour
Bull Run R.	-	-	-	-	3	0.33	-	-
Camp Cr.	1	1.00	5	0.06	-	-	11	0.20
Cedar Cr.	4	1.39	-	-	-	-	-	-
Clackamas R.	296	0.42	381	0.42	202	0.14	213	0.21
Clear Cr.	-	-	-	-	-	-	9	0.44
Collawash R.	2	0.86	11	0.29	-	-	30	0.76
Dairy Cr., E. Fk.	10	0.31	47	0.63	19	0.55	6	0.35
Dairy Cr., W. Fk.	-	-	9	0.70	-	-	3	0.33
Deep Cr.	1	0.50	-	-	-	-	-	-
Eagle Cr.	64	0.82	120	0.13	50	0.04	28	0.02
Fish Cr.	-	-	-	-	-	-	5	0.87
Gales Cr.	-	-	23	0.39	-	-	38	0.38
Johnson Cr.	130	0.06	-	-	-	-	13	0.13
Lost Cr.	-	-	-	-	14	1.53	7	1.29
Milton Cr.	-	-	-	-	-	-	35	0.98
Oak Grove Fk.	10	0.45	10	1.05	4	1.83	5	0.89
Rock Cr.	-	-	-	-	-	-	11	1.42
Salmon R.	31	0.75	51	0.27	321	0.02	-	-
Sandy R.	1,094	0.03	1,992	0.04	1,559	0.03	1,847	0.04
Scappoose Cr., N. Fk.	-	-	-	-	-	-	68	1.20
Scappoose Cr., S. Fk.	-	-	-	-	-	-	50	1.00
Shellrock Cr.	-	-	-	-	3	0.83	6	0.56
Still Cr.	8	0.72	27	1.26	21	0.56	40	1.16
Trout Cr.	-	-	-	-	-	-	4	2.00
Tualatin R.	-	-	-	-	-	-	8	0.25
Willamette R.	182	0.05	-	-	-	-	1,931	0.05
<u>Lake</u>								
Averill	-	-	-	-	-	-	4	1.44
Big Slide	-	-	-	-	9	2.00	3	0.42
Big Slide, Upper	-	-	-	-	4	0.23	-	-
Brook	-	-	-	-	-	-	8	1.75
Buck	-	-	4	1.35	3	0.94	8	1.48
Clackamas	1	0.67	-	-	-	-	-	-
Collins	-	-	11	0.42	14	0.50	23	0.69
Cougar	6	0.31	-	-	-	-	-	-
Cripple Cr.	3	0.50	-	-	7	0.79	9	0.92
Dinger	4	1.10	5	0.18	13	1.48	8	1.03
Dumbell	-	-	-	-	-	-	2	3.75
Emerald	4	1.00	-	-	-	-	-	-
Faraday	-	-	-	-	64	0.25	3	0.20
Finley	2	0.25	-	-	-	-	-	-
Fish	21	1.22	5	0.52	27	0.33	6	0.78

Appendix V continued

Lake	1960		1961		1962		1963	
	Anglers Checked	Fish per Hour	Anglers Checked	Fish per Hour	Anglers Checked	Fish per Hour	Anglers Checked	Fish per Hour
Gifford	3	1.64	-	-	5	1.60	2	0.33
Harriet	14	0.05	66	0.37	41	0.21	4	0.85
Hidden	1	3.00	-	-	-	-	2	0.25
Hideaway	-	-	-	-	-	-	12	0.72
Jude	2	1.13	-	-	-	-	4	0.67
Lower	10	0.45	4	1.92	5	2.10	5	0.20
Mirror	-	-	-	-	15	0.78	9	0.27
North Fork Reservoir (Clackamas R.)	20	0.98	61	0.56	393	0.29	1,787	0.22
Pansy	-	-	5	0.59	-	-	-	-
Pyramid	-	-	5	1.67	-	-	19	1.06
Red	-	-	-	-	10	0.08	-	-
Rock, Lower	3	0.22	-	-	-	-	-	-
Rock, Middle	14	0.45	16	0.74	11	1.40	2	0.83
Rock, Upper	-	-	4	0.10	-	-	2	1.00
Roslyn	212	0.38	152	0.40	270	0.14	155	0.32
Round	-	-	5	1.00	3	0.50	15	0.57
Russ	4	0.61	-	-	-	-	-	-
Salmonberry	-	-	-	-	-	-	2	3.00
Sauvie Island	96	1.08	470	0.66	281	0.67	147	0.29
Serene	9	0.15	-	-	11	1.85	4	0.86
Shellrock	2	0.19	-	-	-	-	7	1.20
Shining	-	-	4	0.69	-	-	9	0.07
Skookum	-	-	4	0.18	-	-	-	-
Squaw	-	-	-	-	-	-	14	1.23
Surprise #3	-	-	-	-	5	0.20	4	0.79
Sturgeon	32	1.50	41	0.55	33	0.55	-	-
Timothy	180	0.10	300	0.45	723	0.48	420	0.25
Trillium	18	0.95	117	0.53	49	0.21	102	0.34
Twin, Lower	-	-	-	-	-	-	10	1.26
Twin, Upper	4	3.34	-	-	-	-	7	1.89
Upper	3	0.50	-	-	-	-	-	-
Veda	1	2.00	-	-	-	-	7	0.80
Welcome	-	-	-	-	8	1.08	21	1.18
Welcome, West	-	-	-	-	3	0.33	6	1.50
Williams	-	-	6	1.00	-	-	-	-

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APPENDIX VI

Lake and Stream Random Creel Census Data, Including Species and Sizes
Lower Willamette Basin, 1963

Stream	Species	6-8"	8-10"	10-12"	12-14"	14" & over	Total Fish	Total Anglers	Hours Fished	Fish per Angler	Hours per Fish	Fish per Hour
Camp Cr.	Rb		5				5	11	25	0.5	5.0	0.20
Clackamas R.	Rb	21	36	34	3		94					
	Ct	11					11					
	Ch					2	2					
	Wf					1	1					
	St					8	8					
							116	213	545	0.5	4.7	0.21
Clear Cr.	Rb	1	3	4			8	9	18	0.9	2.3	0.44
Collawash R.	Rb	17	22	29			68	30	89	2.3	1.3	0.76
Dairy Cr., E. Fk.	Ct		3	3			6	6	17	1.0	2.8	0.35
Dairy Cr., W. Fk.	Ct		1	2			3	3	9	1.0	3.0	0.33
Eagle Cr.	Ch					1	1	16	55	0.1	55.0	0.02
	St					0	0	12	44	0.0	-	-
Fish Cr.	Rb	2	11				13	5	15	2.6	1.2	0.87
Gales Cr.	Rb	2	22	15		1	40					
	Ct		2	1			3					
	St					1	1					
							44	38	115	1.2	2.6	0.38
Johnson Cr.	Ct	2					2	13	15	0.2	7.5	0.13
Lost Cr.	Rb	14	6	2			22	7	17	3.1	0.8	1.29
Milton Cr.	Rb	6	6	3	1		16					
	Ct	2	6	59			67					
							83	35	85	2.4	1.0	0.98
Oak Grove Fork	Ct	5	3				8	5	9	1.6	1.1	0.89

Appendix V. continued

Stream	Species	6-8"	8-10"	10-12"	12-14"	14" & over	Total Fish	Total Anglers	Hours Fished	Fish per Angler	Hours per Fish	Fish per Hour
Rock Cr.	Rb		9	1			10					
	Ct	6	1				7					
							17	11	12	1.5	0.7	1.42
Sandy R.	St					118	118					
	Rb			1			1					
	Ct					1	1					
	Ch					1	1					
	Sh					45	45	1,818	4,510	0.7	37.3	0.03
Scappoose Cr., N. Fk.	Rb		1				1					
	Ct	24	35	48			107					
							108	68	126	1.6	1.2	1.20
Scappoose Cr., S. Fk.	Rb	4	1				5					
	Ct	23	44	1			68					
							73	50	130	1.5	1.8	1.00
Shellrock Cr.	EB		31	3			34	6	11	5.7	0.3	0.56
Still Cr.	Rb	6	79	23			117	40	101	2.9	0.9	1.16
Trout Cr.	Rb	7	1				8	4	4	2.0	0.5	2.00
Tualatin R.	Rb	1					1					
	Ct	1					1					
							2	8	8	0.3	4.0	0.25
Willamette R.	Sh					45	45	52	77	1.2	1.7	0.58
<u>Lake</u>												
Averill	EB	2	15	5	1		23	4	16	5.8	0.7	1.44
Big Slide	EB	4	11				15	3	36	5.0	2.4	0.42
Brook	EB	3	65	39	5	2	114	8	65	14.3	0.6	1.75
Buck	EB	6	29	5			40	8	27	5.0	0.7	1.48

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Appendix VI continued

Lake	Species	6-8"	8-10"	10-12"	12-14"	14" & over	Total Fish	Total Anglers	Hours Fished	Fish per Angler	Hours per Fish	Fish per Hour
Collins	Rb		48	9	3		60					
	EB	2					<u>2</u>					
							62	23	90	2.7	1.5	0.69
Cripple Creek	EB		10	20	19	6	55	9	60	6.1	1.1	0.92
Dinger	Ct	4	2				6					
	EB	28	24	25	5	1	<u>83</u>					
							89	8	86	11.1	1.0	1.03
Dumbell	EB		4	10	1		15	2	4	7.5	0.3	3.75
Faraday	Rb		1		1		2	3	10	0.7	5.0	0.20
Fish	Ct	4	13	1		1	19					
	EB	3	2	2	5		<u>12</u>					
							31	6	40	5.2	1.3	0.78
Gifford	EB		1			1	2	2	6	10.0	3.0	0.33
Harriet	Rb	1	8				9					
	Br					2	<u>2</u>					
							11	4	13	2.8	1.2	0.85
Hidden	Ct		1				1	2	4	0.5	4.0	0.25
Hideaway	EB	19	15	8			42	12	58	3.5	1.2	0.72
Jude	EB	2	3	1			6	4	9	1.5	1.5	0.67
Lower	EB	1					1	5	5	0.2	5.0	0.20
Mirror	EB	3	6				9	9	31	1.0	3.4	0.27
North Fork Reservoir (Clackamas R.)	Rb	101	976	13			1,090					
	St	301					<u>301</u>					
							1,391	1,787	6,363	0.8	4.6	0.22
Pyramid	EB	2			1	35	38	19	36	2.0	0.9	1.06

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Appendix VI continued

Lake	Species	6-8"	8-10"	10-12"	12-14"	14" & over	Total Fish	Total Anglers	Hours Fished	Fish per Angler	Hours per Fish	Fish per Hour
Rock, Middle	EB	2	2	1			5	2	6	2.5	1.2	0.83
Rock, Upper	Rb		4				4					
	EB		1				<u>1</u> 5	2	5	2.5	1.0	1.00
Roslyn	Rb	10	25	34	9	5	83					
	St	57	4				<u>61</u> 144	155	456	0.9	3.2	0.32
Round	Rb	1	12	6	2	1	22					
	Br		5	6	10	2	<u>23</u> 45	15	79	3.0	1.8	0.57
Salmonberry	Ct	1	3	1	1		6	2	2	3.0	0.3	3.00
Sauvie Island	LB		4			1	5					
	WC		49	15			64					
	YP	3					3					
	FC	3	2				5					
	B	39	1	1			<u>41</u> 118	147	397	0.8	3.4	0.29
Serene	EB	4	8	4			16	4	16	4.0	1.0	0.86
Shellrock	EB	6	28	14			48	7	40	6.9	0.8	1.20
Shining	EB			1			1	9	14	0.1	14.0	0.07
Squaw	EB	18	8		1		27	14	22	1.9	0.8	1.23
Surprise #3	Ct	8	7	4			19	4	24	4.8	1.3	0.79
Timothy	Rb	70	107	59	11	2	249					
	Ct	3				2	5					
	EB	46	61	7	2		116					
	K	3	1				4					
	S Ct	1		3			<u>11</u> 385	420	1,530	0.9	4.0	0.25

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Appendix VI continued

Lake	Species	6-8"	8-10"	10-12"	12-14"	14" & over	Total Fish	Total Anglers	Hours Fished	Fish per Angler	Hours per Fish	Fish per Hour
Trillium	Rb	1	9	74	5	7	96	102	283	0.9	2.9	0.34
Twin, Lower	EB	33	16	6	3		58	10	46	5.8	0.8	1.26
Twin, Upper	EB	27	7				34	7	18	4.9	0.5	1.89
Veda	EB	28	3	2			33	7	41	4.7	1.2	0.80
Welcome	Ct	1					1					
	EB	93	32	4			<u>129</u>					
							130	21	110	6.2	0.8	1.18
Welcome, West	EB		3	3			6	6	4	1.0	0.7	1.50

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APPENDIX VII

Results of Fish Distribution Studies Conducted in Lower Willamette Basin Streams, 1963

Stream	Tributary To	Sta. No.	Date	Flow (cfs)	Temp. (°F.)	Method ^{1/}	Location	Stream Mile	Species and Numbers
Clackamas R.	Willamette R.	1	8-28-63	100+	52	Sh	Bridge on Lowe Cr. road	70.0	Ct 8, St or Ct fry 1, Cot 30
Clear Cr.	Clackamas R.	1	7-29-63	15	57	Sh	Hwy. 211 bridge, 5 mi. S. of Estacada	19.7	Ct 1, St 5, S11 1, Cot 3
Little Clear Cr.	Clear Cr.	1	7-29-63	4	54	Sh	First br. above mouth	0.1	Ct 72
Collawash R.	Clackamas R.	1	8-29-63	95	57	Sh	200 yds. below Fan Cr. campground	3.6	St 8, S11 11
"	"	2	"	90	56	Se	Just below Hot Sprgs. Fk., Collawash R.	4.0	St 17, S11 1, Rb (planted) 13
Hot Springs Fk. Collawash R.	Collawash R.	1	8-29-63	25	56	Sh	Mouth	0.0	St 19, Rb (planted) 1, D 2
"	"	2	"	25	56	Sh	1 mi. above log jam	1.2	Cot 14, S11 1
"	"	3	"	25	58	Sh	3½ mi. below new Bagby bridge	3.3	Rb (planted) 5, St 3, Cot 50, D 5
Deep Cr.	Clackamas R.	1	7-23-63	20	60	Sh	First br. above mouth	0.6	Rb 3, St 4, Cot 12, D 2
"	"	2	"	9	63	Sh	Hwy. 211 bridge	6.4	St 1, St or Ct fry 1, S11 3, Rb 1, L 4
"	"	3	"	2.5	57	Sh	2 mi. south on Firwood rd. from Hwy 26.	11.9	St 9, S11 17, Cot 21, L 7
N. Fk. Deep Cr.	Deep Cr.	1	6-14-63	2.7	71	Se	Boring, near old mill	3.1	Ct 2, Cot 20
"	"	1	7-23-63	2	72	Sh	" " " "	3.1	S11 6, D 1
"	"	2	"	2	62	Sh	1 mi. east of Boring	4.2	D 1, L 1
Tickle Cr.	Deep Cr.	1	7-23-63	8	60	Sh	First br. above mouth	1.0	Ct 2, Cot 23
"	"	2	"	2.5		Sh	Second br. above mouth	4.6	Ct 6, St 6, S11 3, D 5, Cot 11

