HATCHERY AND GENETIC MANAGEMENT PLAN
(HGMP)

Hatchery Program:	Middle Fork Willamette Spring Chinook Salmon
Species or Hatchery Stock:	Spring Chinook Salmon (stock 22)
Operator/Funding Agency:	Oregon Department of Fish and Wildlife (ODFW)/ U.S. Army Corps of Engineers
Watershed and Region:	Willamette River, Columbia River
Date Submitted:	September 1, 2016
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List of Acronyms

°F	Degrees Fahrenheit
BKD	Bacterial Kidney Disease
BiOp	Biological Opinion
BOR	Bureau of Reclamation
BPA	Bonneville Power Administration
CEDC	Clatsop Economic Development Council
cfs	Cubic Feet per Second
COP	Configuration and Operations Plan
CWT	Coded Wire Tag
DPS	Distinct Population Segment
ELISA	Enzyme-linked immunosorbent assay
ESA	Endangered Species Act
ESU	Evolutionarily Significant Unit
EWEB	Eugene Water and Electric Board
FHMP	Fish Hatchery Management Policy
FMEP	Fish Management and Evaluation Plan
FPHM	Fish Passage and Hatchery Management Team
FPMP	Fish Passage and Management Plan
FR	Federal Register
ft	feet
gpm	gallons per minute
HGMP	Hatchery and Genetic Management Plan
HMIS	Hatchery Management Information System
HMP	Harvest Mitigation Program
HSRG	Hatchery Scientific Reform Group
HUC	Hydrologic Unit Code
IHOT	Integrated Hatchery Operations Team
INAD	Investigational New Animal Drug Permit
MS-222	Tricaine Methanesulphonate
NFCP	Native Fish Conservation Policy
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NOR	Natural-origin Recruits
NPDES	National Pollutant Discharge Elimination System
NPPC	Northwest Power Planning Council
O&M	Operations and Maintenance
OAR	Oregon Administrative Record
ODEQ	Oregon Department of Environmental Quality
ODFW	Oregon Department of Fish and Wildlife
PA	Proposed Action
pHOS	Proportion of Hatchery-origin Spawners
PIT	Passive Integrated Transponder
PNFHPC	Pacific Northwest Fish Health Protection Committee
pNOB	Proportion of Natural-origin Brood

PSM	Prespawning mortality
RM	River Mile
RM&E	Research, Monitoring, and Evaluation
RPA	Reasonable and Prudent Alternative
SAFE	Select Area Fisheries Enhancement
SAR	Smolt-to-Adult Return Ratio
SBA	Supplemental Biological Assessment
SCAB	Steelhead and Chinook salmon Above Barriers
SMU	Species Management Unit
STEP	Salmon and Trout Enhancement Program
TU	Temperature Unit
USACE	US Army Corps of Engineers
UTM	Universal Transverse Mercator
USFWS	US Fish and Wildlife Service
UWR	Upper Willamette River
VSP	Viable Salmonid Population
WATER	Willamette Action Team for Endangered Species Recovery
WBFMP	Willamette Basin Fish Management Plan
WFMP	Wild Fish Management Policy
WFOP	Willamette Fish Operations Plan
WHMP	Willamette Hatchery Mitigation Program
WVP	Willamette Valley Project

SECTION 1. GENERAL PROGRAM DESCRIPTION

1.1) Name of hatchery or program

Middle Fork Willamette River Spring Chinook Salmon Program

1.2) Species and population (or stock) under propagation and Endangered Species Act (ESA) status

The spring Chinook salmon (CHS) (*Oncorhynchus tshawytscha*) stock reared at Willamette Hatchery (stock 22) originated from the wild stock of CHS in the Middle Fork Willamette River. The natural-origin spawning population[1] and the Willamette Hatchery population of CHS in the Middle Fork Willamette River are part of the Upper Willamette Evolutionarily Significant Unit (ESU) for CHS and are listed as threatened under the ESA.

1.3) Responsible organization and individuals

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[1] Nearly all of the CHS in the Middle Fork Willamette are of hatchery-origin (NMFS 2008).

1.4) Funding source, staffing level, and annual hatchery program operational costs

Funding: Willamette Hatchery – Cost responsibilities for the Willamette Hatchery are split between the US Army Corps of Engineers (USACE) (with partial cost reimbursement by Bonneville Power Administration (BPA) according to its Operation and Maintenance (O&M) power share percentage at Dexter, Lookout Point, and Hills Creek dams) and Oregon Department of Fish and Wildlife (ODFW) based on each party's production level. USACE funds up to 235,000 pounds of CHS for lost production due to the construction and operation of Dexter, Lookout Point, and Hills Creek dams.

Dexter Ponds Fish Facility – The cost to redesign and construct the Dexter Ponds Fish Facility (to accommodate both adult salmon collection for outplanting and juvenile acclimation for release) will be solely borne by the federal government (USACE, with partial cost reimbursement to USACE by BPA as noted above). Costs for O&M of the Facility will also borne by the federal government. Construction was originally slated to be completed in December 2014 with operations to begin in March 2015, but the construction has been put on hold until the feasibility of downstream passage is determined.

Staffing Level: The Willamette Hatchery has ten full-time equivalent staff.

Budget: The annual operation and maintenance budget for the CHS program at Willamette Hatchery for the fiscal year Jul 2015- Jun 2016 is estimated at $1,600,000 (including indirect costs). Funding for fish pathology, fish identification (marking), and Research, Monitoring, and Evaluation (RM&E) is separate from the operation and maintenance budget.

1.5) Location of hatchery and associated facilities

- Willamette Hatchery is located at 43° 44' 37" N, 122° 26' 33" W, along Salmon Creek three miles upstream of the Salmon Creek and Middle Fork Willamette River confluence, which is at River Mile (RM) 42. Site elevation is 1,217 ft above sea level.

- The Dexter Pond Fish Facility is located at 43° 55' 00" N, 122° 45' 00" W along the Middle Fork Willamette River at RM 17.

Adults: The Dexter Dam is a barrier to adult upstream passage on the Middle Fork Willamette River. Spring Chinook salmon adults volunteer to Dexter Ponds Fish Facility located immediately below Dexter Dam via an existing fish ladder. The Dexter Ponds Fish Facility is a satellite facility to the Willamette Hatchery. Adults are then transferred to and spawned at the Willamette Hatchery.

Juveniles: The majority of hatchery production occurs at the Willamette Hatchery. Fish are reared to the fingerling and pre-smolt stages before being transferred downstream to Dexter Ponds Fish Facility in June and November, respectively. These fish are then reared to the smolt stage at the Dexter Ponds Fish Facility, and released into the Middle Fork Willamette River. The

Willamette Hatchery also rears South Santiam CHS (stock 24) from the eyed egg through fingerling and smolt stages; fingerlings are transferred back to the South Santiam Hatchery for late-rearing and smolts are direct-released into the South Santiam River. Additional smolts are reared at Willamette Hatchery for direct release into the Coast Fork Willamette River basin.

Approximately 12,000 eyed eggs are transferred to classrooms as part of the Salmon Trout Enhancement Program (STEP) program. Classroom rearing is brief, and STEP transfers are released as unfed fry into various locations within the Willamette River basin (see Section 10).

Pre-Release Acclimation: Fish transferred to Dexter Ponds Fish Facility for late-rearing are volitionally released.

1.6) Type of program

The Middle Fork Willamette CHS hatchery program is managed as an integrated program to meet goals for both harvest and spring Chinook salmon conservation needs, consistent with survival and recovery of the ESU,[1] including complying with the Willamette BiOp (NMFS 2008) and assisting with implementation of the Upper Willamette Conservation and Recovery Plan for Chinook Salmon and Steelhead (Recovery Plan, ODFW and NMFS 2011), as the Recovery Plan informs the best scientific and commercial data available.[2]

The program provides mitigation for impacts from the construction and operation of Dexter, Lookout Point, and Hills Creek dams that blocked access to historic CHS spawning and rearing areas in order to help provide vital flood damage reduction to the Willamette Valley. The Cooperative Agreement calls for rearing of a maximum of 235,000 lbs of CHS and/or steelhead for release into the Middle Fork Willamette River subbasin to mitigate for lost natural production and fisheries impacts resulting from construction and operation of flood control and hydroelectric projects. Currently, 171,333 pounds of CHS are produced for the Middle Fork Willamette and 28,105 pounds of CHS are produced for the Coast Fork Willamette. Oregon Department of Fish and Wildlife's (ODFW) harvest goal in the Middle Fork Willamette River is 1,125 hatchery CHS adults (ODFW 1998). The program also supports significant fisheries in the lower Willamette River, lower Columbia River, and ocean.

1.7) Purpose (goal) of program

The purpose of the program is to provide ESA conservation benefits, consistent with survival and recovery of the ESU, and, to mitigate for habitat lost or made inaccessible by the construction and operation of Dexter, Lookout Point, and Hills Creek Dams, which will provide adult returns to help meet harvest objectives for the Middle Fork Willamette River, lower basin, and ocean fisheries.

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[1] *See* 65 FR 42477 (Jul 10 2000), codified at 50 CFR 223.203(b)(5)(i)(C).

[2] See 16 U.S.C. 1536(a)(2); See also NMFS "Updated July 2000 4(d) Rule Implementation Binder for Threatened Salmon and Steelhead on the West Coast," (August 2003)("An HGMP must use the best available scientific and commercial information").