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Appendix VII continued

Stream	Tributary To	Sta. No.	Date	Flow (cfs)	Temp. (°F.)	Method	Location	Stream Mile	Species and Numbers
North Fork Eagle Cr.	Eagle Cr.	1	7-24-63	30	62	Sh	Mouth	0.0	Sil 2, Rb(planted) 1, St 2, Cot 6
"	"	2	"		63	Sh	1 mi. above mouth	1.0	Rb or St 14, Sil 1
"	"	3	"	9		Sh	Near Brayn Trout Ranch	8.0	Rb or St 42, Ct 1, Sil 3, Cot 6
Fish Cr.	Clackamas R.	1	8-29-63	16	64	Se	½ mi. above mouth	0.25	Sil 66, St 10
"	"	2	"	12	63	Sh	2 mi. below Wash Cr.	4.2	Sil 10, St 24, Cot 8
"	"	3	"	3	56	Se	1 mi. above Wash Cr.	7.7	St 3
Wash Cr.	Fish Cr.	1	8-29-63	4	58	Sh	½ mi. above mouth	0.5	Sil 8, St 14, Cot 15
"	"	2	"	2.5	54	Sh	2.5 mi. above mouth	2.5	St 18
Lowe Cr.	Clackamas R.	1	8-28-63	2.5	50	Sh	First culvert above mouth	0.2	Ct 22, Cot 2
Oak Grove Fk., Clackamas R.	Clackamas R.	1	8-29-63	9	55	Sh	First br. above mouth	0.6	Sil 10, St 12, Rb(planted) 2, Cot 18
"	"	2	"	200	46	Sh	First br. above Harriet L.	5.5	Ct 1, Ct or St fry 1, Cot 12
Pinhead Cr.	Clackamas R.	1	8-28-63	100	47	Sh	Mouth	0.0	Ct 21, Rb 2, Cot 35.
Last Cr.	Pinhead Cr.	1	8-28-63	7	47	Sh	Mouth	0.0	Ct 5, Cot 9
"	"	2	"	5	47	Se	Mouth of Camp Cr.	1.6	None caught
"	"	3	"	3	46	Sh	Mouth of Poop Cr.	1.9	Ct 6
Sandy River									
Beaver Cr.	Sandy R.	1	8-1-63	2	56	Sh	Second br. above mouth	0.1	Sil 3, Ct or St fry 5, Ch 2, D 25, L 2, Cot 30
"	"	2	"	0.4	60	Sh	Troutdale road crossing	3.2	Sil 2, Ct 11, D 3, L 3, Cot 22
Buck Cr.	Sandy R.	1	8-1-63	4	55	Sh	Mouth	0.0	Sil 6, Ct or St fry 3, D 1, Cot 7
"	"	2	"	2	52	Sh	Culvert 3 mi. above mouth	3.0	Ct 9, Cot 4

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Appendix VII continued

Stream	Tributary To	Sta. No.	Date	Flow (cfs)	Temp. (°F.)	Location	Stream Mile	Species and Numbers
Cedar Cr.	Sandy R.	1	8-16-63	5	65	Sh Culvert just above OFC hatchery	1.0	Sil 8, St 1, L 2, Cot 8
"	"	2	"	4	67	Sh Third road crossing above hatchery	1.9	Sil 11, St 3, L 2, Cot 11
Clear Cr.	Sandy R.	1	7-29-63	10	57	Sh Clear Cr. camp	0.2	Sil 3, St 14, Cot 2
"	"	2	"	6.5	57	Sh Old Maid's Flat on Aschoff Road	2.0	Sil 10, St 18, Cot 10
Clear Fork	Sandy R.	1	7-29-63	15	53	Sh First br. above mouth	0.1	Rb(planted) 20, St 3, Sil 2, L 1, Cot 40
Gordon Cr.	Sandy R.	1	8-1-63	18	59	Sh Bridge near mouth	0.1	Sil 2, Rb or St 10, D 2, Cot 9
Lost Cr.	Sandy R.	1	7-29-63		50	Sh First br. above mouth	1.8	St 14, Rb(planted) 21, Cot 4
Salmon R.	Sandy R.	1	8-27-63		63	Sh Mouth	0.0	St 6, Sil 2, Ch 1, Cot 5
"	"	2	"	50	63	Sh 1.5 mi. above Boulder Cr.	2.2	St 9, Sil 2, Cot 19
"	"	3	"		57	Sh Confluence of Cheeney Cr.	7.1	St 6, Cot 9
"	"	4	8-26-63	40	54	Sh 2.7 miles above Cheeney Cr.	9.8	St 19, Sil 2, L 2, Cot 15
"	"	4	8-27-63	40	53	Sh " " "	9.8	St 7, Sil 9, Cot 10
"	"	5	8-22-63		54	Se Halfway between end of road & confl. of South Fork	10.5	No fish caught. A few observed.
"	"	6	"		54	Se Just above South Fk.	11.1	St 1, Sil 94
"	"	7	"		46	Sh Hwy. 26 below Timber- line Lodge	29.6	Ct 2
Boulder Cr.	Salmon R.	1	8-27-63	3	59	Sh Second br. above mouth	1.0	St 16, Sil 8, Cot 3
Cheeney Cr.	Salmon R.	1	"	3	60	Sh Mouth	0.0	St 6, Sil 25, Cot 6

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Appendix VII continued

Stream	Tributary To	Sta. No.	Date	Flow (cfs)	Temp. (°F.)	Method	Location	Stream Mile	Species and Numbers
S. Fk. Salmon R.	Salmon R.	1	8-22-63	8	54	Se	150 yds. above mouth	0.1	Sil 3, St 1
Trout Cr.	Sandy R.	1	8-1-63	6	56	Sh	Hwy. culvert	0.7	Ct 5
Camp Cr.	Zigzag R.	1	7-29-63	8	54	Sh	Camp Cr. Road #28	0.7	Sil 6, St 22, Cot 8
"	"	2	"	8	54	Sh	Camp Cr. Camp	2.6	Sil 7, St 11, Cot 10
Henry Cr.	Zigzag R.	1	7-29-63	4	49	Sh	First culvert above mouth	0.2	Sil 6, Ct 2, St 5, Ct or St fry 4, Cot 6
Still Cr.	Zigzag R.	1	7-29-63	25	54	Sh	Mouth	0.0	Sil 15, St 9, Cot 13
"	"	2	"	18	52	Sh	3.5 mi. above mouth	3.5	Sil 13, St 10, Cot 7
Small streams tributary to Columbia River									
Bridal Veil Cr.	Columbia R.	1	7-26-63	18	53	Sh	Hwy. 30 culvert	0.08	Sil 1, Ct 1, St 1, Ct or St fry 10, L 4, Cot 8
"	"	2	7-3-63	18.3	55	Se	80 yds. below falls	0.15	(culvert may impede passage) St 4 (one an adult)
"	"	3	7-26-63	18	52	Sh	Just above falls	0.2	Ct 11
Horsetail Cr.	"	1	7-25-63	6	54	Sh	Scenic hwy. br.	0.45	Rb or St 46, Ct 1, D 2, Cot 40
"	"	2	7-26-63		54	Se	Just above falls	0.55	No fish caught
Latourell Cr.	"	1	7-3-63	7.9	55	Se	Scenic hwy. bridge	0.6	Sil 3, Ct 8, Cot 3
"	"	1	7-26-63	5.5	53	Sh	" " "	0.6	Ct or St fry 3
"	"	2	7-26-63			Se	Just above falls	0.7	Ct 3
McCord Cr.	"	1	7-25-63	5	55	Sh	Hwy. 30 bridge	0.2	Rb or St 25, Rb or St or Ct fry 60, Ct 1, Sil 2, Cot 2
"	"	1	7-3-63	5.3	57	Se	"	0.2	Rb or St fry 2
Moffet Cr.	"	1	7-25-63	2.5	57	Sh	Hwy. 30 bridge	0.1	Rb or St 20, Rb or St fry 20, Sil 2, Cot 3

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Appendix VII continued

Stream	Tributary To	Sta. No.	Date	Flow (cfs)	Temp. (°F.)	Method	Location	Stream Mile	Species and Numbers
Multnomah Cr.	Columbia R.	1	7-3-63	9.5	58	Se	Just above scenic hwy. bridge	1.0	St 1, S11 6, Cot 2
"	"	1	7-26-63	7	61	Sh	" " "	1.0	Rb or St 4, S11 10, D 6, Cot 4
"	"	2	7-26-63	3	52	Sh	2.5 mi. above falls	2.6	Ct 12
Oneonta Cr.	"	1	7-3-63	9.3	57	Se	Scenic hwy. bridge	0.2	Rb or St 1, L 1, Cot 1
"	"	1	7-25-63	7	55	Sh	" " "	0.2	Rb or St 14, Rb or St fry 9, Cot 24
"	"	2	7-25-63	7	55	Se	Just above falls	0.9	No fish caught
Tanner Cr.	"	1	7-3-63	5.9	54	Se	0.1 mi. above Hwy. 30 bridge	0.5	St 1, S11 1
"	"	1	7-25-63	4	50	Sh	" " " "	0.5	Rb or St 3, Rb or St fry 90, S11 6, Cot 23
"	"	2	7-25-63	20	49	Sh	Just above hatchery diversion dam	1.0	Rb or St 6, S11 5, Cot 15
Wahkeena Cr.	"	1	7-26-63	3	52	Sh	Railroad br. at Benson Park	0.3	Rb or St 5, S11 3, Cot 6
"	"	2	7-26-63	3	48	Sh	1 mi. above falls	1.4	No fish caught
Small streams tributary to Willamette River									
Johnson Cr.	Willamette R.	1	7-24-63	22	60	Sh	Hwy. 99E br., Milwaukie	1.7	Ct 3, St 1, Su 3, L 1, Cot 6
"	"	2	"	3	65	Sh	10 mi. east of Portland on Foster Rd.	11.0	S11 1, D 75, RsS 100, Cot 100
"	"	3	"	2	65	Sh	Bridge 1 mi. above Gresham	14.9	S11 33, Ct 3, D 10, RsS 3C, Cot 100, L 2
Crystal Springs Cr.	Johnson Cr.	1	7-24-63	15	61	Sh	R.R. access road near golf course	0.8	S11 2, St 2, D 2, RsS 8, Cp 2, Su 10, L 1, Cot 6
Tualatin R.	Willamette R.	1	7-30-63	7	61	Sh	About 3/4 mi. below Lee Falls	74.0	S11 7, Ct 14, D 1, Cot 14

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Appendix VII continued

Stream	Tributary To	Sta. No.	Date	Flow (cfs)	Temp. (°F.)	Method	Location	Stream Mile	Species and Numbers
Tualatin R.	Willamette R.	2	7-30-63	7	63	Sh	Just above Lee Falls	74.8	Ct 8, Cot 4
"	"	3	7-31-63	5	64	Sh	1 mi. above Lee Falls	75.8	Ct 7, Cot 10
"	"	4	"	5	64	Sh	Just above Haines Falls	76.9	Ct 8, Cot 6
East Fork Dairy Cr.	Dairy Cr. (Tualatin)	1	7-2-63	30	62	Sh	First bridge above mouth	0.9	Cot 12
"	"	2	"	25	57	Sh	0.5 mi. east of Mountaindale	5.2	Ct 1, S11 3, Skb 1, Cot 13, BG 1
"	"	3	"		58	Sh	3 road mi. below Meacham School	7.8	Cot 8
"	"	4	"	25	54	Sh	Meacham School	11.2	Ct fry 2, Ct 7, S11 4, Cot 16
Denny Cr.	E. Fk. Dairy Cr.	1	7-2-63		51	Sh	At U-Catchum Trout Farm	0.1	Ct 3, St 3, S11 4, Cot 2
Plentywater Cr.	E. Fk. Dairy Cr.	1	7-2-63	3		Sh	Culvert above mouth	0.1	Ct 17, S11 2, Cot 14 (No S11 found above culvert)
West Fork Dairy Cr.	Dairy Cr.	1	7-4-63	25	59	Sh	Bridge on Tillamook Hwy. (U.S. 6)	5.7	R&S 15, Cot 5
Sadd Cr.	Cedar Canyon Cr. (W. Fk. Dairy Cr.)	1	7-4-63	2.5	57	Sh	At gravel quarry	1.1	Ct 5, Cot 4
Gales Cr.	Tualatin R.	1	6-25-63	55	57	Sh	Hwy. 47 br. at Forest Grove	1.8	L 2, Cot 15
"	"	2	"		57	Sh	Gravel dump 4 mi. above Forest Grove	6.8	L 2, Su 1, Cot 14
"	"	3	"	30	55	Sh	Tillamook Junction 2 mi. above town of Gales Cr.	12.7	Ct 2, S11 1, St or Rb 3, D 1, Cot 14
Beaver Cr.	Gales Cr.	1	7-1-63	4	51	Sh	1 mi. above mouth	1.0	Ct 1, S11 13, Cot 4
Clear Cr.	Gales Cr.	1	7-1-63	15	55	Sh	1/4 mi. above mouth	0.25	St 7, S11 15, Ct 5, Cot 3
Iller Cr.	Gales Cr.	1	7-1-63	5	53	Sh	3 mi. above mouth	3.0	Ct 6
S. Fk. Gales Cr.	Gales Cr.	1	6-25-63	4	52	Sh	100 yds. above mouth	0.1	Ct 6, Rb or St 5, S11 5, Cot 3

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Appendix VII continued

Stream	Tributary To	Sta. No.	Date	Flow (cfs)	Temp. (°F.)	Method	Location	Stream Mile	Species and Numbers
Scoggin Cr.	Tualatin R.	1	7-30-63	11	62	Sh	Hwy. 47 bridge	1.9	Ct 5, RsS 10, D 7, Cot 7
"	"	2	"		61	Sh	At br. above Stimson log pond	4.1	S11 18, Ct 2, Rb(planted) 1, L 10, RsS 3, D 3, Cot 10
"	"	3	"	10	58	Sh	Lee Road bridge	5.6	S11 21, Ct 2, L 12, Cot 13, RsS 14, D 15
"	"	4	"	4	57	Sh	4 mi. above Stimson log pond	7.4	Ct 22, D 25, Cot 10
Seine Cr.	Scoggin Cr.	1	7-30-63	3	57	Sh	Second br. above mouth on Seine Cr. Road	0.8	S11 25, Ct 2, St 3, Ct or St fry 1, Cot 16
Tanner Cr.	Scoggin Cr.	1	7-30-63	1.5	54	Sh	1 mi. above mouth on Tanner Cr. Road	1.0	Ct 7, S11 21, Cot 13 D 10

1/ Sh - Electric shocker

Se - Seine

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To: M. MITTICK	From: A. MIRATI
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Dept.	Page 1 of 4
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ac
Oregon

March 19, 1991

DEPARTMENT OF
FISH AND
WILDLIFE

Mr. Bill Fujii
Resource Management Division
Water Resources Department
3850 Portland Road NE
Salem, OR 97310



Subject: Streamflow recommendations for fish in the lower
Sandy River, OR

Dear Bill:

The Water Resources Department (WRD) has requested the Oregon Department of Fish and Wildlife (ODFW) to make recommendations for streamflows required in the lower Sandy River to support fish resources. The WRD will use ODFW's recommendations in establishing flow requirements for recreation, fish and wildlife in the Sandy River Scenic Waterway. ODFW staff has evaluated available information and developed the attached flow recommendations (Table 1).

A previous study on the Sandy River developed recommendations for a portion of the year using a No-Net-Loss criterion (Beak 1985). These recommendations were developed from habitat exceedence analysis derived from habitat simulations based on the Instream Flow Incremental Methodology. In that analysis, flows were selected that resulted in no or very little (less than 5 percent) reduction in available habitat during each month of interest over a 20 year period of synthesized daily flow record (1961 - 1980). A separate analysis was performed for each month of interest for each of the 20 years. Recommendations were developed for the months of December through May (shaded portions of Table 1.)

In response to the WRD request for flow recommendations for the missing months, ODFW has performed a habitat exceedence analysis for the months of June through November using methods similar to the 1985 analysis. The present analysis is based on habitat exceedence over all months in a 5 year period of gaged mean daily flow records (1985 - 1990). The principal difference in these analyses is that the ODFW analysis lumps all months (all Junes 1985-90, all Julys 1985-90, ... etc) together in a single analysis, rather than performing a separate analysis for each month in each year

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Mr. Bill Fujii
March 19, 1991
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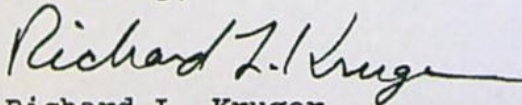
(June 1985, June 1986, ... etc.). The effect of this difference in approach is that the ODFW method is somewhat less sensitive to short term flow changes (less protective of the fish habitat) and annual variation in water abundance.

Results of present and previous analyses compared to median and 90 percent exceedence flows show that the required flows for fish are equal to or less than the median flow for all months except June and July (Table 1 and Figure 1). ODFW believes requiring flows that appear to be higher than the median June and July flows are justified for several reasons. First, the flows are necessary to protect incubating steelhead eggs deposited by spawning in prior months. Second, the habitat analysis is based on highly detailed and carefully conducted IFIM studies and true incremental analysis. Third, the flow records on which the analysis is based contain a number of biases and vagaries which widens the uncertainty of these statistical reflections of norms and extremes.

Biases and vagaries which I am aware of are: 1) the gaged flow records reflect an unknown amount of upstream withdrawals (both legal and illegal), and thus do not necessarily represent natural flows, 2) the median flow is likely less than the mean monthly flow, 3) flow records on which the Beak analysis is based are pre-1966 data, synthesized to reflect current operations of PGE's Bull Run hydro project and the City's water supply and hydro projects, and 4) the post-1984 gaged period of record is short (5 years) and is generally reflective of a dry hydrologic cycle that is probably not indicative of the full range of flows that occur in the Sandy River.

Please call me at 229-5410, ext. 437 if you have questions regarding this analysis or want to discuss the recommendations.

Sincerely,



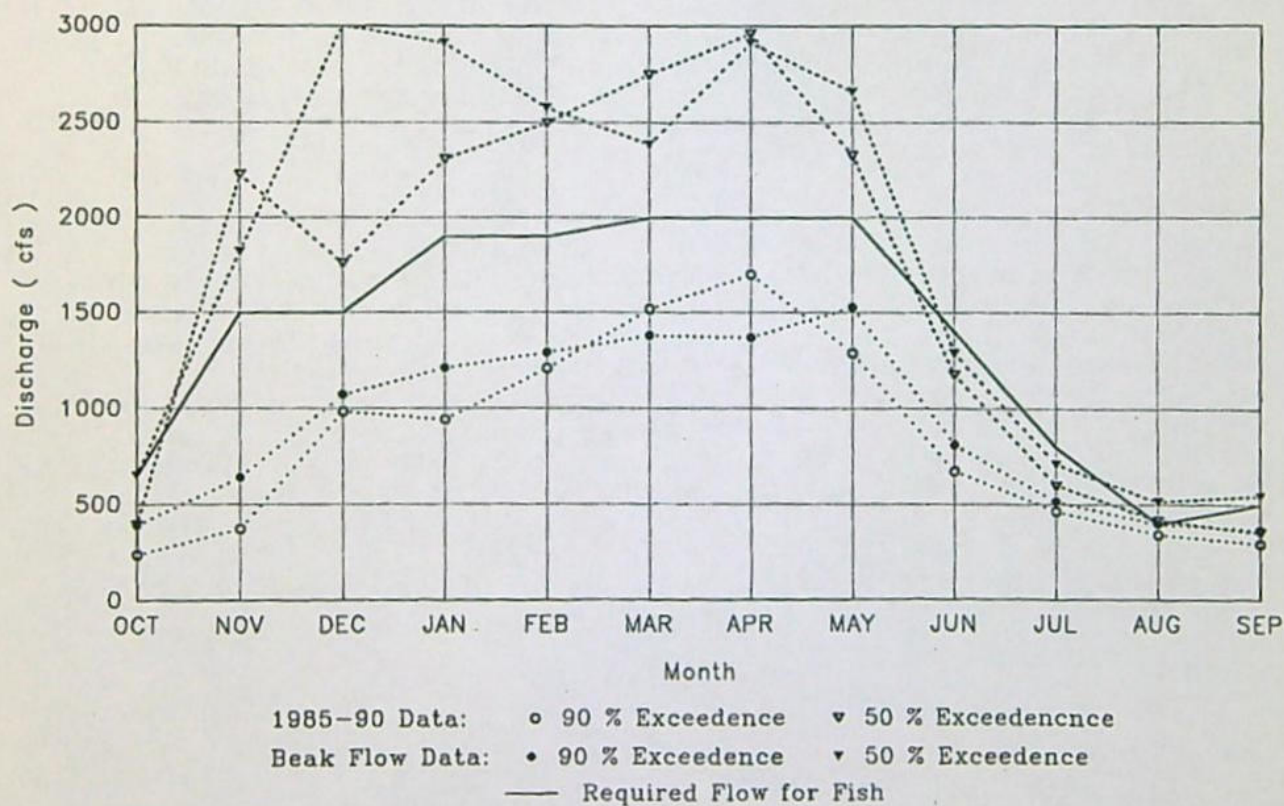
Richard L. Kruger
Hydropower and Water Projects Coordinator
Habitat Conservation Division

Attachments

c: Amin Wahib, WRD, Salem
Audrey Simmons, WaterWatch

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Figure 1. Flow exceedence ranges for Sandy River stream flows and recommended required flows for fish.



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Table 1. Required flows by species and life stages for the Sandy River below Bull Run River.

Species / Life Stage	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Steelhead												
Spawning				1900	1900	2000	2000	2000	1400			
Incubation				1900	1900	2000	2000	2000	1400	800		
Fry						600	600	600	600			
Juveniles	400	400	600	600	600	600	600	600	400	400	400	400
Chinook Salmon												
Spawning	650	1500	1500	1500								500
Incubation	650	1500	1500	1500	1500	1500	1500					500
Fry					600	600	600	600	600			
Juveniles	200	200						600	600	200	200	200
Highest Required Flow	650	1500	1500	1900	1900	2000	2000	2000	1400	800	400	500
Median River Flow	653	1823	3006	2914	2578	2388	2914	2661	1290	712	516	548
90 % Exceedance Flow	393	643	1075	1212	1292	1380	1370	1530	812	517	400	372
Recommended Flow	650	1500	1500	1900	1900	2000	2000	2000	1400	800	400	500

Data Source: Beak 1985 ODFW staff

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APPENDIX I

RECOMMENDED MINIMUM FLOWS FOR FISH LIFE, LOWER WILLAMETTE BASIN

Stream	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Location
Clackamas R.	-	-	-	-	-	-	400	400	-	-	-	-	USGS gage 2095 (Three Lym)
" 1/	240	240	240	240	240	200	150	150	150	240	240	240	USGS gage 2080 (Big Bottom)
Clear Cr.	-	-	-	-	-	40 - 35	30 25	20 25	20	-	-	-	Mouth
"	-	-	-	-	-	25	20 15	15	15	-	-	-	Viola
Collawash R.	250	250	250	250	250	200	150 100	75 60	60 250	250	250	250	Mouth
E. Fk. Collawash R.	-	-	-	-	-	-	-	15 10	7	-	-	-	"
Elk Lake Cr.	-	-	-	-	-	-	-	20 15	12	-	-	-	"
Hot Springs Fk.	75	75	75	75	75	75	50 30	20	20 75	75	75	75	"
Deep Cr.	35	35	35	35	35	20 15	15 10	8	8	8 12	35	35	"
N. Fk. Deep Cr.	20	20	20	20	20	3	3 2	1	1	1 3	20	20	"
Tickle Cr.	30	30	30	30	30	6 5	4	4	4	4 6	30	30	"
Eagle Cr.	125	125	125	125	125	100	75 50	40 35	30	30 40	125	125	"
N. Fk. Eagle Cr.	45	45	45	45	45	35 30	20 15	10	8	8 10	45	45	"
Fish Cr.	60	60	60	60	60	50 40	25 15	12	12	12 15	60	60	"
"	-	-	-	-	-	-	-	3	3	-	-	-	Confl. of Wash Cr.
Wash Cr.	25	25	25	25	25	20 15	10 5	3	3	-	-	-	Mouth
Love Cr.	8	8	8	8	8	8 6	3 2	2	2	2	8	8	Mouth
Oak Grove Fk.	-	-	-	-	-	-	-	10	10	-	-	-	"
Pinhead Cr.	75	75	75	75	75	50	50	50	50	50	75	75	"
Roaring R.	100	100	100	100	100	75	40	40	40	40 60	100	100	"
S. Fk. Clackamas R.	75	75	75	75	75	50 30	25 20	15	15	15 20	75	75	"
Sandy R. 1/	510	510	510	510	510	-	-	-	-	510	510	510	"
"	-	-	-	-	-	-	50	50	50	-	-	-	Release from Marmot Dam
"	-	-	-	-	-	-	300	300	-	-	-	-	USGS gage 1370 (Marmot)
Alder Cr.	250	250	250	250	250	200	150 100	100	100 250	250	250	250	Conf. of Zigzag R.
Beaver Cr.	14	14	14	14	14	15 10	8 5	4	4	4 25	25	25	Mouth
Bull Run R.	-	-	-	-	-	3 2	1	1	1	1 14	14	14	Mouth
Little Sandy R.	-	-	-	-	-	-	25 20	12	12	-	-	-	USGS gage 1400
N. Fk. Bull Run R.	-	-	-	-	-	-	-	15	15	-	-	-	USGS gage 1415
S. Fk. Bull Run R.	-	-	-	-	-	-	-	10	10	-	-	-	Mouth
Cedar Cr.	-	-	-	-	-	-	-	10	10	-	-	-	"
Clear Cr.	45	45	45	45	45	30 20	15 8	8 6	6	6 45	45	45	"
Clear Fk. Sandy R.	25	25	25	25	25	20 15	12	8	8	8 25	25	25	"
Gordon Cr.	50	50	50	50	50	30 20	15	15	15	20 50	50	50	"
Lost Cr.	20	20	20	20	20	15	15 12	12	12	12 20	20	20	Conf. of Cast Cr.
Salmon R.	250	250	250	250	250	250	150 125	100 80	80 250	250	250	250	Mouth
"	-	-	-	-	-	-	-	60	60	-	-	-	Conf. of South Fk.
Boulder Cr.	30	30	30	30	30	20 10	8	5 4	3	3 30	30	30	Mouth
Chaeney Cr.	35	35	35	35	35	20 10	8	5 4	3	3 35	35	35	"
S. Fk. Salmon R.	-	-	-	-	-	-	-	5	5	-	-	-	"

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Appendix I continued

Stream	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Location
Trout Cr.	-	-	-	-	-	-	-	3	3	-	-	-	Mouth
Zigzag R.	200	200	200	200	200	150	100	75	75 200	200	200	200	"
Camp Cr.	25	25	25	25	25	20	20	15	15	15 25	25	25	"
Henry Cr.	18	18	18	18	18	10 7	4 3	2	2	2 18	18	18	"
Still Cr.	60	60	60	60	60	50 40	30 25	25	25 60	60	60	60	"
<u>Small streams tributary to Scappoose Bay</u>													
Milton Cr.	25	25	25	25	25	10 8	5 4	3	3	3 5	25	25	Confl. of Salmon Cr.
Cox Cr.	6	6	6	6	6	3 2	1 0.5	0.5	0.5	0.5 1	6	6	Mouth
Salmon Cr.	5	5	5	5	5	1 0.5	0.3	0.3	0.3	0.3 0.5	5	5	"
N. Fk. Scappoose Cr.	40	40	40	40	40	25 18	15 8	5	5	5 7	40	40	"
Alder Cr.	8	8	8	8	8	3 2	1	1 0.5	0.5	0.5 1	8	8	"
Cedar Cr.	6	6	6	6	6	3 2	1	0.5	0.5	0.5 1	6	6	"
Chapman Cr. (Lizzie Cr.)	6	6	6	6	6	4 2	1.5	1	1	1	6	6	"
N. Fk. of N. Fk.	7	7	7	7	7	4 3	2 1	1	1	1 2	7	7	" (Joins S. Fk. of N. Fk. 0.2 mi. above Mollenhoar Cr.)
Sierkes Cr. (Deep Cr.)	7	7	7	7	7	1.5 0.5	0.5	0.4	0.3	0.3 0.4	7	7	Mouth
S. Fk. of N. Fk.	8	8	8	8	8	4 3	2 1	1	1	1 2	8	8	"
S. Fk. Scappoose Cr.	25	25	25	25	25	15 9	7 6	5 4	4	4 6	25	25	Confl. of Raymond Cr.
Gourley Cr.	10	10	10	10	10	3 2	1 0.5	0.5	0.5	0.5 1	10	10	Mouth
Raymond Cr.	8	8	8	8	8	2 1	1 0.5	0.5	0.5	0.5 1	8	8	"
<u>Small streams tributary to Columbia River</u>													
Bridal Veil Cr.	-	-	-	-	-	-	-	5	4	-	-	-	Mouth
Horsetail Cr.	-	-	-	-	-	-	-	3	3	-	-	-	"
Latourell Cr.	-	-	-	-	-	-	-	3	3	-	-	-	"
McCord Cr.	-	-	-	-	-	-	-	1	1	-	-	-	"
Moffet Cr.	-	-	-	-	-	-	-	1	1	-	-	-	"
Multnomah Cr.	-	-	-	-	-	-	-	4	4	-	-	-	"
Oneonta Cr.	-	-	-	-	-	-	-	3	2.5	-	-	-	"
Tanner Cr.	-	-	-	-	-	-	-	15	15	-	-	-	To arrive at hatchery dam
Wahkeena Cr.	-	-	-	-	-	-	-	2	2	-	-	-	Mouth
<u>Small streams tributary to Willamette River</u>													
Johnson Cr.	25	25	25	25	25	5 4	4	4	4	4 5	25	25	USGS gage 2115
Crystal Springs	15	15	15	15	15	10	10	10	10	10	15	15	Mouth
Tualatin R.	30	30	30	30	30	25	20 15	15	15	30	30	30	USGS gage 2075 (West Limb)
"	-	-	-	-	-	-	-	15	15	-	-	-	USGS gage 2035 (Valley)
" 2/	65	65	65	65	65	30 20	15 10	10	10	10 15	20 65	65	River mile 70

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Appendix I continued

Stream	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Location
Dairy Cr.													
E. Fk. Dairy Cr. ^{2/}	50	50	50	50	50	30 25	20 15	10	10	10 12	15 50	50	River mile 13
Denny Cr. ^{2/}	15	15	15	15	15	4 3	2.5	2	2	2	4 15	15	Mouth
Plentywater Cr. ^{2/ 3/}	5	5	5	5	5	2	2	1	1	1	2 5	5	"
McKay Cr. ^{2/ 3/}	36	36	36	36	36	-	-	4	4	-	- 36	36	River mile 15.5
E. Fk. McKay Cr.	-	-	-	-	-	-	-	2	2	-	-	-	Mouth
Gales Cr. ^{1/}	100	100	100	100	100	50 35	25 15	12	12	12 15	- 100	100	"
" ^{1/}	70	70	70	70	70	-	-	-	8	8	- 70	70	River mile 12
Beaver Cr. ^{2/}	17	17	17	17	17	3 2	2 1	1	1	1	2 17	17	Mouth
Clear Cr. ^{2/}	17	17	17	17	17	10 6	3	2.5	2.5	2.5 3	5 17	17	"
Iller Cr. ^{2/ 3/}	23	23	23	23	23	5 3	2 1	1	1	1 2	2 23	23	"
Little Beaver Cr.	-	-	-	-	-	-	-	1	1	-	-	-	"
N. Fk. Gales Cr.	25	25	25	25	25	4 3	2.5 2	2 1.5	1.5	1.5 2	3 25	25	"
S. Fk. Gales Cr.	20	20	20	20	20	3 2	1.5 1	1	1	1	2 20	20	"
McFee Cr.	12	12	12	12	12	-	-	2	2	-	- 12	12	Confl. of Gulf Canyon
Scoggin Cr.													Cr.
Seine Cr.	25	25	25	25	25	10 6	3 2	1.5	1.5	1.5 2	3 25	25	Mouth
Tanner Cr.	9	9	9	9	9	-	-	1	1	-	- 9	9	"

^{1/} The optimum or near optimum spawning flow listed is based on Oregon Game Commission studies utilizing transects.