1.8) Justification for the program

The original purpose of the hatchery mitigation program was to mitigate for lost fish natural production due to habitat and fisheries losses resulting from construction and operation of specific federal Willamette Valley Project (WVP) dams constructed to reduce the damage associated with flooding in the Willamette Valley. US Army Corps of Engineers mitigation was developed prior to ESA-listing of Upper Willamette River (UWR) CHS.

Since this ESA-listing, it has become important to evaluate and minimize risk from the hatchery program to naturally produced populations of CHS while maintaining fisheries goals.

The July 2008 BiOp issued by NMFS contains several actions as part of its Reasonable and Prudent Alternative (RPA) to avoid jeopardy or destruction or adverse modification of critical habitat for spring Chinook by reducing effects of Corps projects and operations, including federally funded hatchery mitigation programs in the Willamette.

In addition, the 2011 Recovery Plan for UWR CHS and winter steelhead prepared by ODFW and NMFS, recommends objectives and strategies for conservation, consistent with survival and recovery of the ESU, including some recommended actions for hatchery reform.

The upper Willamette hatchery CHS program contributes to significant sport, commercial and tribal fisheries in the Pacific Ocean, lower Columbia River, lower Willamette River, and mainstem and tributary fisheries. Hatchery spring Chinook production from the Upper Willamette basin supported harvest of nearly 22,000 adults in sport and commercial fisheries in the lower Willamette and Columbia Rivers in 2012 (ODFW 2013).

CHS outplanted above the project dams serve conservation and RM&E purposes by informing managers about the effectiveness of ongoing reintroduction efforts of natural-origin recruits. Decisions regarding fish outplanting are made by the ODFW, NMFS, and USFWS, collectively referred to as the fishery co-managers in coordination with the region. Further details on the reintroduction efforts using hatchery fish are being discussed and formalized by the co-managers with recommendations from the Hatchery Management and Fish Passage Technical Teams within the advisory BiOp Willamette Action Team for Ecosystem Restoration (WATER) forum. Outplanting protocols are contained in Section 15.

The following is a list of current hatchery practices used in the Middle Fork Willamette spring Chinook salmon hatchery program.

- Willamette Hatchery broodstock originated from native Middle Fork Willamette River spring Chinook salmon. Current broodstock is collected exclusively from fish returning to the Dexter Ponds Fish Facility, located just downstream of Dexter Dam.
- As a general practice, all unmarked and natural-origin adults (intact adipose fin) returning to the Dexter Ponds Fish Facility will be incorporated into the broodstock to maintain heterozygosity of the hatchery stock and avoid genetic drift to the extent possible. This HGMP and Appendix E of the Recovery Plan outline recommendations for integration of

natural-origin fish into the hatchery broodstock. Unmarked and natural-origin adults may also be outplanted into Little Fall Creek to aid in restoring productivity of CHS in the system. Standard operating procedures will be to include all unmarked and natural-origin returning adults into the broodstock. Adult releases into Little Fall Creek will be considered on a case by case basis in coordination with NMFS and pending monitoring to determine efficacy of outplanting in Little Fall Creek.

- All portions of the run and all age classes are incorporated into the egg takes to ensure genetic diversity.
- All hatchery smolts are adipose fin clipped (target 100 percent) to distinguish between hatchery and natural origin fish. This allows for a selective sport fishery on hatchery Chinook salmon. All hatchery smolts are thermally otolith marked, and a proportion of the smolt release receives a CWT for RM&E purposes.
- All juveniles are reared at Willamette Hatchery until the fingerlings are pre-smolt size; late-rearing and volitional release of smolts occurs at the Dexter Ponds Fish Facility. Smolts are released to take advantage of increase in river flows near the finish dates of acclimation listed on the production schedule.
- Hatchery adults are selectively removed from the fish trap at the Dexter Ponds Fish Facility for broodstock collection, tribal needs, adult outplanting, nutrient enrichment and fish sales.
- A portion of the hatchery adults surplus to broodstock needs are outplanted into the Middle Fork Willamette River above Lookout Point and Hills Creek dams and in Salt and Little Fall creeks to provide natural production in those areas and to support RM&E and natural fish reintroduction strategies, as described in section 15.
- Willamette Hatchery complies with Integrated Hatchery Operations Team (IHOT) standards for prevention and treatment of fish diseases.

1. 9 & 1.10) List of program "Performance Standards and Indicators designated by "Benefits" and "Risks".

Category 1: Legal Mandates

Standard 1.1: Meet production levels for mitigation, fisheries, and spring Chinook salmon conservation objectives consistent with survival and recovery of the ESU, consistent with the Cooperative Agreement (2012).

Indicator 1.1.1: Production of approximately 1,672,000 spring Chinook salmon smolts for release into the Middle Fork Willamette River basin and approximately 267,000 spring Chinook salmon smolts for release into the Coast Fork Willamette River basin. Currently the total smolt release is approximately 1,939,000. Approximately 100,000 fingerlings are released annually into Hills Creek Reservoir for fisheries. In addition, this HGMP allows for flexibility and adjustments in the total number of fish released, up to 2,300,000 fish to account for mitigation agreements as described in contractual

Benefit

arrangements.

Standard 1.2: Ensure program goals are aligned with authorized federal, state, regional, and local fisheries conservation and restoration initiatives.

Indicator 1.2.1: Program complies with the Willamette BiOp (NMFS 2008), and where appropriate is consistent with the objectives and strategies recommended by the Upper Willamette River Conservation and Recovery Plan for Chinook Salmon and Steelhead (ODFW and NMFS 2011), as it informs the best scientific and commercial data available. ***Benefit***

Category 2: Harvest

Standard 2.1: Provide sufficient hatchery production to mitigate lost natural production above Dexter, Lookout Point, and Hills Creek dams to meet harvest goals while minimizing impacts to natural-origin Chinook salmon.

Indicator 2.1.1: Ensure that the number of hatchery spring Chinook salmon available for harvest in Middle Fork Willamette River sport fishery meet the ODFW harvest goal of 1,125 and provide fish for commercial and sport fisheries in the mainstem Willamette River, Columbia River, and ocean. ***Benefit***

Category 3: Conservation

Standard 3.1: Maintain genetic diversity in hatchery broodstock that is similar to natural-origin spring Chinook by integrating all returning natural-origin adults into the broodstock.[1]

Indicator 3.1.1: Compare genetic diversity between hatchery- and natural-origin fish. Potential phenotypic characteristics that are representative of genetic diversity are: age at maturity, run timing, sex ratio, size, fecundity, etc. ***Benefit***

Standard 3.2: Reduce opportunity for negative ecological interactions between hatchery and naturally produced adults.

Indicator 3.2.1: Specific interactions to look for are: Evidence of residualism or delayed migration that could result in competition for food and space; disease prevalence in hatchery fish that could be transferred to naturally produced fish, and risk of hatchery smolt predation on natural-origin recruit Chinook fry. ***Benefit***

[1] Hatchery-origin fish likely contain the only genetic remnants of the historic CHS Middle Fork Willamette run available (NMFS 2008). The population was considered extirpated by ODFW (ODFW and NMFS 2011). Recently, less than 1% of the broodstock has been natural-origin fish (NMFS 2008, citing Schroeder et al. 2006).

Indicator 3.2.2: Flow management to promote efficient downstream migration of hatchery smolts, protect eggs deposited during spawning and provide juvenile rearing habitat.

Standard 3.3: Maintain hatchery-origin fish outplanting until a self-sufficient run of natural-origin Chinook salmon is developed upstream of Lookout Point and Hills Creek dams (the goal for naturally produced females returning from outplants above the dams will be determined after further monitoring and research, and passage improvements have occurred). Once sufficient numbers of NORs return, hatchery supplementation will decrease and/or be terminated.

Indicator 3.3.1: Abundance and productivity of fish returning from the outplants are adequate to determine: spawning success (including pre-spawning mortality (PSM)), smolt-to-adult return ratio (SAR), recruits per spawner (productivity), adult migration and spawn timing, number of juveniles emigrating from spawning areas, and genetic diversity. ***Benefit***

Standard 3.4: Produce and release sufficient numbers of fish to support successful outplanting upstream from Lookout Point and Hills Creek Dam for RM&E and reintroduction efforts. The intent is to inform passage studies to aid in formulation of passage alternatives, potential design of passage alternatives, and reintroduction protocols and strategies.

Indicator 3.4.1: Number of fish released above Lookout Point and Hills Creek dams. ***Benefit***

Standard 3.5: Reduce opportunity for negative ecological interactions between hatchery and naturally produced juveniles.

Indicator 3.5.1: Percentage of hatchery fish residualism or delayed migration, disease prevalence in hatchery fish, and hatchery smolt predation on natural-origin Chinook fry. ***Risk***

Standard 3.6: Use best management practices to meet or exceed benchmarks for rearing to minimize impacts on naturally produced fish.

Indicator 3.6.1: Performance targets for benchmarks for rearing and release as indicated in Table 1.9-1. ***Benefit***

Standard 3.7: Minimize impacts of adult returns on naturally produced populations to meet spring Chinook salmon conservation needs.

Indicator 3.7.1: Performance targets for benchmarks for returning hatchery fish as indicated in Table 1.9-2. ***Benefit***

Standard 3.8: Meet benchmarks and protocols for broodstock.

Indicator 3.8.1: Performance targets for benchmarks for hatchery broodstock as indicated in Table 1.9-3. ***Benefit***

Standard 3.9: The proportion of hatchery-origin adults spawning (pHOS) with natural-origin adults in Fall Creek both above and below Fall Creek Dam is less than 10%; manage to maintain pHOS = 0 upstream of dam.