^{2/} The optimum or near optimum spawning flow listed is based on Oregon Fish Commission studies.

^{3/} The lowest summer flow listed is the recommended minimum rearing flow based on Oregon Fish Commission studies.

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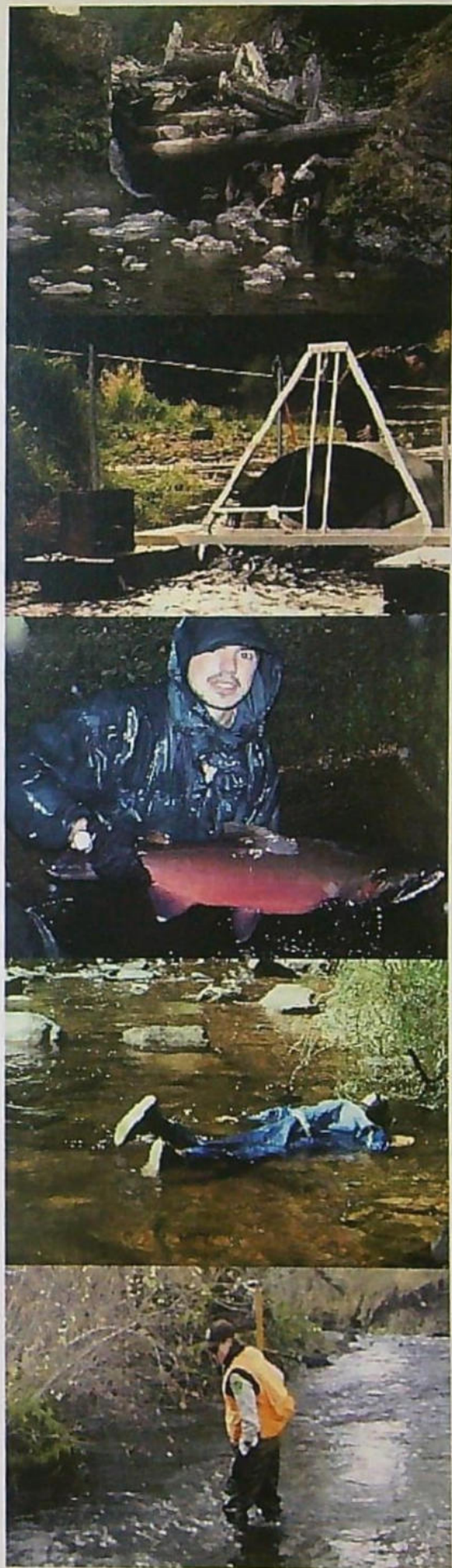
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THE OREGON PLAN *for* *Salmon and* *Watersheds*



Assessment of Western Oregon Adult Winter
Steelhead and Lamprey – Redd Surveys 2015

Report Number: OPSW-ODFW-2015-09



Assessment of Western Oregon Adult Winter Steelhead and Lamprey – Redd Surveys 2015

Oregon Plan for Salmon and Watersheds

Monitoring Report No. OPSW-ODFW-2015-09

October, 2015

Ryan Jacobsen
Jonathan Nott
Eric Brown
Matt Weeber
Mark Lewis

Oregon Adult Salmonid Inventory and Sampling Project
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Citation: Jacobsen R., J. Nott, E. Brown, M. Weeber and M. Lewis. 2015. Assessment of Western Oregon Adult Winter Steelhead and Lamprey – Redd Surveys 2015. Monitoring Program Report Number OPSW-ODFW-2015-09. Oregon Department of Fish and Wildlife, Salem, Oregon.

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SUMMARY

This report provides a summary of results from winter steelhead spawning ground surveys conducted in Oregon Coast and Lower Columbia (Oregon side) basins in 2015. Also included is a brief summary of lamprey data collected from the same monitoring efforts. Precision goals were met (95% C.I. $\pm$ 30% of point estimate) for steelhead estimates in the Oregon Coast Distinct Population Segment (DPS) and Southwest Washington (SWW) Evolutionarily Significant Units (ESU), but not in the Lower Columbia River (LCR) ESU nor the Klamath Mountains Province (KMP) DPS. Winter steelhead redd estimates for the 2015 spawning year were very close to both the 5-year and 10-year averages for the Oregon Coast DPS. Estimates in the KMP DPS were the lowest recorded since monitoring began in 2003. We do not have long-term data on winter steelhead redd abundance in the Lower Columbia, but 2015 estimates in the SWW ESU and LCR ESU are higher than those in 2012 and 2013. Indices for Pacific Lamprey were generally improved in 2015 compared to recent years. Weather and stream flows made for very good survey conditions during the 2015 season. Regional patterns are apparent for redd density, proportion of hatchery spawners, and spawn timing.

INTRODUCTION AND METHODS

As part of the Oregon Plan for Salmon and Watersheds, the Oregon Department of Fish and Wildlife (ODFW) initiated a project to monitor spawning winter steelhead (*Oncorhynchus mykiss*) in coastal Oregon streams in 2003 under the Oregon Adult Salmonid Inventory and Sampling (OASIS) project. The project is designed to assess yearly status and trend, abundance, proportion of hatchery fish, and distribution of winter steelhead spawners. Monitoring currently occurs in the Oregon Coast and KMP DPSs at the monitoring area (MA) scale, though monitoring does not encompass the Rogue River MA. The Southwest Washington and Lower Columbia ESUs are currently monitored at the population scale, though funding limited efforts in 2015 to only the Clatskanie, Scappoose, Clackamas, and Sandy populations.

A spatially balanced probabilistic sampling design (Stevens 2002) was used to randomly select survey sites across a stream network of winter steelhead spawning habitat. The selection frame was developed using professional knowledge of biologists from a variety of private and governmental biologists. Within the sampling frame there are/were dams or fish traps where counts of fish are available, including; North Fork Clackamas, Marmot, Winchester and Gold Ray dams, Bonnie Falls Trap, and Big Creek Hatchery Weir. Counts of steelhead passed upstream are used for monitoring these areas rather than spawning surveys. This report provides results for surveys outside those areas. In accordance with prior work conducted by ODFW in coastal streams, monitoring of winter steelhead abundance is based on counts of redds, with rearing origin determined from live and dead fish (Susac and Jacobs 1999). Repeat visits to each site from February through May generate a total redd count for each survey. Sites are visited at least once every fourteen days (Susac and Jacobs 1999). Redds are marked with colored rocks and flagging to prevent re-counting during subsequent surveys. Specific descriptions of project protocols can be found in the annual survey procedures manual (ODFW 2015).

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The geographic scale of monitoring used in this report (Figure 1) is based on a variety of sources. Boundaries for the four ESU/DPS units are as determined by the National Oceanic and Atmospheric Administration (Busby et.al. 1996). Population boundaries are based on Myers et. al. (2006) for the LCR ESU population structure and the 2005 Oregon Native Fish Status Report (ODFW 2005) for other populations. Monitoring area boundaries match those used for coho salmon monitoring by the OASIS project (Lewis et. al. 2009).

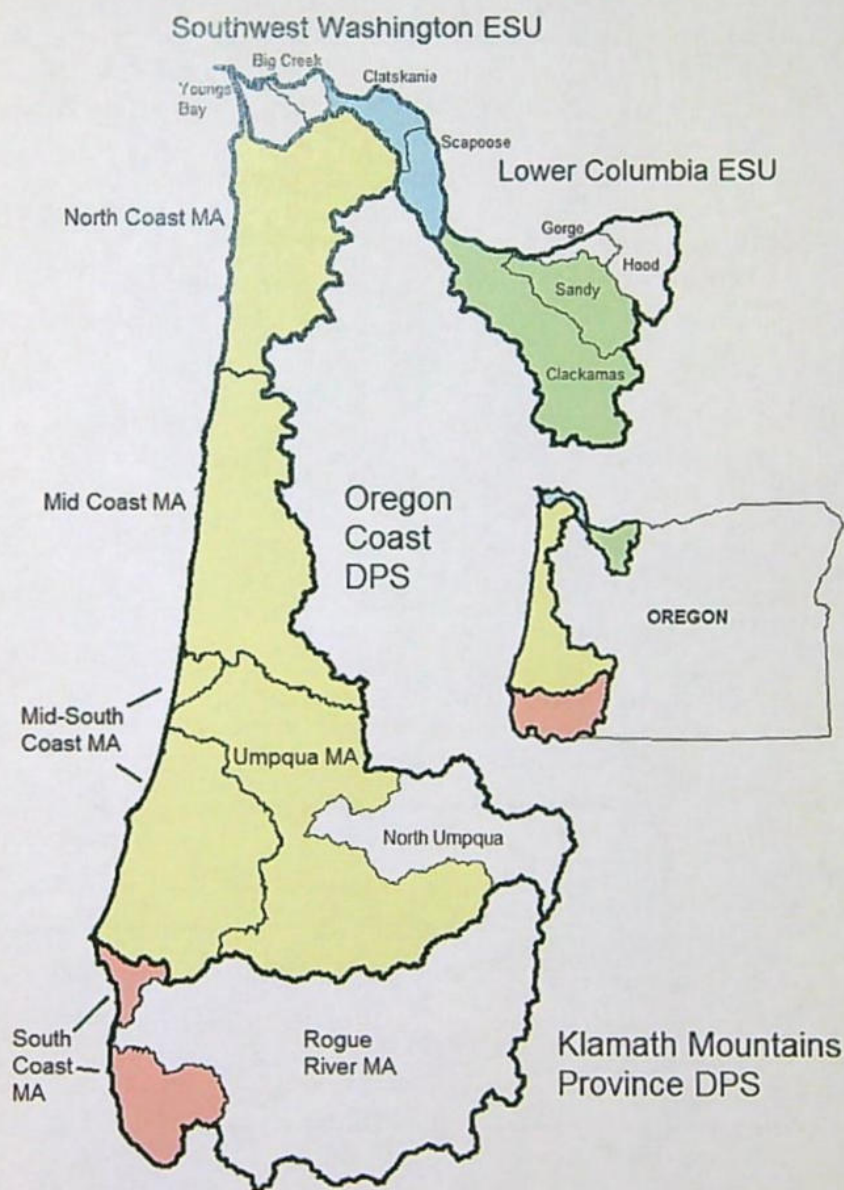


Figure 1. Steelhead spawner monitoring areas during 2015. Monitoring scales include: Evolutionary Significant Unit (ESU), Dependent Population Segment (DPS), Monitoring Areas (MA), and population. Areas without color were not monitored in 2015.

RESULTS AND DISCUSSION

This report contains monitoring area level summaries for each steelhead DPS along the Oregon Coast, as well population level summaries for the LCR and SWW ESUs. Counts of adult lamprey and lamprey redds are recorded during steelhead surveys and the results are included in a brief summary at the end of this report.

A total of 263 sites were successfully surveyed in 2015, split between the four steelhead DPS/ESU areas monitored (Table 1). Successful surveys represent 62% of the 421 total sites selected for 2015. Sites were selected at a rate of 1/24 miles of habitat in the Oregon Coast DPS. Selection densities were greater in the KMP DPS (1/19) and the two Lower Columbia ESU's (1/4). Ten percent of sites in 2015 were not surveyed because of landowner access restrictions. The proportion of sites that were surveyed, but were not used in final estimates due to turbidity and/or large gaps between survey dates averaged 12.6%, ranging from 6.8% in the Oregon Coast DPS to 16.7% in the KMP DPS. The percentage of sites that were outside of steelhead spawning habitat averaged 4.5% across the four DPS/ESU areas, ranging from 0% in the KMP DPS to 14.0% in the Oregon Coast DPS.

Table 1. Site status by monitoring area or population in 2015. Target sites were within and non-target sites were outside of steelhead spawning habitat. Response sites were successfully surveyed. Non-response sites couldn't be surveyed, or were not successfully surveyed.

DPS/ESU	Monitoring Area or Population	Target Response	Target Nonresponse	Nontarget
Oregon Coast	North Coast	41	12	14
	Mid Coast	44	12	11
	Mid South Coast	38	19	3
	Umpqua	39	23	9
	Total	162	66	37
Klamath Mountains Province	South Coast	13	5	0
	Rogue River ^a	-	-	-
	Total	13	5	0
Southwest Washington	Young's Bay ^a	-	-	-
	Big Cr ^a	-	-	-
	Clatskanie	22	4	0
	Scappoose	15	15	1
	Total	37	19	1
Lower Columbia River	Clackamas	27	6	0
	Sandy	24	22	2
	Gorge ^a	-	-	-
	Total	51	28	2

a = Surveys in the Rogue River, Young's Bay, Big Cr and Gorge MA's were not conducted in the 2015 season due to budget constraints.

The target level of precision for steelhead redd estimates is a 95% confidence interval within $\pm 30\%$ of the point estimate. In 2015, this goal was achieved for the Oregon Coast DPS and SWW ESU, as well as in the Mid Coast and Mid-South Coast MA's, and the Clatskanie population (Table 2). Precision goals were not met in the LCR ESU or any of its populations. The Scappoose population, the North Coast, Umpqua, and South Coast MA's also did not meet precision goals. Steelhead spawning survey effort has been dramatically reduced on the Oregon Coast since 2008, resulting in not meeting precision goals at most spatial monitoring scales.

Table 2. Oregon winter steelhead redd abundance estimates in 2015. Wild proportions are derived from fin-mark observation rates on live and dead steelhead.

DPS/ESU	Monitoring Area or Population	Survey Effort		Winter Steelhead Redd Abundance			
				Total		Wild	
		Number of Surveys	Miles	Estimate	95% Confidence Interval	Estimate	95% Confidence Interval
Oregon Coast	North Coast	41	33	25,761	13,529	24,641	12,941
	Mid Coast	44	36	19,786	5,349	15,443	4,175
	Mid South Coast	38	33	13,054	3,545	11,548	3,136
	Umpqua	39	34	10,975	3,878	10,975	3,878
	Total	162	136	69,576	15,468	62,607	14,483
Klamath Mountains Province	South Coast	13	10	2,329	1,235	1,682	892
	Rogue River	-	-	-	-	-	-
	Total	13	10	2,329	1,235	1,682	892
Southwest Washington	Young's Bay	-	-	-	-	-	-
	Big Cr	-	-	-	-	-	-
	Clatskanie	22	21	1,145	283	1,145	283
	Scappoose	15	13	107	64	107	64
	Total	37	33	1,252	290	1,252	290
Lower Columbia River	Clackamas	27	27	1,414	574	1,247	507
	Sandy	24	30	3,050	1,259	2,745	1,133
	Gorge	-	-	-	-	-	-
	Total	51	57	4,464	1,384	3,993	1,241

Oregon Coast DPS

The 2015 estimate of 62,607 wild winter steelhead redds in the Oregon Coast DPS approximates the long term average; it is within 1% of both the 5-year average and the average since this monitoring began in 2003 (Figure 2). While the 2015 redd estimate for the DPS as a whole was about average, there is a distinct geographic pattern across MAs: North Coast at 139% of average, Mid Coast at 103%, and the Mid-South and Umpqua just under 80% (Appendix Table A-1). While the estimated abundance of wild steelhead redds in the Oregon Coast DPS has ranged from about 41,000 to 95,000 across the 13 years of monitoring (2003

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through 2015), there does not appear to be any clear trend in abundance over this time period. The relatively short time period of monitoring and the reduced effort in recent years (and thus larger 95% confidence intervals) currently limit the ability to detect long-term trends in abundance.

Density of redds (steelhead redds/mile of spawning habitat) also varied across monitoring areas, ranging from the 5.5 redds/mile observed in the Umpqua MA to the 22.7 redds/mile in the North Coast MA (Table 3 and Figure 3). Geographic patterns in redd density matched that of the redd abundance estimates; North and Mid Coast MAs were above average while Mid-South and Umpqua MAs were below average.

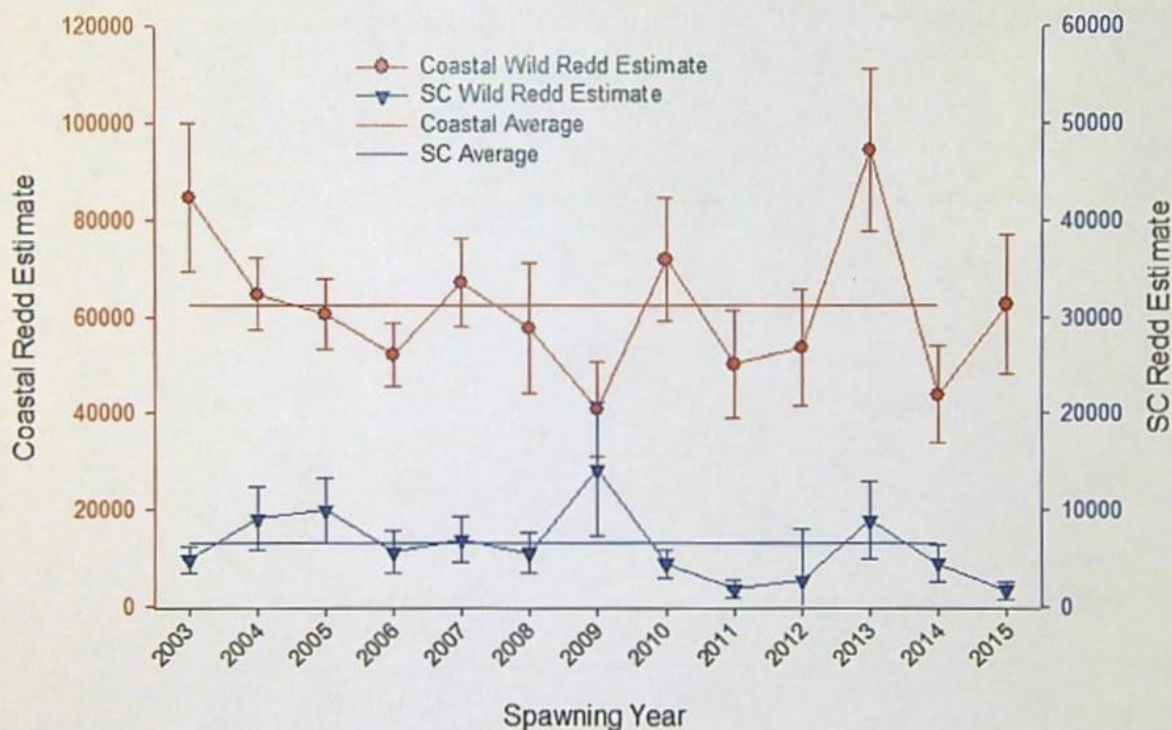


Figure 2. Estimated number of wild winter steelhead redds in the Oregon Coast DPS and South Coast MA, 2003 to 2015. Error bars represent 95% confidence intervals, and horizontal lines show the previous 12-year average.

An occupied site was defined as having at least one steelhead redd recorded during the season. The proportion of occupied sites in 2015 in the Oregon Coast DPS was 11 percent lower than the previous 12-year average (Table 3). The North and Mid-South Coast monitoring areas had the most notable decreases in occupancy. Geographic patterns in occupancy rates for 2015 were consistent with the 12 year average, being highest in the Mid-South Coast MA and lowest in the Umpqua MA (Table 3). The unusually low occupancy rate for the North Coast MA in 2015 was an exception to this pattern. It is worth noting that low stream flow conditions can reduce occupancy, and that stream flows in 2015 were generally lower than normal.

The proportion of hatchery origin spawners (pHOS) in the naturally spawning steelhead populations of the Oregon Coast DPS was 10% in 2015, below the 2003-2014 average of 14% (Table 4). The 2015 proportion is near the lowest observed in the 13 years of monitoring in the Oregon Coast ESU. There have only been four years (2003, 2005, 2012 and 2013) with a lower pHOS rate, all at 9%. The proportion of hatchery origin spawners varied among the monitoring areas in 2015 (Figure 4), ranging from 0% in the Umpqua MA to 22% in the Mid Coast MA. All four MAs had 2015 pHOS rates at or below their previous 12 year average pHOS rates (Table 4). Geographic patterns in pHOS rates for 2015 were similar to the previous 12 year average; the Mid Coast and Mid-South Coast MAs tend to have higher pHOS rates than the Umpqua and North Coast MAs (Table 4).

Table 3. Oregon winter steelhead redd density and percent occupancy in 2015.

DPS/ESU	Monitoring Area or Population	Redds / Mile		% Sites With Redds	
		2015	Average *	2015	Average *
Oregon Coast	North Coast	22.7	17.9	61%	80%
	Mid Coast	12.6	11.2	74%	81%
	Mid-South Coast	12.7	18.6	79%	90%
	Umpqua	5.5	9.4	64%	73%
	Total	12.2	13.4	70%	81%
KMP	South Coast	6.8	19.0	77%	97%
	Rogue River	-	9.6	-	82%
	Total	6.9	14.8	77%	90%
Southwest Washington	Young's Bay	-	6.3	-	56%
	Big Creek	-	5.7	-	59%
	Clatskanie	19.5	10.2	76%	63%
	Scappoose	1.7	2.3	46%	42%
	Total	10.4	6.2	65%	55%
Lower Columbia River	Clackamas	7.4	6.0	54%	57%
	Sandy	17.9	8.7	71%	61%
	Gorge	-	-	-	-
	Total	12.4	7.2	62%	55%

* = Average for period of monitoring: Oregon Coast and KMP is 2003-2014; SWW is 2012-2013; SWW is 2012-2014.

In the recent years, there have been a small handful of survey sites that were adjacent to hatcheries or hatchery acclimation sites. These surveys tend to have a higher proportion of hatchery fish and redd densities, which can bias estimates of abundance and pHOS. The new ODFW Coastal Multi-Species Conservation and Management Plan allows for higher maximum pHOS rates in areas adjacent to hatchery release sites. Identification of which areas meet the criteria in the plan, and methods for separate monitoring of those areas are under development. One option under consideration is stratification of future steelhead spawner abundance estimates to account for these areas with different allowable pHOS rates.

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Oregon Coast DPS winter steelhead spawning began somewhat earlier in 2015 compared to previous years, with generally above average redd counts in Mid-January (Figure 5). The earlier start is most notable in the Umpqua MA, with the remaining MA's more similar to previous year averages. In spite of the earlier start to spawning in 2015, the peak spawning time (defined as maximum number of new redds observed) was comparable to previous years. Over the 13 years of monitoring typical peak spawning time for the four monitoring areas are: early April in the North Coast MA; a bi-modal peak in late February and early April in the Mid Coast MA; and late February for both the Mid-South Coast MA and Umpqua MA (Figure 5). Spawning timing differences between the monitoring areas suggest differences between the steelhead populations, but may also be impacted by weather and stream flow events. Aside from moderately high flow events in mid-January and mid-February, river discharge on the Oregon Coast held at fairly low levels throughout the remainder of winter steelhead spawning survey season (Figure 6). Much of the peak spawning occurred during this February event and as those flows receded.

Table 4. Number of known fin-mark status steelhead observed on spawning grounds, and resulting percent hatchery fish in 2015. Hatchery percentage based on adipose fin clip observations of live and dead steelhead in successfully conducted surveys.

DPS/ESU	Monitoring Area or Population	Number Known Fish		Percent Hatchery	
		2015	Average *	2015	Average *
Oregon Coast	North Coast	92	102	4%	11%
	Mid Coast	123	70	22%	22%
	Mid South Coast	104	102	12%	17%
	Umpqua	44	54	0%	6%
	Total	363	328	10%	14%
Klamath Mountains Province	South Coast	18	69	28%	5%
	Rogue River	-	50	-	7%
	Total	18	94	28%	4%
Southwest Washington	Young's Bay	-	11	-	46%
	Big Cr	-	12	-	95%
	Clatskanie	29	17	0%	3%
	Scappoose	-	3	-	0%
	Total	29	42	0%	41%
Lower Columbia River	Clackamas	17	29	12%	6%
	Sandy	60	28	10%	3%
	Gorge	-	0	-	-
	Total	77	57	11%	5%

* = Average for period of monitoring: Oregon Coast and KMP is 2003-2014; SWW is 2012-2013; SWW is 2012-2014

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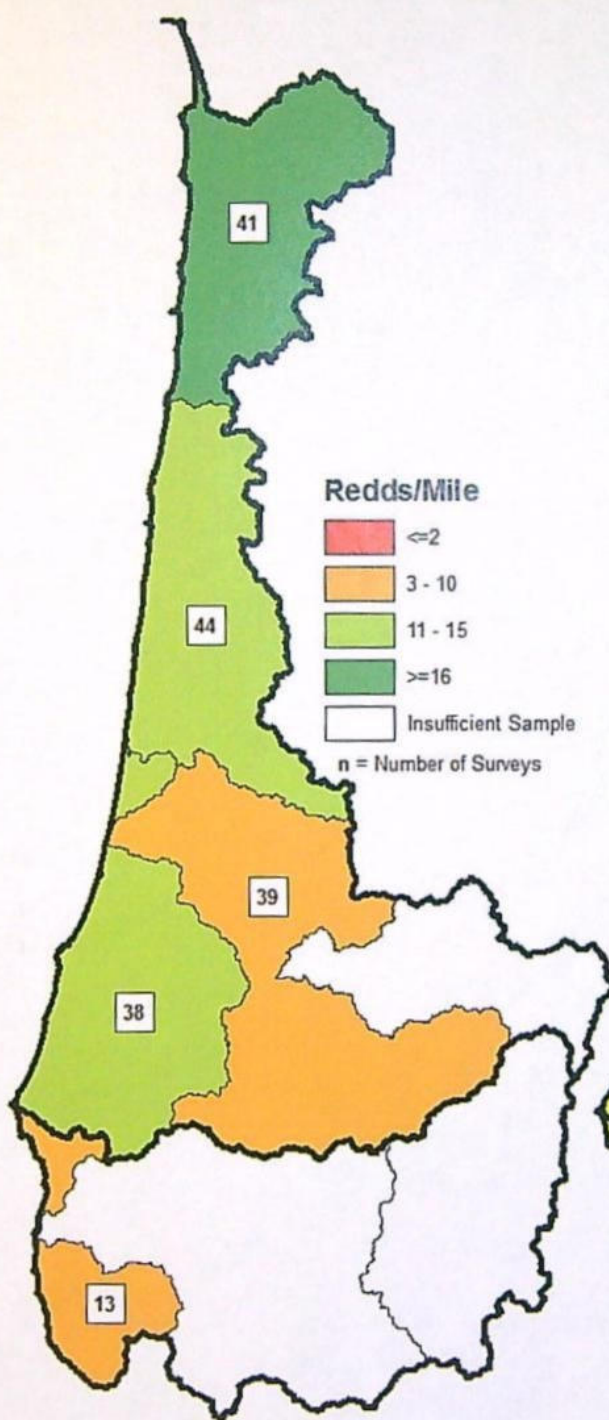


Figure 3. Total steelhead redds/mile in random surveys in 2015 by monitoring area in the Coastal and KMP DPSS, with the number of surveys in each monitoring area.

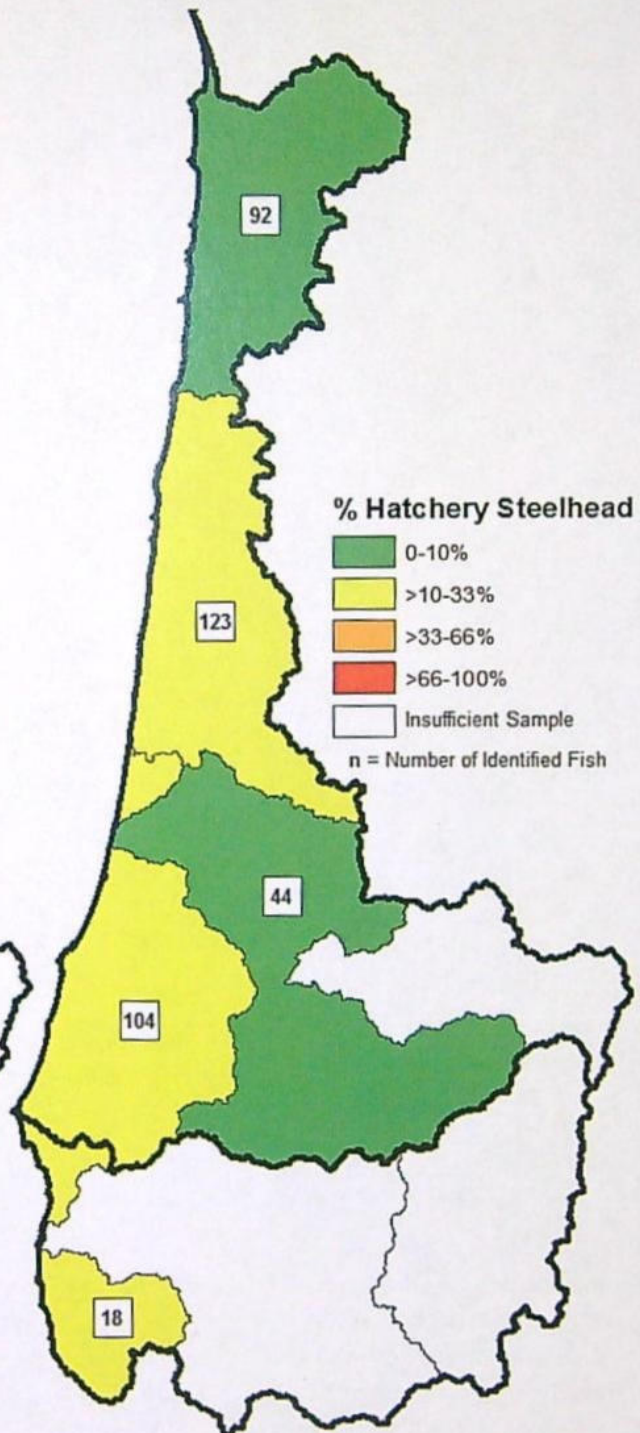


Figure 4. Percentage hatchery steelhead found on random surveys in each of the five Coastal and KMP monitoring areas in 2015 based on adipose fin clip observations of live and dead steelhead, with the number of identified steelhead in each monitoring area.