Indicator 3.9.1: Proportion of hatchery fish on the spawning grounds in Fall Creek (current practices only release natural-origin fish in Fall Creek). ***Risk***

Standard 3.10: The proportion of hatchery-origin adults spawning (pHOS) with natural-origin adults in the MF Willamette River above Dexter/Lookout Point Dams will be less than 10% once survival conditions improve and natural production increases in the future

Indicator 3.10.1: Proportion of hatchery fish on the spawning grounds in MF Willamette River upstream of Dexter/Lookout Point dams. ***Risk***

Category 4: Life History Characteristics

Standard 4.1: Maintain life history characteristics of broodstock as similar as possible (e.g. within 10%) to natural-origin spring Chinook salmon.

Indicator 4.1.1: Compare life history characteristics of the broodstock to natural-origin adults. Indicators include: morphometrics (length and weight), sex ratio, average number of eggs per female by age class, age structure, adult migration, and spawn timing (Table 1.9-3). ***Benefit***

Standard 4.2: Rear and release hatchery spring Chinook salmon to minimize impacts to naturally produced juvenile spring Chinook salmon.

Indicator 4.2.1: Hatchery fish will be released in time and space that minimizes the interaction with listed fish. ***Risk***

Standard 4.3: Release hatchery fish that are ready to migrate.

Indicator 4.3.1: Indicators are: residualism rates, rates of outmigration, precocial rates, and proportion of fish that migrate per day. ***Risk***

Category 5: Genetics

Standard 5.1: Ensure outplanting is implemented in a way to minimize potential genetic risks to the self-sustaining natural population upstream

of Fall Creek. In addition, ensure adequate consideration is also given to future populations above Dexter, Lookout Point, and Hills Creek dams.

Indicator 5.1.1: Proportion of hatchery fish introduced into areas upstream of Fall Creek and Dexter, Lookout Point, and Hills Creek dams. ***Risk***

Standard 5.2: Ensure that broodstock collection maintains the genetic diversity of the naturally spawning population (e.g. diversity shows no more than a 10% divergence).

Indicator 5.2.1: Genetic diversity of natural and hatchery fish. ***Risk***

Standard 5.3: Integrate all returning NOR broodstock (see Standard 3.1), increasing integration to a rate averaging 5-10%.

Indicator 5.3.1: Proportion of natural-origin fish in the broodstock. ***Benefit***

Category 6: Operation of Artificial Production Facilities

Standard 6.1: Willamette Hatchery facilities are operated in compliance with all applicable fish health guidelines and facility operation standards and protocols such as those described by IHOT, Pacific Northwest Fish Health Protection Committee (PHFHPC), and Investigational New Animal Drug Permit (INAD).

Indicator 6.1.1: Annual reports indicating compliance. ***Benefit***

Standard 6.2: Willamette Hatchery effluent will not negatively impact any natural populations.

Indicator 6.2.1: Determine if facilities are operated under permits issued by ODEQ, and comply with the permit. ***Risk***

Standard 6.3: Water withdrawals and instream water diversions associated with the hatchery and fish collection facility intakes will not impact any natural, ESA-listed populations.

Indicator 6.3.1: Water intake screens are consistent with NMFS criteria. ***Benefit***

Standard 6.4: Release only fish that are pathogen-free or have been certified by a state pathologist, and that will not increase levels of existing pathogens in natural populations.

Indicator 6.4.1: Certification of juvenile fish health immediately prior ***Risk***

to release, including pathogens present and virulence.

Category 7: Socio-Economic Effectiveness

Standard 7.1: Estimated harvest and spring Chinook salmon conservation benefits, consistent with survival and recovery of the ESU, will equal or exceed hatchery production costs based on benefit-cost model (ODFW 1999).

Indicator 7.1.1: Annual budget expenditures. ***Neutral***

Indicator 7.1.2: The number of spring Chinook salmon to support sport, tribal, and commercial fisheries in the Pacific Ocean, Lower Columbia and Willamette rivers, and Middle Willamette River while complying with the ESA. ***Benefit***

Category 8: Ecosystem Function

Standard 8.1: Provide nutrient enrichment and food web benefits in natural spawning streams in the Middle Fork Willamette River Basin, consistent with the goal of not placing hatchery-origin fish upstream of Fall Creek Dam. Any hatchery carcasses placed for nutrient enrichment will comply with ODFW and Oregon Department of Environmental Quality (ODEQ) guidelines for disease control and water quality.

Indicator 8.1.1: Number of hatchery fish placed in streams for nutrient enrichment. ***Benefit***

Table 1.9-1. Recommended performance targets for hatchery rearing and release of hatchery fish.

Variables	Performance Target (benchmark)
Size–at-release	Middle Fork Willamette: 8.0 fpp (Nov); 12 fpp (Feb); 9 fpp (Mar); 9 fpp (April). Hills Creek Res.: 100 fpp (June) Coast Fork: 9.5 fpp (Feb)
Release timing	Nov, Feb, March, April, June
Acclimation time	Spring releases: over-winter; Fall release: over-summer
Migration timing	As similar as possible to naturally produced fish
Level of disease occurrence	Below IHOT standard
Total number of fish released	Up to approximately 2,300,000 juveniles for all hatchery purposes. The proposed release is up to 1,939,000 smolts and 100,000 fingerlings annually for at least brood years 2016 through 2019[1].
In-hatchery life stage survival	Maximum and unbiased survival
Rearing density	Implement best management practices
Growth rate	Achieve target size at release
Residualism rates	< 10%
Precocial rates	< 10%

[1] This HGMP allows for flexibility and adjustments in the total number of fish released, up to 2,300,000 fish to account for mitigation agreements as described in contractual arrangements.

Table 1.9-2. Recommended performance targets for returning adult hatchery fish. [1]

Variables	Performance Target (benchmark)
Number of hatchery produced adults required for broodstock	Approximately 3,000 to support production of 1,939,000 smolts and 100,000 fingerlings. This number accounts for in-hatchery PSM (50%) and females representing 45% of adult returns.
Number of hatchery produced fish harvested	State of Oregon goal of 1,125 minimum within in Willamette River Basin above the mouth of the McKenzie River , plus ocean/Columbia River/Lower Willamette fisheries, consistent with the authorized Fisheries Management and Evaluation Plan (FMEP, ODFW 2001)
Number of fish passed upstream into target areas above Lookout Point Dam	Target 1,350 adults (500 female minimum), for the North Fork Middle Fork and 1,100 adults (300 female minimum) for the Middle Fork above Hills Creek Dam.
Age structure	As similar as possible to naturally produced fish
Sex Ratio	As similar as possible to naturally produced fish
Fecundity	As similar as possible to naturally produced fish
pHOS	pHOS <10% within the Fall Creek basin (includes fish both above and below Fall Creek Dam). pHOS <10% above Dexter/Lookout Point Dams once sustainable production of natural-origin CHS returns increases.
Abundance (return to Dexter)	7,400
Genetic diversity	Maintain genetic diversity and avoid genetic drift, to the extent possible
Adult migration and spawn timing	As similar as possible to naturally produced fish
SAR (back to Dexter)	0.58%

[1] When using the past 26 years of data, pre-spawning mortality rates suggest a broodstock goal of 2,244; however, given very high pre-spawning mortality in recent years and deteriorating conditions of the holding pond, up to 3,000 adults may be collected to meet broodstock goals.

Table 1.9-3. Recommended performance targets for hatchery broodstock.

Variables	Performance Target (benchmark)
Number of naturally produced fish spawned	Integrate all returning NOR broodstock, increasing integration to a rate averaging 5--10%, consistent with the long-term goal in the Recovery Plan, as appropriate in the future if natural-origin populations are restored upstream from Lookout Point and Hills Creek reservoirs.
Number of hatchery fish spawned	Approximately 1,414 (707 pairs),
Morphometrics	Representatively sample broodstock, n= approximately 100
Run timing	As similar as possible to naturally produced fish
Spawn timing	As similar as possible to naturally produced fish
Age	As similar as possible to naturally produced fish
Fecundity	As similar as possible to naturally produced fish
Sex	As similar as possible to naturally produced fish
Genetic diversity	Maintain heterozygosity and avoid genetic drift
Sex ratio	As similar as possible to naturally produced fish
Age structure	As similar as possible to naturally produced fish
Average number of eggs per female by age class	As similar as possible to naturally produced fish
Adult migration and spawn timing	As similar as possible to naturally produced fish
Average size (post-orbital hypural plate length and fork length) per age class	As similar as possible to naturally produced fish

1.11) Expected size of program

1.11.1) Proposed annual broodstock collection level

The Middle Fork Willamette target release of 1,672,000 smolts into the Middle Fork Willamette River helps ensure a return of up to 3,000 adults (835 females) needed for spawning protocols and for Bacterial Kidney Disease (BKD) culling protocols, PSM and brood for the 267,000 smolts released into the Coast Fork Willamette River. Additional broodstock may be required if production is increased to meet basinwide conservation needs.

1.11.2) Proposed annual fish releases

Proposed annual fish release levels are described in Table 1.11.2-1. Release periods are approximate and are adjusted as necessary based on fish growth, river flows and other variables. Releases may be increased to 2,300,000 smolts (plus fingerling) based on basinwide conservation need.

Table 1.11.2-1. Proposed annual releases of Middle Fork Willamette spring Chinook salmon.

Life stage	Release location	Release period	Mean size at release (fish per lb)	Number of fish released	Total lbs released
Unfed fry	Upper Willamette (various locations)[1]	Dec		10,000	
Fingerlings	Hills Creek Res.[2]	June	100	100,000	1,000
Yearling	MF Willamette at Dexter Ponds	Nov	8	300,000	37,500
1+ yearling	MF Willamette at Dexter Ponds	Feb	12	670,000	55,833
1+ yearling	MF Willamette at Dexter Ponds	Mar	9	234,000	26,000
1+ yearling	MF Willamette at Dexter Ponds	Mar	9	234,000	26,000
1+ yearling	MF Willamette at Dexter Ponds	Apr	9	234,000	26,000
1+	Coast Fk Willamette basin	Feb	9.5	267,000	28,105
Totals				2,039,000	200,438

[1] Transferred to Upper Willamette STEP program (*not included in totals*).
[2] Variable numbers of RM&E are not included (currently about 300,000).

1.12) Current program performance

Performance of the Middle Fork Willamette spring Chinook salmon hatchery program can be assessed through hatchery returns, smolt-to-adult survival rates, support for reintroduction efforts, and contributions to the fisheries.

Numbers of adult spring Chinook salmon returning to Dexter Trap from 1990-2011 are given in Table 1.12-1. From 1990 to 1995, adult returns to Dexter varied from a high of more than 17,000 adults to a low of fewer than 5,000. In more recent years, adult returns have fluctuated from a high of 10,621 adults in 2002 to a low of 2,171 fish in 2008. Prior to brood year 1997, not all hatchery-reared spring Chinook salmon were marked, and therefore, distinguishing between hatchery and natural-origin fish was not possible until 2002. The estimated percent of natural-origin fish returning to Dexter since 2002 has ranged from 0.2 percent in 2003 and 2010 to 11.9 percent in 2008 (Table 1.12-1).

The ODFW harvest goal for the Middle Fork Willamette River sport fishery is 1,125 spring Chinook salmon.

Table 1.12-1. Adult spring Chinook salmon returning to Dexter trap, 1990-2015.

	Adults Returning to Dexter Trap		
Calendar Year	Total Counted	Estimated Number Natural-Origin	Estimated Percent Natural-Origin
1990	17,928		
1991	9,705		
1992	7,753		
1993	7,519		
1994	6,397		
1995	4,686		
1996	5,462		
1997	7,239		
1998	8,891		
1999	9,155		
2000	5,650		
2001	7,709		
2002	10,621	82	0.8
2003	6,571	14	0.2
2004	11,375	57	0.5
2005	6,392	50	0.8
2006	5,673	78	1.4
2007	3,744	251	6.7

2008	2,171	259	11.9
2009	5,313	27	1
2010	6,024	14	0.2
2011	7,145	82	1.1
2012	8,413	52	0.6
2013	8,753	67	0.8
2014	7,536	NA	NA
2015	9,809	NA	NA

1.13) Date program started

Hatchery Chinook salmon were first released into the Middle Fork Willamette subbasin in 1919, but few adults are thought to have returned from releases made prior to 1960s (NMFS 2008). The Middle Fork Willamette spring Chinook salmon program (stock 022) began in the 1950s. In 1952, the US Army Corps of Engineers rebuilt the Oakridge Salmon Hatchery (established in 1911) to mitigate for fishery losses associated with the construction and operation of Dexter, Lookout Point, and Hills Creek dams. In 1983, Oakridge Hatchery was combined with the adjacent Willamette Trout Hatchery to operate as the present-day Willamette Hatchery.

1.14) Expected duration of program

The program will continue for an undefined period into the future.

1.15) Target watersheds

Spring Chinook salmon smolts are released into the mainstem Middle Fork and Coast Fork Willamette rivers. Adipose fin-clipped fingerling releases occur into Hills Creek and Lookout Point reservoirs. Unfed fry are released into the Alton Baker Canoe Canal (Willamette River mainstem) as part of the STEP program.

1.16) Alternative actions considered

1.16.1) Key issues and alternatives

In order to meet the stated goals of the Middle Fork Willamette Hatchery Program, including harvest and spring Chinook salmon conservation goals, consistent with survival and recovery of the ESU, the facilities release approximately 1,939,000 spring Chinook smolts and 100,000 spring Chinook fingerlings annually. As described above, the program was developed to release adequate numbers of juveniles to mitigate for lost production and harvest opportunity of natural-origin adults due to construction and operation of Hills Creek, Lookout Point, and Dexter dams and to return sufficient numbers of adults for commercial and sport fisheries, RM&E, and reintroduction efforts to support conservation and recovery. However, it is anticipated that hatchery production associated with the federal mitigation responsibility for lost habitat above the projects will be reduced in the future to meet spring Chinook salmon conservation needs consistent with survival and recovery of the ESU, and commensurate with improvements in natural production above the projects following implementation of the 2008 BiOp, and appropriate objectives and strategies of the 2011 Recovery Plan, as those documents inform the best available scientific and commercial data. There may also be production increases to account for basinwide conservation needs. Due to an altered temperature and flow regime, current habitat conditions below Dexter Dam are not conducive to successful spring Chinook natural production. Consequently there is minimal concern for hatchery impacts to the naturally producing population below the dam. Reducing the production and/or closing the hatchery is not proposed at this time because the

program is necessary to meet federal mitigation responsibilities and reintroduction in the Middle Fork. Similarly, expanding hatchery production is also not an action proposed at this time due to concerns about impacts of hatchery fish on the natural population. Particular upgrades to the facility would improve the proficiency of the program. The current broodstock pond at Willamette Hatchery needs to be replaced to update infrastructure and correct water quality issues that contribute to very high PSM. Improving the broodstock pond up to current IHOT standards and guidelines would increase the survival of ESA-listed broodstock and increase hatchery efficiency.

Chinook smolts are released into the Coast Fork Willamette Basin to produce a fishery for harvest in an area of the Willamette Basin that has very low incidence of NOR CHS. CHS spawning and rearing habitat is limited in the Coast Fork subbasin and substantial natural reproduction is unlikely. Oregon Department of Fish and Wildlife's harvest goal in the Willamette River Basin above the mouth of the McKenzie River is 1,125 hatchery CHS adults (ODFW 1998). The program also supports fisheries in the lower Willamette River, lower Columbia River, and ocean.

SECTION 2. PROGRAM EFFECTS ON ESA-LISTED SALMONID POPULATIONS

2.1) ESA permits or authorizations

This HGMP and the resulting 4(d) determination will serve as the authorizing documents under the ESA for direct take of listed CHS for the Middle Fork Willamette River hatchery spring Chinook salmon program. The program already has incidental take authorization via the 2008 Willamette Project BiOp (Section 11.1.5) and its subsequent letter of clarification dated February 2013.

At this time, several other ESA documents provide additional analysis relating to the spring Chinook salmon resources in the Middle Fork Willamette River. Citations for the documents follow.

NMFS (National Marine Fisheries Service). 2000. Biological Opinion on the impacts from the collection, rearing, and release of listed and non-listed salmonids associated with artificial propagation programs in the Upper Willamette spring Chinook salmon and winter steelhead evolutionarily significant units. Portland, OR.

ODFW and NMFS (Oregon Department of Fish and Wildlife and National Marine Fisheries Service). 2011. Upper Willamette River Conservation and Recovery Plan for Chinook Salmon and Steelhead. Oregon Department of Fish and Wildlife. Salem, Oregon. National Marine Fisheries Service, Portland, Oregon.

USACE (U.S. Army Corps of Engineers), Bonneville Power Administration, Bureau of Reclamation. 2007. Supplemental Biological Assessment of the Effects of the Willamette River Basin Flood Control Project on Species Listed Under the Endangered Species Act. Final, May 2007. USACE Portland District.

ODFW also has a Section 6 Cooperative Agreement with the USFWS for dealing with listed species under USFWS jurisdiction.

2.2) ESA-listed natural populations in the target area

2.2.1) Description of ESA-listed Salmonid population(s) affected by the program.

(a) ESA-listed population(s) that will be directly affected by the program

Upper Willamette River (UWR) Chinook Salmon

Spring Chinook salmon are native to the Middle Fork Willamette subbasin. Historically, the spring Chinook salmon run in the subbasin may have been the largest of any subbasin above Willamette Falls (Hutchison et al. 1966; USACE 1982). Current distribution is severely limited since Dexter, Lookout Point and Hills Creek dams block approximately 80 percent (215 miles) of the basin formerly used by spring Chinook salmon. Prior to dam construction in the early 1950s, the primary spawning areas for spring Chinook salmon were the mainstem of the Middle Fork Willamette River, North Fork Middle Fork Willamette, Salt Creek, Salmon Creek, and Fall Creek (Mattson 1948). Historically, the majority of natural spring Chinook spawning occurred upstream of Dexter Dam, and therefore only a small portion of spring Chinook spawning occurred below Dexter Dam. Currently, because of poor spawning conditions downstream of the dam (poor spawning habitat and high water temperature), successful spawning below Dexter Dam is believed to be minimal.

The UWR CHS ESU, listed as threatened under the ESA on March 24, 1999 (64 FR 14308) and reaffirmed on June 28, 2005 (70 FR 37160), includes all naturally spawned populations of spring-run Chinook salmon upstream from Willamette Falls and in the Clackamas River. Natural populations include spring Chinook salmon in the North Santiam, the McKenzie, the Middle Fork Willamette, and the Clackamas basins. Wild spring Chinook salmon are commingled with hatchery spring Chinook salmon released from hatcheries located on the Clackamas, North Santiam, South Santiam, McKenzie, and Middle Fork Willamette rivers. NMFS designated these five hatchery stocks as part of the ESU.