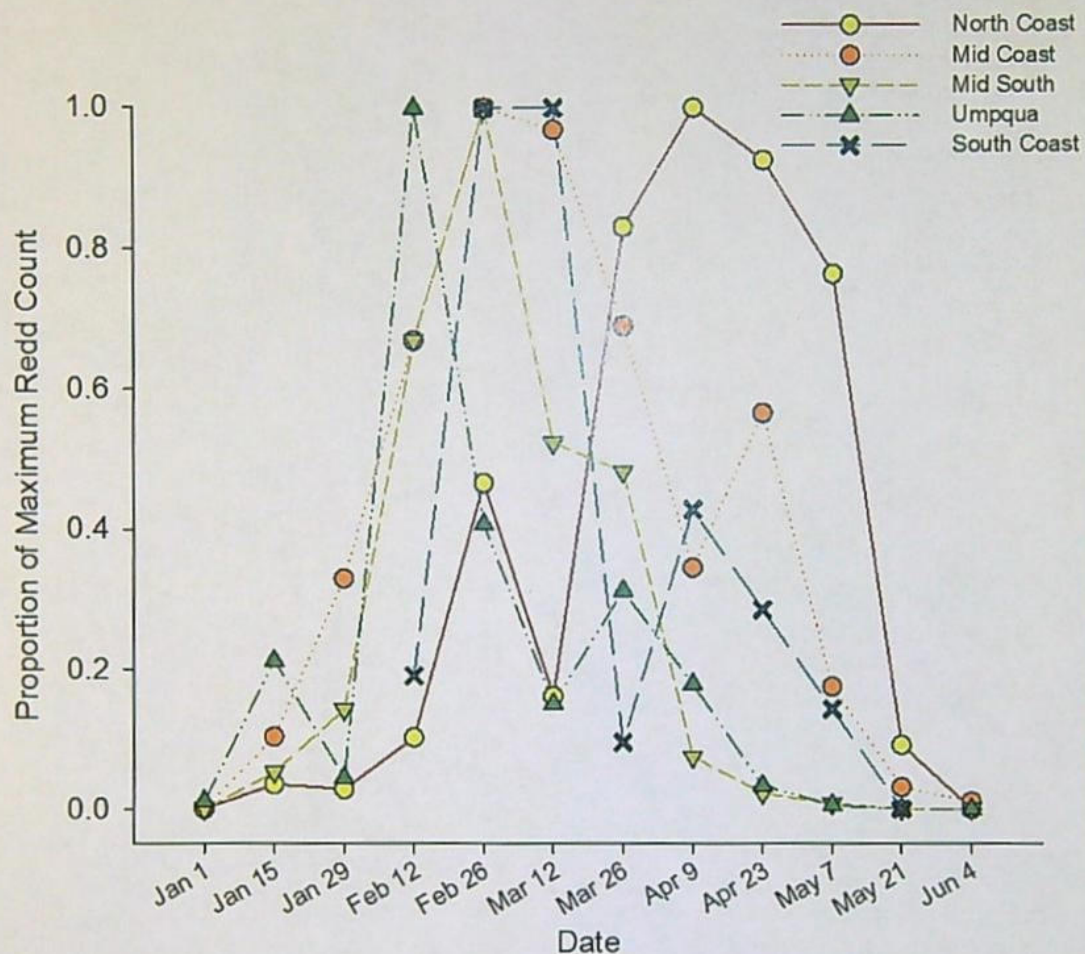


Figure 5. Proportions of the maximum winter steelhead redd count in each of the five Coastal and KMP monitoring areas by two-week period in 2015.

Klamath Mountains Province DPS

No surveys have been conducted in the Rogue MA since 2009 due to budget constraints. Thirteen of the 18 sites selected in the South Coast MA were successfully surveyed in 2015, four sites more than the average of nine successfully surveyed sites over the past 5 years. Survey conditions in the South Coast MA were similar to those experienced in other Western Oregon winter steelhead spawning survey areas in 2015. This likely contributed to the better than average rate of successful surveys in 2015.

In the South Coast MA we estimated 1,682 wild steelhead produced redds (Table 2). The 2015 estimate was 38% of the previous 5-year average estimate of 4,477 redds (Figure 2). Redd density and percent of surveys with at least one steelhead redd observed were also well below the 2003 through 2014 average in the South Coast MA (Table 3 and Figure 3). Estimated pHOS in

the South Coast MA in 2015 was 28% (Table 4 and Figure 4). This is the first year in the South Coast since 2009 that there has been a pHOS greater than 0%. The sample size for calculating pHOS was much lower than average in 2015, 18 versus an average of 69 for the period 2003 through 2014. Also, it is worth noting that the five adipose clipped fish of the 18 total steelhead with known adipose fin clip status observed this season in the South Coast were observed on a single survey visit on the Elk River. Spawn timing in 2015 peaked from late-February through mid-March, which is about average for the South Coast MA. Steelhead monitoring in the South Coast MA will not be conducted by this project next season, as surveyors will no longer be located in the area.

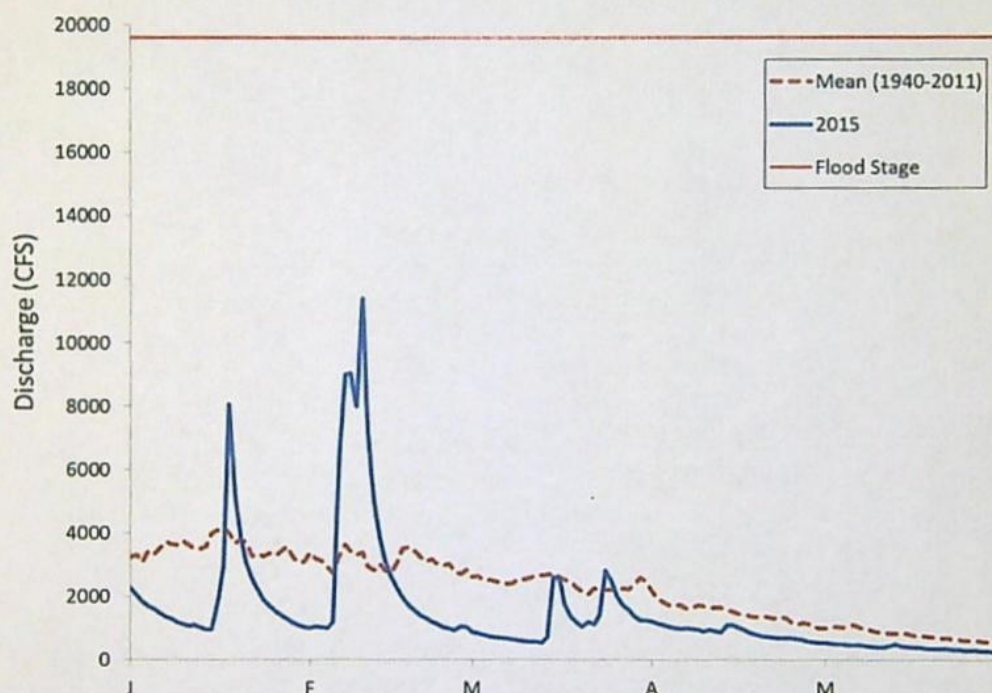


Figure 6. Stream discharge at Alsea River near Tidewater during 2015, compared to mean discharge from 1940 to 2011. (Flood stage = 19,500 CFS)

Southwest Washington ESU

The 2015 estimate of wild winter steelhead redds in the Oregon portion of the SWW ESU was 1,252 (Table 2). This is higher than the 2012 estimate and similar to the 2004 and 2013 estimates (Figure 7). The Clatskanie population accounted for 91% of the 2015 wild winter steelhead redds within this ESU, although only 2 of 4 populations were sampled in 2015. Redd densities ranged from 1.7 redds per mile in the Scappoose population to 19.5 redds per mile in the Clatskanie population (Table 3 and Figure 8). Average density across the ESU was 10.4 redds per mile, which is slightly higher than the ESU average of 6.2 (Table 3). The percentage of sites with at least one redd observed ranged from 46% in the Scappoose population to 76% in the Clatskanie population, higher than the averages from previous years (Table 3).

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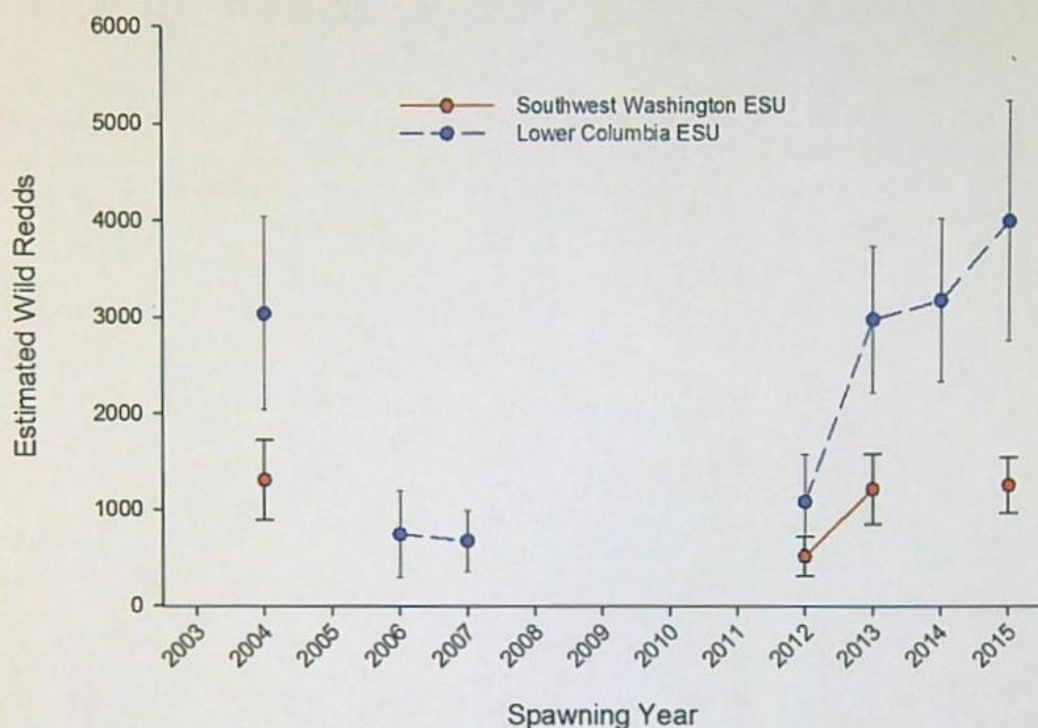


Figure 7. Winter steelhead wild redd estimates in the Oregon portions of the LCR and SWW ESUs based on random surveys, 2004 to 2015. Error bars represent 95% confidence intervals. Inclusion of survey data from specific populations and from above counting stations has varied across years, see Appendix Table A-2.

On average the Scappoose population has had only three steelhead observations with known fin-mark status, but none were observed in 2015 (Table 4 and Figure 9). In contrast, sample size for calculating hatchery proportion in the Clatskanie population was 29, better than average from prior years (Table 3). Ideal stream conditions throughout the season likely contributed to the high sample size of known fish for the ESU. The Clatskanie population had a 0% pHOS rate in 2015, lower than the prior average of 3% (Table 4 and Figure 9). This is the second year of 0% pHOS in three years of sampling in the Clatskanie population.

Spawn timing was fairly consistent across the SWW ESU populations in 2015. The Clatskanie and Scappoose populations experienced bi-modal peaks in late February and late March (Figure 10). Another small peak was observed in the Scappoose population in late April. This spawn timing is consistent with years past. Consistently favorable survey conditions during the 2015 spawning season enhanced the ability to detect peaks in redd deposition. More years of data will be required to explore similarities and differences in winter steelhead spawn timing between these populations, and across years.

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Lower Columbia ESU

The Oregon portion of the Lower Columbia Steelhead ESU includes four populations. However, due to budgetary and logistical issues no surveys were conducted in the Lower Gorge or Hood River populations in 2015. Spawning ground survey effort was limited to the Sandy population, and the portion of the Clackamas population located below River Mill Dam. The following results are for those two areas.

The 2015 estimate of wild winter steelhead redds in the LCR ESU was 3,993 (Table 2). This is the highest LCR ESU redd estimate in the seven years of monitoring that include both the Sandy and Clackamas populations (Appendix Table A-2). However, trend analysis is not possible considering the lack of a long continuous time series (Figure 7). Redd distribution across the ESU in 2015 was slightly disproportionate, with 69% and 31% of estimated redds located in the Sandy and Clackamas populations, respectively. The 2015 Clackamas estimate of 1,247 wild redds is similar to recent estimates, though much lower than the 2004 estimate (Figure 11). Part of this difference is that the 2004 estimate is for the entire Clackamas population and all subsequent estimates are only for the area below River Mill Dam. The 2015 Sandy population estimate of 2,745 wild redds is the highest estimate observed since 2004 (Figure 11). However, the 2004 through 2007 estimates in the Sandy are only for the area below Marmot Dam, while all subsequent estimates are for the whole Sandy population.

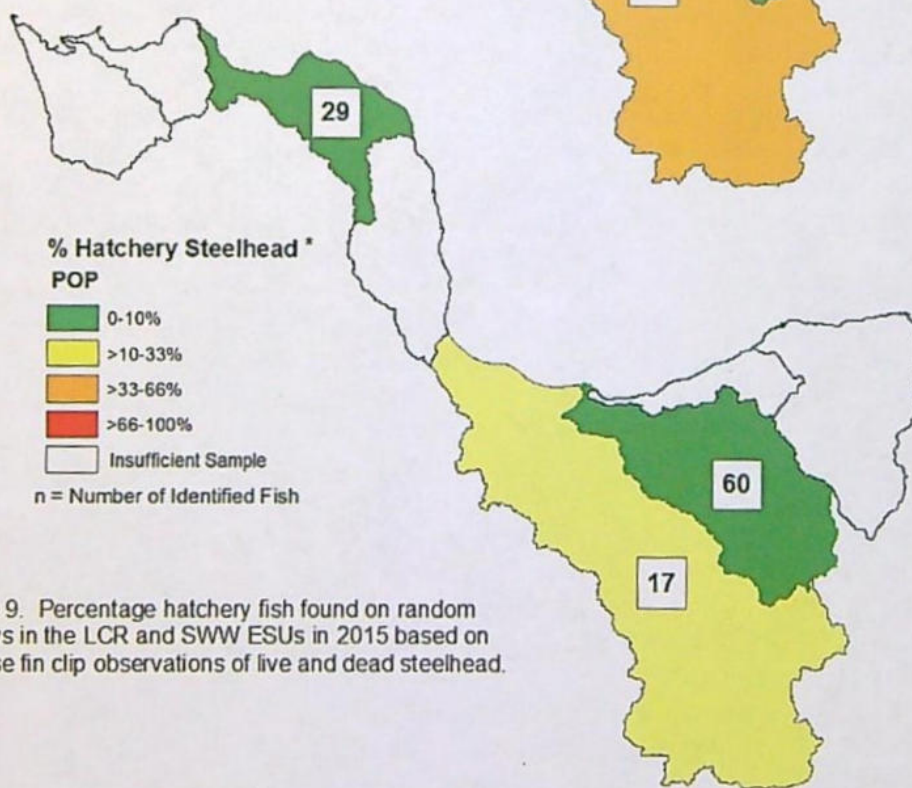
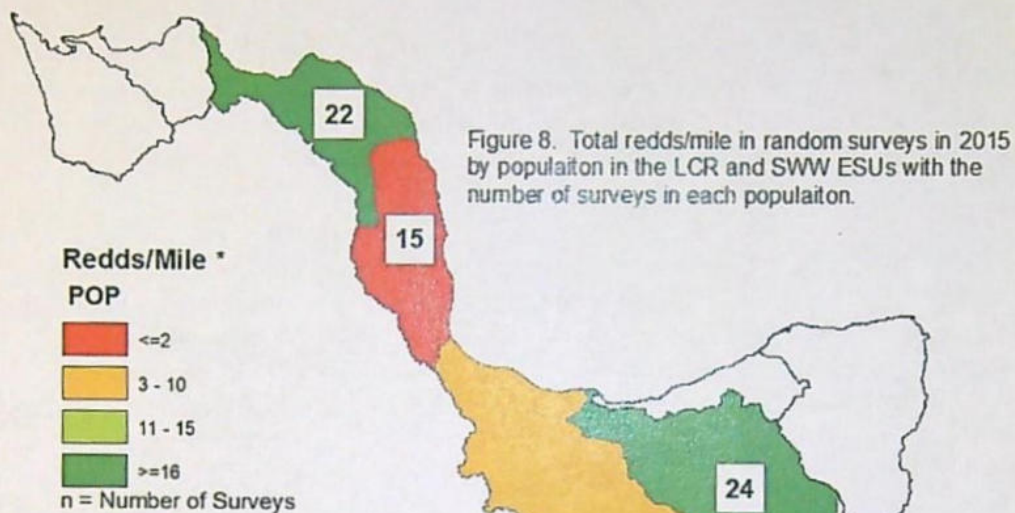
Survey effort in the Sandy population in 2013 through 2015 differed from all other populations reported, in that surveys were conducted weekly rather than bi-weekly. This was done primarily to improve the sample size of known fin-marked adults in the basin, but also to maintain a higher number of successfully surveyed sites. In the Sandy population, 75% of the sites surveyed in 2015 met protocols for inclusion in the estimate calculation. Increased survey visits during the spawning season were a likely factor in the high proportion of valid surveys completed in 2015 compared to previous years. The combination of increased survey effort and excellent survey conditions may be a factor in the higher abundance estimates (i.e. increased rate of redd observation) in recent years.