The run timing of spring Chinook salmon in the Middle Fork Willamette River is similar to other Willamette River stocks. Adults typically enter the Middle Fork Willamette River in mid-May, with adults reaching Dexter Trap from mid-June through October. Spawning occurs from August through October, with peak spawning in September (Mattson 1962).

Willamette River spring Chinook salmon return from the ocean as 3, 4, 5, and 6-year-old fish. Through the use of marking studies on Willamette basin spring Chinook salmon runs between 1916 and 1927, Rich and Holmes (1928) reported that the most abundant age class was age 5 fish, and age 6 fish were more abundant than age 4 fish. Mattson (1963) analyzed scales from spring Chinook salmon caught in the sport fisheries in the Willamette River from 1946-1948 and 1951. He reported that 4.6 percent were 3-year-olds (jacks); 24.2 percent were age 4; 61.1 percent were age 5; and 10.5 percent were age 6. The samples analyzed by these investigators were presumably a mixture of hatchery and wild Chinook salmon from throughout the Willamette basin.

More recent age composition analyses have distinguished between natural and hatchery origin fish. Scales collected from carcasses recovered on spawning grounds suggest that current natural origin spring Chinook salmon spawning populations in the Middle Fork Willamette River basin are composed primarily of age 4 and age 5 fish (Table 2.2.1-1). Similarly, hatchery-origin fish returning to the Dexter Ponds Facility are primarily age 4 adults, although age 5 fish tend to be well represented among the hatchery returns as well. The results are similar to other nearby hatchery returns and suggest there has been a significant shift toward 4-year-old returns within the hatchery population and a reduction of the age-5 and age-6 returns.

The reason for the apparent shift in age-at-return observed in the hatchery population is unclear. Mattson (1963) showed that the faster growing individuals of a given year class tended to migrate to the ocean at an earlier age. He also showed that early migrants also tended to return at a younger age, primarily at age 3 and 4. Thus the shift to younger age-at-return in the hatchery population may be a reflection of the faster growth rate experienced by hatchery fish rather than a genetic bias. The apparent reduction of age 6 fish in both hatchery and natural-origin populations may be due to increasing fishing pressure and selective gear types, where the cumulative vulnerability to capture is increased with each successive year of ocean life.

Table 2.2.1-1. Age composition (percent of sample) by return year of natural origin spring Chinook salmon in the Middle Fork Willamette River basin, 2006–2013. Data are based on analysis of scales collected from carcasses recovered on spawning grounds, except in 2007, which includes scales collected at the hatchery. Origin of fish was determined by absence of fin clips and absence of thermal marks in otoliths. Includes scales from carcasses recovered in Fall Creek. Sample sizes were too small in 2002–2005 to estimate age composition. Sources: Schroeder et al. 2007; K. Schroeder, unpublished data; C. Sharpe, unpublished data.

	Total adult age				
Return year	Age 3	Age 4	Age 5	Age 6	Sample size
2006	12.8	79.5	7.7	0.0	39
2007	0.6	17.2	81.5	0.6	157
2008	4.5	80.5	13.6	1.3	154
2009	1.5	44.8	52.2	1.5	67
2010	0.0	35.8	62.8	1.5	137
2011	1.3	53.5	40.9	4.4	159
2012	10.0	74.3	15.7	0.0	70
2013	7.9	68.4	23.7	0.0	38

Table 2.2.1-2. Age composition (percent of sample) by return year of hatchery origin spring Chinook salmon in the Middle Fork Willamette basin, 1995-2000, 2007-2008 and 2011-2013. Based on analysis of scales from randomly selected adults at the time of spawning and from mortalities prior to spawning. Source: K. Schroeder, personal communication (November 2009), Boatner and Foster 2001; C. Sharpe, unpublished data.

Return year	Percent of Sample				Sample size
	Age 3	Age 4	Age 5	Age 6	
1995	5.7	52.3	41.7	0.3	386
1996	2.5	60.5	35.2	1.8	440
1997	6.5	64.9	28.6	0.0	370
1998	2.2	60.0	37.7	0.0	453
1999	4.1	62.9	32.6	0.5	442
2000	0.0	79.2	20.8	0.0	120
2007	0.0	55.3	43.7	0.0	103
2008	0.0	90.6	9.4	0.0	64
2011	0.0	73.2	26.8	0.0	41
2012	2.9	70.6	26.5	0.0	102
2013	0.0	66.7	33.3	0.0	3

Water temperature is the main factor influencing the time of incubation and lack of spawning success below Dexter Dam. Studies specific to the incubation of natural-origin spring Chinook salmon eggs in the Middle Fork Willamette River have not been conducted.

Generally, Willamette spring Chinook salmon exhibit complex and variable rearing and migration patterns. Chinook salmon juveniles may spend up to 1½ years in their natal stream. Mattson (1962) identified three general migration patterns in seaward migration of Willamette spring Chinook salmon observed in the lower Willamette River at Lake Oswego. The first is a spring-summer migration of 0-age juveniles which usually peaks from April through June. However, Chinook salmon juveniles were observed as early as January, and peak counts were made as late as August. These first-spring migrants range in size from 40-90 mm. The second migration period occurs in the fall and winter when the fish are about one year old. This migration generally peaks in October and is associated with the onset of heavy fall rains. Fall migrants are usually between 100-130 mm in length. The third migration occurs in the second spring when the fish are about 1½ years old. This migration peaks between March and May, and the fish 100-140 mm in length.

Captures of CWT fish during commercial fisheries suggest that Middle Fork Willamette spring Chinook salmon spend most of their ocean life in coastal Alaskan and British Columbia waters (NMFS 2000).

(b) ESA-listed population(s) that may be <u>incidentally</u> affected by the program

Columbia River Bull Trout

Columbia River Bull Trout (*Salvelinus confluentus*) were listed as "threatened" under the federal ESA in June of 1998. The Willamette River Recovery Unit encompasses the Willamette River, a major tributary to the Columbia River, and forms part of the range of the Columbia River population. The UWR Recovery Unit includes local populations in the upper Middle Fork Willamette River, and the Salt Creek/Salmon Creek/North Fork, Middle Fork Willamette River complex. Other Willamette populations occur in the mainstem McKenzie and South Fork McKenzie rivers.

Only a "handful" of adult bull trout were thought to remain in the Middle Fork Willamette (USFWS 2002). Thus, this distinct Willamette River population is considered to have been extirpated. However, since 1997 ODFW has been transplanting bull trout fry from Anderson Creek in upper McKenzie River into seven sites throughout the Middle Fork Willamette (USFWS 2002). Subsequent surveys have indicated that an unknown portion of the transplants have survived. ODFW has captured small number of both juvenile and adult bull trout within the Middle Fork Willamette River (ODFW 2005) and low numbers of adult bull trout have been spawning annually since 2005.

Lower Columbia River Steelhead

The Lower Columbia River steelhead ESU was listed as threatened under the ESA on March 19, 1998 and reaffirmed January 05, 2006 (71 FR 834). This ESU occupies tributaries to the Columbia River between the Cowlitz and Wind Rivers Washington, inclusive, and the Willamette and Hood Rivers in Oregon, inclusive. Excluded are steelhead in the UWR Basin above Willamette Falls, and steelhead from the Little and Big White Salmon Rivers in Washington. Many populations in the Lower Columbia River steelhead ESU are small and have long and short-term trends in abundance. Hatchery management practices have reduced the diversity and productivity of natural populations in the Lower Columbia River ESU.

Upper Willamette River (UWR) Steelhead

The UWR steelhead ESU (listed as threatened under the ESA on March 24, 1999 and reaffirmed January 05, 2006 (71 FR 834)), includes native winter-run populations from Willamette Falls upstream to and including the Calapooia River. Significant natural populations of steelhead occur in the North Santiam, the South Santiam, the Molalla, and the Calapooia rivers. Additionally, smaller, but still significant natural populations occur in several West Valley tributaries (Tualatin, Yamhill, Luckiamute, Rickreall). There are no hatchery programs included in this ESU (NMFS 2006). Steelhead numbers in this ESU are depressed from historical levels but to a much lesser extent then spring Chinook salmon in the Willamette Basin (McElhany et al. 2007).

Lower Columbia River Chinook Salmon

The Lower Columbia River Chinook salmon ESU was listed as threatened under the ESA on

March 24, 1999 and reaffirmed June 28, 2005 (70 FR 37160). This ESU includes all naturally spawned Chinook salmon populations residing below impassable natural barriers (e.g. long-standing, natural waterfalls) from the mouth of the Columbia River to the crest of the Cascade Range just east of the Hood River in Oregon and the White Salmon River in Washington. This ESU excludes populations above Willamette Falls. Within this ESU, there are historic runs of three different Chinook salmon populations: spring-run, fall-run (tules), and late-fall (bright) Chinook salmon. Current data for the Lower Columbia River Chinook salmon ESU indicated that populations currently have low abundance. Hatchery management practices have reduced the diversity and productivity of natural populations in the Lower Columbia River Chinook salmon ESU.

Lower Columbia River Chum Salmon

The Lower Columbia River chum salmon ESU was listed as a threatened species on March 25, 1999 and reaffirmed on June 28, 2005. The ESU includes all naturally spawned populations of chum salmon in the Columbia River and its tributaries in Washington and Oregon.