Redd density for the LCR ESU was 12.4 redds per mile; ranging from 7.4 redds per mile in the Clackamas to 17.9 redds per mile in the Sandy (Table 3 and Figure 8). Both the Clackamas and Sandy redd densities are above average (Table 3). The percentage of sites having at least one redd also varied between the two populations, with 54% of sites occupied in the Clackamas and 71% of sites occupied in the Sandy population (Table 3). Site occupancy rate in the Clackamas was slightly below average in 2015, and in the Sandy was well above average.

The proportion of naturally spawning hatchery steelhead in the LCR ESU was 11% in 2015. The 2015 PHOS rate was 10% in the Sandy population and 12% in the Clackamas population, both well above average (Table 4). Increased survey frequency in the Sandy improved the number of known fin-clip status steelhead from three in 2012 to 60 in 2015.

The Sandy River contains a hatchery summer steelhead program; differentiating summer and winter steelhead on the spawning grounds is difficult. The two runs differ somewhat in spawn timing, with most summer-run fish spawning from late December into

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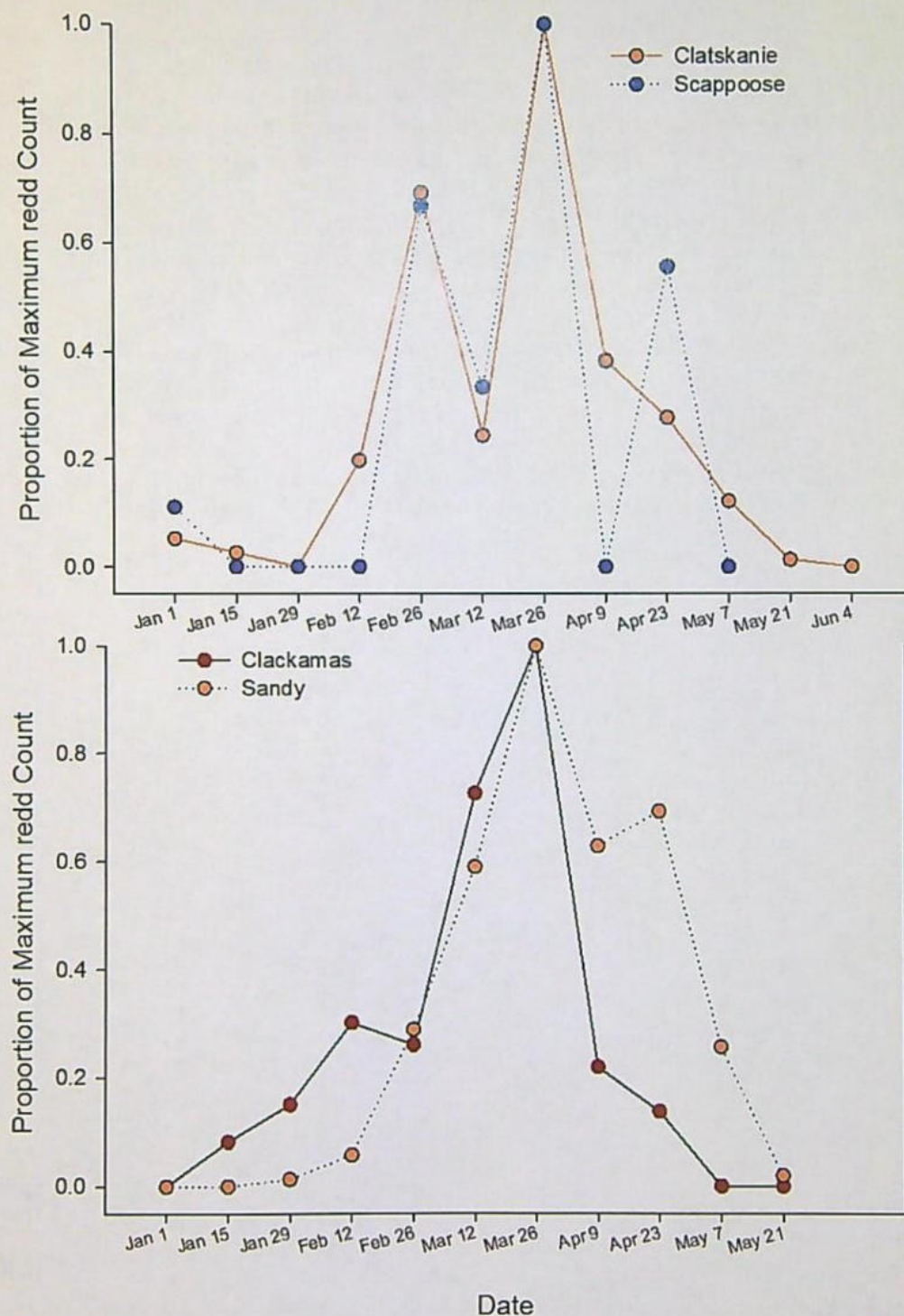
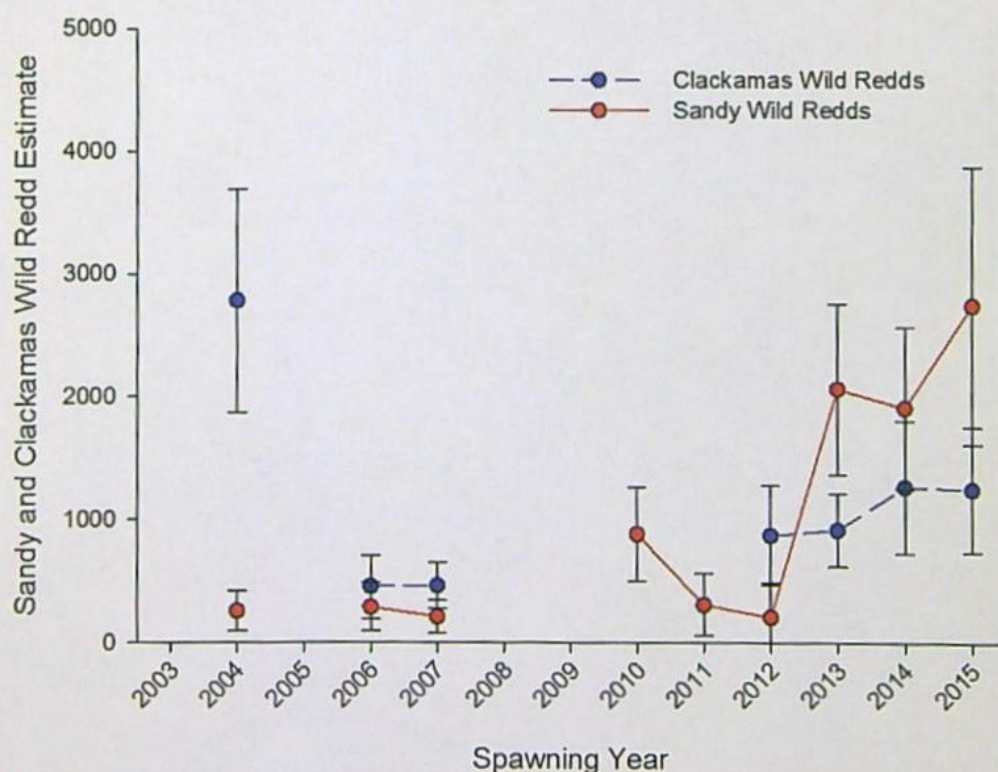


Figure 10. Proportion of the maximum winter steelhead redd count in each of the Lower Columbia populations by week of the year in 2015.

February, and winter runs spawning February through May. Management plans for wild winter steelhead in the Sandy set different maximum allowable pHOS rates for the two steelhead runs. When the Sandy total hatchery steelhead pHOS rate is less than the lower of the two run specific pHOS limits, both are in compliance. If the total exceeds the lower limit (5% for summer steelhead), then a separate pHOS calculation is made for the period of spawning overlap between wild winter and hatchery summer steelhead runs. This calculation is based on redds and known fin clip status steelhead observed before March 1st. The 10% total pHOS rate for the Sandy in 2015 triggered the calculation of a summer steelhead pHOS. The estimated pHOS for the period before March 1st, 2015 in the Sandy population is 2.3%.

Peak spawn timing was similar across the two surveyed populations within this ESU, with the peak occurring during late March in both populations (Figure 10). Exceptions to the pattern were a small mid-February increase in spawning in the Clackamas population, and the Sandy population continued relatively high spawning activity into late April. Survey conditions were relatively ideal and consistent in the LCR ESU, and there was no indication that these timing signatures were the product of survey conditions or any other surveying affect.



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Figure 11. Winter steelhead wild redd estimates in the Clackamas and Sandy River populations based on random surveys, 2004 to 2015. Error bars represent 95% confidence intervals.

Inclusion of survey data from above North Fork Clackamas and Marmot dams has varied across years, see Appendix Table A-2.

Steelhead Escapement

In recent years there has been an increased emphasis on a redd-to-fish conversion factor so that estimates can be reported in terms of fish rather than redds. In 2013 we conducted a re-analysis of previous calibration efforts, based on four calibration sites over a five-year time span (1998-2002). This re-analysis resulted in a conversion rate which is intended to be used across all of the monitoring areas and populations included in this report (ODFW 2013).

$$\text{Total steelhead} = (1.70 * \text{Redds}) + 3.74$$

Estimates of winter steelhead escapement in 2015, derived from redd counts and then converted with the above equation are reported in Table 5. Starting in 2014, we began exploring additional calibration sites using similar methods and a mix of new and repeated calibration sites. However, those results are not yet reported nor used for conversions. These calibration efforts are intended to be an ongoing, annual component of these monitoring efforts. Some variation does exist between sites and between years, so the goal is to build on previous calibration work by exploring the feasibility of producing a redd-to-fish conversion on an annual basis.

Table 5. Oregon winter steelhead fish abundance estimates in 2015. Estimates do not include steelhead above counting stations and are thus not complete population estimates in all areas, see Appendix Tables A-1 and A-2.

DPS/ESU	Monitoring Area or Population	Winter Steelhead Abundance			
		Total		Wild	
		Estimate	95% Confidence Interval	Estimate	95% Confidence Interval
Oregon Coast	North Coast	43,798	23,003	41,894	22,003
	Mid Coast	33,641	9,097	26,257	7,101
	Mid South Coast	22,195	6,031	19,635	5,335
	Umpqua	18,661	6,596	18,661	6,596
	Total	118,284	26,299	106,435	24,625
Klamath Mountains Province	South Coast	3,963	2,103	2,863	1,520
	Rogue River	-	-	-	-
	Total	3,963	2,103	2,863	1,520
Southwest Washington	Young's Bay	-	-	-	-
	Big Cr	-	-	-	-
	Clatskanie	1,949	484	1,949	484
	Scappoose	186	113	186	113
	Total	-	-	-	-
Lower Columbia River	Clackamas	2,407	980	2,124	865
	Sandy	5,189	2,144	4,671	1,930
	Gorge	-	-	-	-
	Total	7,593	3,121	6,791	2,792

LAMPREY MONITORING

Over the course of steelhead monitoring, ancillary data recorded on each survey include the counts of Pacific Lamprey (*Entosphenus tridentatus*) redds, as well as counts of observed live and dead lamprey. In addition, Western Brook Lamprey (*Lampetra richardsoni*) are observed and data recorded, but that data is not summarized in this report. While these data do provide information for lamprey coast-wide and in the Lower Columbia, it is worth noting that survey sites are selected from the known distribution of steelhead spawning habitat, which does not necessarily cover lamprey spawning distribution. Furthermore, while live lamprey are observed spawning on surveys, we do not survey often enough nor when lamprey are most active (at night) to use live lamprey counts for abundance estimates. As a result, lamprey density on spawning surveys is summarized in this report by peak redds per mile. The peak redd count is the highest number of lamprey redds visible during any one survey date within a given spawning season. Abundance estimates for lamprey are not available because the cumulative number of redds deposited over a spawning season is not accounted for and because there is no reliable information on the ratio of redds to fish. However, peak redd counts do provide information on the distribution and timing of lamprey spawning activity, as well as some indication of relative density (and by proxy, relative abundance). Lamprey redd counts also provide occupancy information, though survey methods have not been precision tested. So, while a lamprey redd likely proves lamprey presence in a given survey, the lack of recorded redds does not necessarily mean lamprey were absent. Despite the many caveats, this lamprey data set has grown quite large, and contains some information that may begin to provide a method of tracking Pacific Lamprey trends and relative abundance.

Oregon Coast Pacific Lamprey

Over the past 13 years, Pacific Lamprey peak redd density on the Oregon Coast has fluctuated from 1 to 9 redds/mile in random steelhead surveys, averaging about 4.2 redds/mile (Figure 12). The proportion of sites occupied by Pacific Lamprey (sites with at least one Pacific Lamprey redd) has ranged from about 25% to 54% (avg. = 39%); with increases and decreases in occupancy often tracking similar increases and decreases in peak redd density (Figure 12).

Beginning in 2010, thirteen annual random steelhead surveys across the Oregon Coast were selected to be index surveys for the monitoring of Pacific Lamprey through their full spawn timing. These index surveys were picked with consideration to the following: (a) consistent presence of lamprey spawning activity across years; (b) a mix of smaller and larger streams in each steelhead monitoring area; and (c) the feasibility of conducting these surveys with limited staff availability. Index surveys are visited during each steelhead spawning season (February-May), and while steelhead surveys are primarily discontinued by the end of May, lamprey index surveys continue through late June (some years even into early July) in an attempt to capture the full lamprey spawn timing. The average spawn timing among index sites over the past five years peaked in mid-May, with the earliest peak occurring in April (2014), and the latest occurring in early-June (2011) (Figure 13). Pacific Lamprey spawning timing in 2015 was very similar to the 5-year average timing. Results so far from the index sites suggest surveys should be continued through mid to late July to encompass the entire Pacific Lamprey spawn timing.