Oregon Chub

The reduction of suitable habitat, threat of non-native fish, and the restricted distribution of the Oregon chub (*Oregonichthys crameri*) resulted in a determination of "endangered" status under the federal ESA in 1993. The listing was downgraded to “threatened” in early 2010 and the fish was removed from the list in 2015. Oregon chub are endemic to the Willamette Valley of western Oregon. Historically, Oregon chub were found throughout the Willamette Basin from Oregon City to Oakridge. The historical records note collections from the Clackamas River, Molalla River, Mill Creek, Luckiamute River, North Santiam River, South Santiam River, Calapooia River, Long Tom River, Muddy Creek, McKenzie River, Coast Fork Willamette River, Middle Fork Willamette River drainages, and the mainstem Willamette River. Oregon chub distribution and abundance have improved dramatically since the species was listed. However, compared to the historical distribution, the current distribution is limited to populations in the Molalla River, Luckiamute River, Santiam River, Mary’s River, McKenzie, Coast Fork and Middle Fork Willamette River drainages. These chub populations may be incidentally affected through predation activities by the out-migrating smolts of Willamette Hatchery spring Chinook program. No chub populations are known to exist in the Willamette River drainage downstream of Willamette Falls.

2.2.2) Status of ESA-listed Salmonid population(s) affected by the program

(a) Status of listed natural population(s) relative to “critical” and “viable” population thresholds

The State of Oregon and NMFS have adopted a Conservation and Recovery Plan for the UWR CHS ESU (ODFW and NMFS 2011). The Recovery Plan recommends objectives and strategies for recovery and prescribes delisting criteria for spring Chinook salmon and winter steelhead in the Upper Willamette basin. This plan contains standards for a “viable salmonid population” (VSP) of Middle Fork Willamette River spring Chinook salmon in

terms of abundance, productivity, distribution, and diversity. Along with the Willamette BiOp, the Recovery Plan informs spring Chinook salmon conservation, consistent with survival and recover of the UWR CHS ESU, as part of the best scientific and commercial data available.

Spring Chinook salmon in the Middle Fork Willamette River are currently at a very high risk of extinction with a desired status of low (<5% extinction risk over a 100 year period) risk of extinction. The gap between current and desired status of the MF Willamette population is approximately 5,820 natural-origin CHS (including Fall Creek).

NMFS (2000) concluded that blockage of the Middle Fork Willamette River by Dexter, Lookout Point, Hills Creek, and Fall Creek dams jeopardizes spring Chinook salmon in this system and indicates that the Middle Fork Willamette hatchery program will be important to minimize risk of extinction over the short-term.

Recent natural-origin spawning escapements in the Middle Fork Willamette River do not meet critical and viable thresholds for abundance and productivity and may continue to fall short regardless of fishery and hatchery and dam passage management actions. Viability analyses conducted for the Upper Willamette Recovery Plan (ODFW and NMFS 2011) graded the population at a very high risk of extinction, based on VSP criteria (see Chapter 4 of the Recovery Plan for details). The availability of areas historically used for spawning by spring Chinook salmon in the Middle Fork Willamette was severely reduced by construction of Dexter, Lookout Point, Hills Creek, and Fall Creek dams in the 1950's. Mattson (1948) estimated that over 80 percent of the spring Chinook salmon spawning in 1947 were located upstream from the site of these dams. Today, some, but very marginal, spawning and rearing habitat is still available below these dams. In addition, there is successful passage through Fall Creek reservoir and dam albeit seasonally when the reservoir is drawn down in the fall for flood control management. The area below Dexter and Fall Creek dams, although accessible for spawning by spring Chinook salmon, has been altered with different thermal and flow regimes associated with reservoir operations. A temperature control spill regime that the Action Agencies started in 2011 has improved water temperature beneath the Hill Creek, Lookout Point, Dexter system; however, benefits to CHS from the action are unconfirmed. The higher stream temperatures and different flow patterns severely impact incubating eggs and newly emerged fry.

The status of hatchery and wild population returns is available from spring Chinook salmon counts made at Dexter Trap. Data on adult returns to Dexter Trap are presented in Table 1.12-1.

(b) Most recent 12-year progeny-to-parent ratios, survival data by life-stage, or other measures of productivity for the listed population

Data were not available for analysis of survival or productivity of natural-origin salmon in the Middle Fork Willamette River.

(c) Most recent 12-year annual spawning abundance estimates or other abundance information

Table 2.2.2-1 provides redd densities for survey sections in the Middle Fork Willamette River basin.

(d) Most recent 12-year estimates of annual proportions of direct hatchery-origin and listed natural-origin fish on natural spawning grounds

The composition of natural origin recruits, as determined by otolith analysis of carcasses recovered on the spawning grounds between Dexter and Jasper ranged from 4 percent in 2003 to 69 percent in 2007 (Table 2.2.2-2). From 2004-2007, the percent of natural-origin spawners showed an increasing trend, although a substantial reduction was observed in 2008.

Table 2.2.2-1. Summary of Chinook salmon spawning surveys in the Middle Fork Willamette Basin, 2002-2013. From Kenaston et al. 2009; Schroeder et al. 2005; Cannon et al. 2012; ODFW, unpublished data.

	Redds/km											
Section	2013[1]	2012	2011	2010	2009	2008	2007	2006	2005	2004	2003	2002
Below Dexter	0.8	5.3	6.9	1.5	2.5	9.3	0.6	7.7	0.6	0.6	1.0	4.4
North Fork Middle Fork	7.2	6.9	4.0	4.2	--	--	--	--	--	--	--	--
Fall Creek	0.5	2.2	2.2	2.6	1.4	3.5	1.1	8.3	5.1	8.1	3.8	8.1
Little Fall Creek	2.8	3.8	6.7	--	--	--	--	--	--	--	--	--
Above Hills Cr Reservoir	4.8	16.3	--	--	--	--	--	--	--	--	--	--

[1] Note that surveys in 2013 were compromised by a severe storm event late in the spawning season. Peak redd counts were probably biased low.

Table 2.2.2-2. Composition of spring Chinook salmon in the Middle Fork Willamette River basin between Dexter and Jasper, including Fall Creek for all run years except 2006, based on carcasses recovered. Sources: Kenaston et al. 2009, Cannon et al. 2010, Cannon et al. 2011, Cannon et al. 2012, and ODFW, unpublished data.

Run year	Number of Carcasses Recovered	Total Number Clipped	Total Number Unclipped	Number Unclipped with Otolith Mark	Number Unclipped without Otolith Mark	Percent Natural-Origin Spawners
2002	335	228	107	91	16	5
2003	114	62	52	48	4	4
2004	174	120	54	32	22	13
2005	57	37	20	10	10	18
2006	--	--	--	--	--	--
2007	102	81	21	4	17	28
2008	81	20	61	5	56	69
2009	121	55	66	5	61	50
2010	420	244	176	40	136	32
2011	201	96	105	19	86	82
2012	185	70	115	15	100	54
2013	146	71	33	2	37	47

2.2.3) Potential take of listed fish due to hatchery activities

(a) Hatchery activities that may lead to the take of listed salmonid populations in the target area, including how, where, and when the takes may occur, the risk potential for their occurrence, and the likely effects of the take

Broodstock collection at the Dexter Ponds Fish Facility occurs between June and October. All spring Chinook salmon captured at Dexter Ponds are ESA-listed as part of the Upper Willamette ESU. Thus, direct take of listed spring Chinook salmon is a consequence of river blockage by the flood control/hydroelectric dams and intended as part of normal trap operation through migration delay, capture, handling, and upstream release. Trapping and handling devices may further lead to injury to listed fish through confinement, delayed migration and spawning, or delayed mortality as a result of injury. For the hatchery program, coverage is needed for up to 3,000 adults for broodstock needs which supports conservation and reintroduction activities including an integration rate averaging 5% natural-origin adults. Competition, disease, predation, and genetic interactions between hatchery and natural-origin fish in the Middle Fork Willamette River may result in additional indirect take; however, these effects have not been quantified but are presumed minimal due to lack of viable spawning below Dexter. Interactions between hatchery-origin Chinook salmon smolts and naturally-produced juveniles are minimized by release strategies which promote rapid emigration. Enhanced river flow can also be used to expedite outmigration of smolts.

Baseline monitoring is included as part of the Cooperative Agreement for hatchery funding through the USACE. In addition, the USACE has developed an RM&E plan that recommends a framework for RM&E activities related to the Willamette Hatchery Program in general and the Middle Fork Willamette River Spring Chinook Salmon Hatchery Program, specifically. The hatchery RM&E plan identified variables important for evaluating hatchery performance. Individual RM&E actions will be associated with various levels of take. These actions and potential take associated with uncertainty research will be addressed separately on an annual basis.

(b) Past takes associated with the hatchery program, including numbers taken and observed injury or mortality levels for listed fish (if known)

Prior to 2002 (i.e. before all of the returning hatchery fish were marked), wild spring Chinook salmon were not readily distinguishable from hatchery fish. Consequently, there is little specific information on the level of take associated with the adult trapping and holding before that time. Table 2.2.3-1 gives the mortality of adult spring Chinook salmon at Willamette Hatchery from 1990 to 2012. Assuming the proportion of natural origin fish in the spawning population between Dexter and Jasper in 2002 (Table 2.2.2-2) is representative of adults captured at Dexter Ponds prior to 2002; approximately 5 percent of the broodstock prior to 2002 may have been natural origin fish. However, this estimate could be biased upward, because natural origin fish may be less inclined to enter the trap than hatchery origin fish. Due to unnaturally poor water quality below Dexter, nearly all natural spawning is unsuccessful, resulting in a net benefit of moving fish to

Willamette Hatchery for holding and spawning. However, holding pond conditions and pathogen levels in returning adults also contribute to high holding mortality observed at the hatchery.