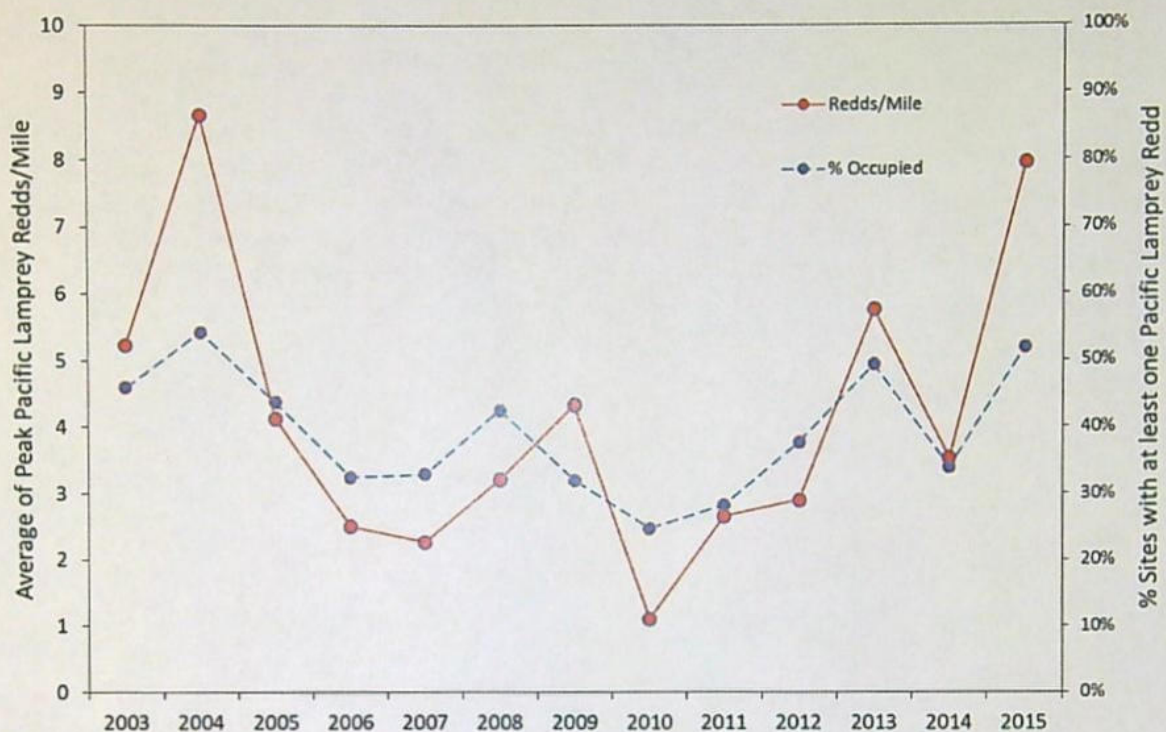


Figure 12. Oregon coast Pacific Lamprey peak redd density and percent of sites occupied in random steelhead spawning surveys, 2003 to 2015.

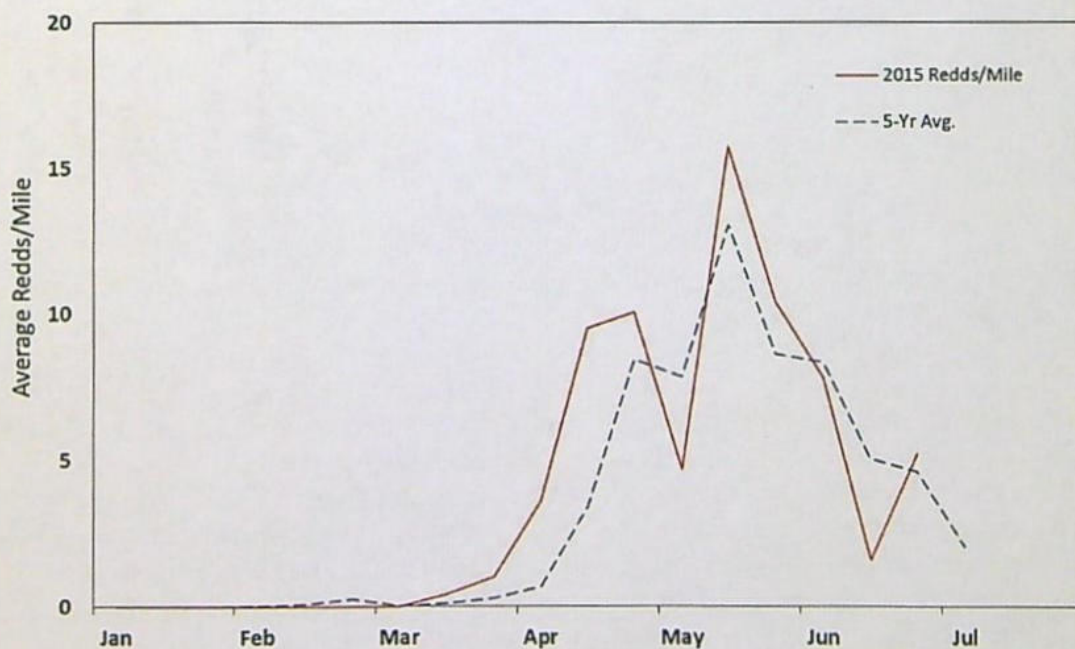


Figure 13. Oregon coast Pacific Lamprey spawn timing in index surveys.

Lower Columbia Pacific Lamprey

During the 2015 monitoring season, Pacific Lamprey redd densities were higher than last year in most areas of the Lower Columbia with the exception of the Sandy River. While the Pacific Lamprey redd density in 2015 was higher than redd density in 2014, it was generally well below redd densities in 2013, which are the highest observed in this short time series (Figure 14). Pacific Lamprey redds were identified in 54% of random steelhead surveys sampled in the Lower Columbia River ESU in 2015. By population in 2015, Pacific Lamprey redd occupancy ranged from 59% for the Clackamas to 30% for the Sandy.

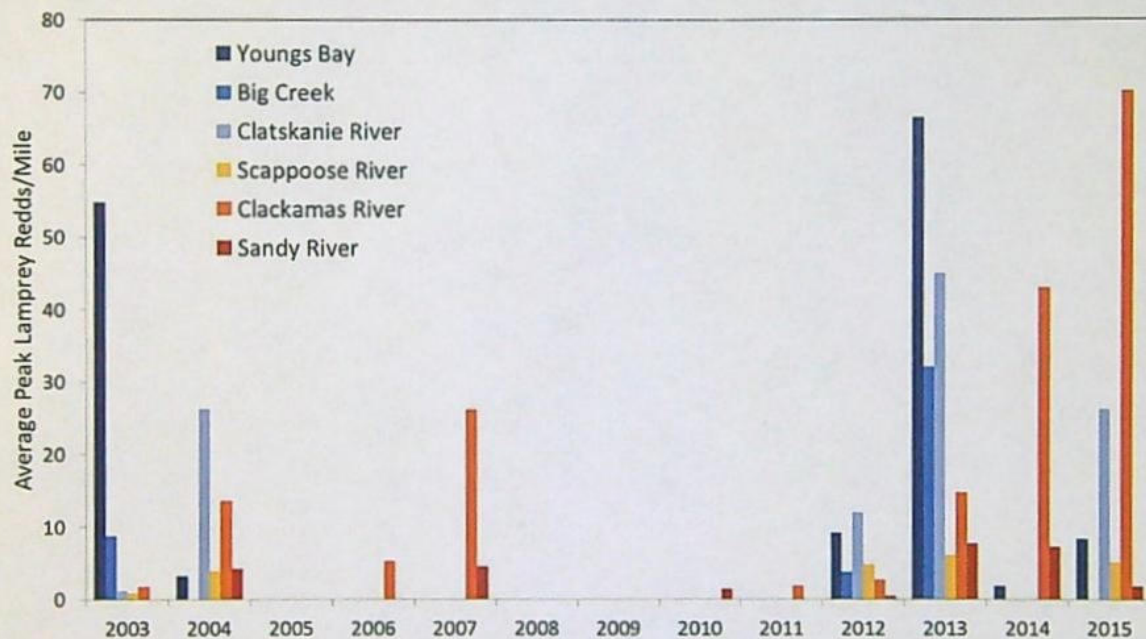


Figure 14. Lower Columbia Pacific Lamprey Peak Redd Density in Random Steelhead Spawning Surveys, 2003-2015. Note that not all populations were monitored in all years.

Pacific Lamprey redds in the Scappoose and Sandy were observed almost exclusively between late April and late May, however the generally low numbers of Pacific Lamprey redds observed in these populations in 2015 preclude analysis outside of a general sense of spawn timing. Higher numbers of Pacific Lamprey redds in the Clatskanie and Clackamas populations allow for a more complete review of spawning timing. In the Clackamas, spawning occurred mainly between late April and the end of May, with a distinct peak in early May (Figure 15). Pacific Lamprey spawn timing in the Clatskanie was much more protracted, with substantial numbers of redds observed from late April through the end of the sampling season in late June (Figure 15). There appears to have been a generally increasing trend in the Clatskanie through May, followed by a peak in early June at a time when Pacific Lamprey redds per mile in the Clackamas had declined substantially. This late peak is likely positively biased, as the only sites

remaining active beyond the last week of May are either lamprey index sites (which are hand-selected for high lamprey abundance), or steelhead sites having continued steelhead spawning activity.

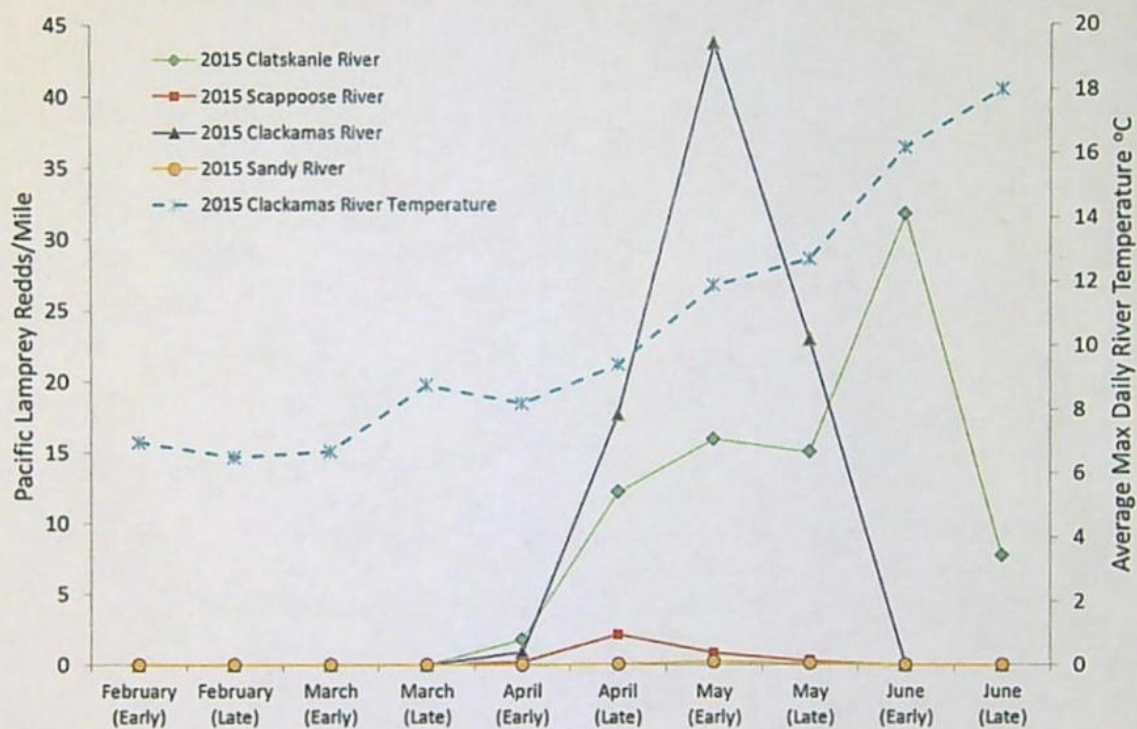


Figure 15. Lower Columbia Pacific Lamprey spawn timing in random steelhead surveys in 2015 and average daily water temperature in the Clackamas River.

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APPENDIX

Table A-1. Annual redd abundance estimates of naturally spawning wild steelhead by Monitoring Area (MA), in Oregon Coast Steelhead DPSs, run years 2003 to 2015. n.a. = not available. Highlighted cells do not include estimates for areas above counting stations.

Year	Oregon Coast DPS				Klamath Mountains Province DPS	
	North Coast MA	Mid Coast MA	Mid-South Coast MA	Umpqua MA	South Coast MA	Rogue River MA
2003	28,726	18,092	11,853	26,044	4,852	7,105
2004	28,599	14,043	10,195	11,922	9,093	n.a.
2005	19,125	7,890	22,871	10,628	10,035	4,995
2006	21,065	13,496	19,550	8,786	5,667	7,372
2007	20,592	10,133	24,312	13,900	6,917	6,986
2008	11,859	12,628	18,806	15,556	5,520	5,822
2009	10,433	12,080	9,136	9,282	14,268	12,352
2010	18,928	16,684	19,927	16,266	4,430	n.a.
2011	9,961	19,347	9,504	11,394	1,808	n.a.
2012	15,864	19,074	7,414	11,416	2,738	n.a.
2013	29,371	27,927	15,423	21,895	8,961	n.a.
2014	14,185	9,012	10,877	9,791	4,449	n.a.
2015	24,641	15,443	11,548	10,975	1,682	n.a.

Table A-2. Annual redd abundance estimates of naturally spawning wild steelhead by Population, in Lower Columbia Steelhead ESUs, run years 2003 to 2015. n.a. = not available. Highlighted cells do not include estimates for areas above counting stations.

Year	Southwest Washington ESU				Lower Columbia ESU	
	Youngs Bay	Big Creek	Clatskanie	Scappoose	Clackamas	Sandy
2003	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
2004 *					2,784	257
2005	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
2006	n.a.	n.a.	n.a.	n.a.	453	288
2007	n.a.	n.a.	n.a.	n.a.	463	210
2008	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
2009	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
2010	n.a.	n.a.	n.a.	n.a.	n.a.	879
2011	n.a.	n.a.	n.a.	n.a.	n.a.	308
2012	197	0	242	72	871	208
2013	94	14	898	205	914	2,062
2014	n.a.	n.a.	n.a.	n.a.	1,265	1,909
2015	n.a.	n.a.	1,145	107	1,247	2,745

* = Random surveys were conducted in 2004, but population scale estimates have not been done in all areas.



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December 1, 2017

BY HAND DELIVERY

Tom Byler
Director
Oregon Water Resources Department
725 Summer Street NE, Suite A
Salem, OR 97301-1271

Re: Protests to PFOs Issued for Water Right Application Nos. IS-88322, IS-88323, IS-88326, IS-88327, IS-88328, IS-88329, IS-88330, IS-88331, IS-88332, IS-88333, IS-88334, IS-88335, IS-88336, IS-88337, and IS-88355

Dear Director Byler:

Please find enclosed protests of the above-referenced instream water right applications and required filing fees.

This firm represents East Fork Irrigation District, Oregon Farm Bureau Federation, Hood River County Farm Bureau, and Columbia Gorge Fruit Growers in connection with protests of application numbers IS-88322, IS-88327, IS-88334, and IS-88335.

This firm represent Oregon Farm Bureau Federation, Hood River County Farm Bureau, and Columbia Gorge Fruit Growers in connection with protests of application numbers IS-88323, IS-88328, IS-88330, IS-88332, IS-88333, and IS-88336.

This firm represent Oregon Farm Bureau Federation, Wasco County Farm Bureau, and Columbia Gorge Fruit Growers in connection with protests of application numbers IS-88326, IS-88329, IS-88331, and IS-88337.

Finally, this firm represents Oregon Farm Bureau Federation and Clackamas County Farm Bureau in connection with protest of application number IS-88355.

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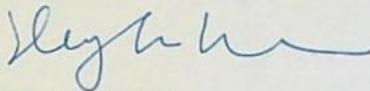
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Tom Byler
December 1, 2017
Page 2

Please contact David Filippi at (503) 294-9529 or david.filippi@stoel.com if you have any questions regarding this letter or the above-listed protests.

Sincerely,



Hayley K. Siltanen

Enclosures

cc (via email):

John Buckley
Mary Anne Cooper
Randy Kiyokawa
Ken Polehn
Mike Doke
Matt Bunch

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