Table 2.2.3-1. Numbers of spring Chinook salmon taken for broodstock and holding mortality at Willamette Hatchery for brood years 1990-2015.

Brood Year	Fish Held (No.)			Holding Mortality					
	Males	Females	Total	Males		Females		Total	
				(No.)	%	(No.)	%	(No.)	%
1990	499	1,645	2,144	213	42.7	1,096	66.6	1,309	61.1
1991	481	1,409	1,890	88	18.3	356	25.3	444	23.5
1992	659	1,484	2,143	307	46.6	890	60	1,197	55.9
1993	413	823	1,236	22	5.3	129	15.7	151	12.2
1994	396	905	1,301	129	32.6	485	53.6	614	47.2
1995	422	877	1,299	28	6.6	169	19.3	197	15.2
1996	402	827	1,229	40	10	171	20.7	211	17.2
1997	565	999	1,564	31	5.5	101	10.1	132	8.4
1998	680	889	1,569	17	2.5	108	12.2	125	8
1999	746	980	1,726	23	3.1	60	6.1	83	4.8
2000	967	994	1,961	76	7.9	205	20.6	281	14.3
2001	1,047	1,246	2,293	259	24.7	705	56.6	964	42
2002	902	1,022	1,924	44	4.9	177	17.3	221	11.5
2003	979	1,239	2,218	98	10	493	39.8	591	26.7
2004	1,113	1,375	2,488	215	19.3	270	19.6	485	19.5
2005	1,015	1,657	2,672	167	16.5	762	46	929	34.8
2006	950	1,327	2,277	59	6.2	134	10.1	193	8.5
2007	985	1,351	2,336	153	15.5	486	36	639	27.4
2008	850	841	1,691	68	8	65	7.7	133	7.9
2009	824	934	1,758	873	10.1	112	12	195	11
2010	1,049	1,095	2,144	232	22	252	23	484	22.6
2011	894	998	1,892	130	14.5	155	15.5	285	15
2012	1,075	1,082	2,166	367	34	249	23	616	28.4
2013	1,115	1,395	2,510	260	23	861	61.7	1,121	44.7
2014	1,270	1,441	2,711	594	47	814	56.5	1,408	51.9
2015	1,309	1,445	2,754	846	64.6	982	68	1,828	66.4
MEAN					19.3		30.9		23.5

(c) Projected annual take levels for listed fish by life stage and type of take (e.g., capture, handling, tagging, injury, lethal take) resulting from the hatchery program

Projected incidental take levels for spring Chinook salmon are presented in Tables 2.2.3-2 and 2.2.3-3. Take levels were estimated independently for the hatchery and wild components of the ESU. Incidental take attributable to some hatchery operations (e.g., juvenile releases) and related RM&E programs are not quantifiable at this time. As part

of the RM&E program, monitoring and evaluation activities will be conducted to provide information on incidental take levels associated with hatchery operations, and will result in task-specific take estimates. Generated take estimates should be reviewed annually as part of baseline monitoring as identified in the hatchery mitigation agreement.

Table 2.2.3-2. Estimated annual incidental take of adult spring Chinook salmon associated with trapping at Dexter Ponds Fish Facility, transport for outplanting or broodstock, and holding at Willamette Hatchery

Listed species affected: Spring Chinook Salmon ESU/Population: Upper Willamette
Activity: Adult Trapping

Location of hatchery activity: Dexter Trap Dates of activity: June - October Hatchery program operator: ODFW

	Annual Take of Listed Fish *(Number of Fish)*	
Type of Take	**Hatchery-Origin**	**Natural Origin**
Collect for transport (above dams)[1]	2,450	TBD
Capture, handle, and release[2]	0	0
Removal (e.g., broodstock)[3]	3,000	0-150
Unintentional lethal take[4]	<10%	< 5%

[1] Take associated with weir or trapping operations where listed fish are captured and transported for release.
[2] Take associated with weir or trapping operations where listed fish are captured, handled and released upstream or downstream. Represents a subset of the listed fish that are captured and transported for release.
[3] Listed fish removed from the wild and collected for use as broodstock. Fish removed for broodstock are also considered to be intentional lethal take. Note that the estimate for natural-origin reflects the number of unmarked adults returning to the trap; however, all adults will be NOR will be taken into the broodstock until spawning, incubation, and passage conditions improve.
[4] Unintentional mortality of listed fish, including loss of fish during transport or holding prior to spawning or prior to release into the wild, or, for integrated programs, mortalities during incubation and rearing.

(d) Contingency plans for addressing situations where take levels within a given year have exceeded, or are projected to exceed, take levels described in this plan for the program

Given the relatively low numbers of natural origin adult returns to Dexter Trap (Table 1.12-1) compared to the allowable take levels (as described above), it is not anticipated that take will be exceeded, with the exception of the possibility of exceeding unintentional lethal take. Take estimates for NOR incorporated into the broodstock reflect the range of unclipped adults returning to the trap. Adults in excess of the listed take estimate will be in incorporated into the broodstock until spawning, incubation, and passage conditions improve.

SECTION 3. RELATIONSHIP OF PROGRAM TO OTHER MANAGEMENT

OBJECTIVES

3.1) Alignment of the hatchery program with any Evolutionary Significant Unit (ESU)-wide hatchery plan

Upper Willamette River Conservation and Recovery Plan for Chinook salmon and steelhead

In August 2011, ODFW adopted the Recovery Plan for the UWR CHS ESU and steelhead DPS, which includes the Middle Fork Willamette spring Chinook salmon population. The Recovery Plan provides primary guidance for ESA Section 4 recovery of the UWR CHS ESU, including delisting criteria. It also informs ESA Section 7 analysis of effects and actions to avoid jeopardy and destruction or adverse modification of critical habitat, where it informs the best scientific and commercial data available. Chapters 4 and 6 of the plan document the current status of the population across the ESU and report desired status goal for the population from a recovery perspective, based on interrelations of the populations, limiting factor threats, and recovery potential by subbasin.

The Middle Fork Willamette spring Chinook population is currently at a very high risk of extinction, and the desired status under the Plan is to improve it to low extinction risk (viable). Chapter 7 of the Recovery Plan identifies several management actions to achieve the desired status, again from a recovery standpoint. For details, see http://www.dfw.state.or.us/fish/CRP/docs/upper_willamette/UWR%20FRN2%20Mainbody%20final.pdf.

Recovery Plan goals related to the hatchery program are cross-referenced in Table 3.1-1 of this HGMP.

Willamette Hatchery River Basin Flood Control Project Biological Opinion (NMFS 2008)

In May 2008, the NMFS released their BiOp regarding impacts to ESA-listed species that are related to the Willamette Project, including operation of USACE's 13 Willamette Project dams and funding of the Hatchery Mitigation Program (NMFS 2008). In this opinion, NMFS concluded that the proposed action (PA) was likely to jeopardize the continued existence of the listed spring Chinook salmon ESU and winter steelhead DPS, and to adversely modify or destroy designated critical habitat for those species. NMFS provided a Reasonable and Prudent Alternative (RPA) to ensure the species' survival with an adequate potential for recovery. NMFS also included the terms and conditions with which actions must comply in order to meet reasonable and prudent measures that were deemed necessary to minimize the impacts to listed species from incidental take.

Section 2.10 of the BiOp describes the proposed action with regard to fish hatcheries and related programs, including the CHS reintroduction/outplant program. Section 5 describes the effects of the PA on ESA-listed fish, with the effects of hatchery programs

specifically presented in Section 5.1.5. Chapter 9 contains the RPA.

Some particular RPA measures related to the Middle Fork Willamette spring Chinook salmon program are as follows:

RPA measures 1.1-1.4 of the BiOp, describing WATER, the interagency coordination and adaptive management forum that will be used to implement actions delineated in the BiOp.

- Adult Chinook Outplanting – RPA measures 4.1 and 6.2.3 provide direction for adult Chinook salmon outplanting above Lookout Point and Hills Creek dams via trap and haul measures, in order for fish to access historic spawning and rearing habitats above the projects.
- WFOP – RPA measures 4.3 and 4.4 provide for completion, annual review, and implementation of a Willamette Fish Operations Plan (WFOP) that includes protocols for optimal handling, sorting, and release conditions for Dexter and Fall Creek fish collection facilities, and identification of the number, origin, and species of fish to be released upstream of USACE dams, incorporated into hatchery broodstock, or taken to other destinations.
- Upgrade Adult Fish Collection Facilities and Release Sites – RPA measure 4.6 prescribes upgrades to the Dexter Ponds Fish Facility and the Fall Creek Dam Trap. As part of the Dexter Pond Fish Facility upgrades, additional adult holding pond space is needed at Willamette Hatchery to support broodstock and potential over-summer holding of adults for late season outplanting. RPA measure 4.7 addresses study, identification, and construction of adult fish release sites where Lookout Point, Hills Creek, and Fall Creek reservoirs are site candidates to be prioritized in the context of the Configuration and Operation Plan (COP) in RPA measure 4.13.
- Hatchery operations – RPA 6 addresses hatcheries, including but not limited to implementation of HGMPs (6.1.1), including conducting genetically integrated management (6.2); improving fish collection facilities basin-wide (6.1.2); mass marking of fish (6.1.3); and adjusting spring Chinook release strategies (6.2.4).
- Spring Chinook Hatchery Program RM&E – RPA 9.5.1 provides for RM&E activities to measure the effectiveness of hatchery measures to reduce adverse effects, including but not limited to composition and reproductive success of hatchery fish on the spawning grounds, and survival of adult outplants above the dam.

In addition, RPA measure 4.8 provides interim operational measures for safe and efficient downstream juvenile fish passage through reservoirs and dams. Implementation of RPA 9.3 (fish passage RM&E) through sub-actions identified in RPA measures 4.10 and 4.11, provide for RM&E assessment of downstream juvenile fish passage options. RPA measures 4.12 and 4.12.2 provide for investigating feasibility of downstream passage and implementing potential passage solutions at Lookout Point Dam after analysis of alternatives in the COP process (RPA 4.13) and decision making in the WATER process (RPAs 1.3 and 1.4).

RPAs related to the hatchery program are cross-referenced in Table 3.1-1 of this HGMP.

Fishery Management and Evaluation Plan-Upper Willamette River Spring Chinook salmon in Freshwater Fisheries of the Willamette Basin and Lower Columbia River Mainstem (ODFW 2001)

This document outlines the plans for selective fisheries for hatchery Chinook salmon in the Willamette and lower Columbia rivers, and plans for evaluation of the effectiveness of the fishery regulations in protecting natural spawning populations. The Middle Fork Willamette hatchery program is part of this comprehensive plan. The selective fishery was implemented in 2001. The Fishery Management and Evaluation Plan (FMEP) calls for a comprehensive monitoring and evaluation program assessing the catch of wild fish, the abundance of wild and hatchery fish, and angler compliance throughout the basin. The results of the monitoring program are assessed and presented in annual reports.

Willamette Basin Fish Management Plan (WBFMP) - Spring Chinook Salmon Chapters (ODFW 1998)

This document provides direction for the management of Willamette River Basin spring Chinook salmon populations by identifying and addressing factors that impact each subbasin population. The plan also restricts fisheries on spring Chinook salmon adults in ways consistent with rebuilding wild populations. The measures outlined in the plan are designed to maintain viable populations of spring Chinook salmon in the Willamette Basin.

ODFW Policies

Native Fish Conservation Policy (OAR 635-007-0502 through -0506): The Oregon Fish and Wildlife Commission has approved the Native Fish Conservation Policy (NFCP). The NFCP defines ODFW's principle obligation for fish management as the conservation of naturally produced native fish in the geographic areas to which they are indigenous. The policy is based on the concept that locally adapted populations provide the best foundation for maintaining and restoring sustainable naturally produced fish. The NFCP requires a conservation plan for each native stock within each Species Management Unit (SMU). The ODFW completed an Oregon Native Fish Stock Status Report in 2005. Information in the document will be used for the development of a conservation plan as part of the NFCP. ODFW and NMFS have jointly completed a conservation and recovery plan for Chinook salmon and steelhead in the Upper Willamette River subbasin for the SMU (ODFW and NMFS 2011) that includes direction regarding the role and responsible management of hatchery-produced fish to achieve recovery.

Hatchery Management Policy (OAR 635-007-0543 though -0548): This policy provides guidance for the responsible use of hatchery-produced fish. The policy outlines the best management practices for hatchery programs to ensure conservation and management of both naturally produced native fish and hatchery produced fish in Oregon.

Table 3.1-1 outlines pertinent BiOp and Recovery Plan goals specific to the Middle Fork

Willamette Hatchery program. Funding for BiOp compliance is derived from USACE annual budgets for the hatchery program. US Army Corps of Engineers' annual funding is subject to congressional approval, and may require obtaining Congressional authority, prior to seeking federal funding, in order to implement. Some actions could also be funded through special budget allocations outside of hatchery program budget, or through other programs such as harvest management, conservation and recovery programs, or research.

Table 3.1-1. BiOp and Recovery Plan Actions

Proposed Action (PA)	**Recovery Plan Goals and Reasonable and Prudent Alternative (RPA)**	**Timeframe**
Continue use of the Middle Fork (stock 022) spring Chinook salmon.	Recovery Plan (249-SUB-MF); BiOp (RPA measures 4.1 and 6.2.3 adult Chinook outplanting; 6.2.2 genetically integrated management and 9.5.1 RM&E): use Middle Fork stock to help re-establish production above USACE dams in the Middle Fork basin.	Immediate/ ongoing
Continue collecting all Middle Fork spring Chinook salmon broodstock at the Dexter Pond Fish Facility.	Recovery Plan (240-SUB-MF); BiOp (RPA measures 4.1 and 6.2.3 adult Chinook outplanting and 4.6 and 4.7 facility upgrade): use Dexter Ponds facility upgrade to support outplanting and reintroduction efforts.	Immediate/ ongoing
Continue to collect Middle Fork broodstock throughout the run (including the early part of the season) to ensure the hatchery population is as similar as possible to any naturally spawning population.	Recovery Plan (249-SUB-MF); BiOp (RPA measures 4.1 and 6.2.3 adult Chinook outplanting, 6.2.2 genetically integrated management and 9.5.1 RM&E): It will be important to integrate all returning natural-origin adults into the broodstock, given that: 1) hatchery-origin fish likely contain the only genetic remnants of the historic population, 2) recently, less than 1% of the broodstock has been natural-origin fish, 3) successful natural production is minimal, and 4) hatchery fish represent nearly all spawners (NMFS 2008). In addition, ODFW considers the population to be extirpated (ODFW and NMFS 2011).	Immediate/ ongoing;

Proposed Action (PA)	Recovery Plan Goals and Reasonable and Prudent Alternative (RPA)	Timeframe
Due to lack of natural production below Dexter, all natural origin adults will be incorporated into the broodstock to maintain the genetic lineage of the population to the extent possible. Integration need and guidelines will be reassessed if safe passage and habitat conditions are achieved in the future.	Recovery Plan (22-ESU-ADM and 249-SUB-MF); BiOp (RPA measures 6.2.2 and 9.5.1): 1) Integration is needed to meet conservation and outplanting/reintroduction goals above Lookout Point and Hills Creek dams. All natural returns to the Dexter Fish Collection facility will be incorporated into the broodstock. This protocol will be reviewed if habitat and passage conditions are improved and support successful spawning, rearing, and passage. 2) HMP integration goals: Maintain production goals and run characteristics - continue current practice of incorporating all natural origin adults returning to the Dexter Fish Collection Facility into the broodstock. 3) Conduct scientific review of current UWR hatchery programs and develop recommendations for maintaining a hatchery stock suitable for outplanting and reintroduction including strategies that promote and maintain a locally adapted population in the short term (until other LFT conditions are improved), and how to be consistent with VSP attributes and recovery goals.	Immediate/ ongoing
Continue to use random spawning protocol with a 1:1 male-to-female ratio for Middle Fork spring Chinook salmon.	It should be noted that recent science suggests that non-random mating may be preferable in some instances to mimic mate selection in natural-origin fish. Alternative mating strategies will be reviewed and implemented based on best available science to achieve program objectives.	Immediate/ ongoing
Continue to adipose fin-clip and otolith mark (as needed) all Middle Fork spring Chinook salmon.	Recovery Plan (29-ESU-ADM and 30-ESU-ADM); BiOp (RPA 6.1.3): needed to implement harvest management program, and to assist in genetically-integrated management and outplanting efforts	Immediate/ ongoing
Insert coded wire tags (CWTs) into representative groups of juvenile hatchery fish at Willamette Hatchery in addition to current practice of adipose fin-clipping and otolith marking all juveniles.	Recovery Plan (29-ESU-ADM and 30-ESU-ADM); BiOp (RPA 6.1.3): Continue to mark all hatchery fish releases in the Willamette Basin with an adipose fin-clip and otolith mark; CWTs (or blank tags if appropriate) or PIT tags inserted into a proportion of all hatchery spring Chinook salmon released to confirm origin and support RM&E needs.	Immediate/ ongoing

Proposed Action (PA)	Recovery Plan Goals and Reasonable and Prudent Alternative (RPA)	Timeframe
Operate and maintain Willamette Hatchery.	Recovery Plan 29-ESU-ADM); BiOp (RPA measures 6.1, 6.2.2, 9.5.1)	Immediate/ ongoing
Operate, maintain, and possibly rebuild the Dexter Pond Fish Facility.	Recovery Plan (239-SUB-MF); BiOp (RPA 4.6, and 6.1.2 and 6.2.3): Design, construct, install, operate, and maintain new or rebuilt adult fish collection, handling, and transport facilities at Dexter Ponds Fish Facility, if it is determined to be biologically effective.	Immediate/ ongoing; construction completion Dec. 2014; begin operation Mar. 2015
Investigate and implement improvements to the collection and transport of fish at Dexter Dam.	Recovery Plan (239-SUB-MF); BiOp (RPA 4.6, and 6.1.2 and 6.2.3): Planning and design work to update the existing adult collection facility and fish ladder is currently underway	Immediate/ ongoing
Resolve hatchery infrastructure maintenance needs and develop a long-term Hatchery Maintenance Plan for Dexter Ponds Fish Facility and Willamette Hatchery.	BiOp (RPA 6.1.2): Improve fish collection facilities associated with hatchery mitigation program, including salmonid ladders, traps, holding, and acclimation facilities associated with hatchery broodstock collection and the outplanting program. This may include a new brood holding pond at Willamette.	Immediate/ ongoing

Proposed Action (PA)	Recovery Plan Goals and Reasonable and Prudent Alternative (RPA)	Timeframe
Continue the spring Chinook salmon Reintroduction/Outplant Program and evaluate long-term feasibility of establishing viable populations in existing habitat in the Middle Fork Willamette above Lookout Point and Hills Creek dams. .	Recovery Plan (236-SUB-MF, 237-SUB-MF, 238-SUB-MF, and 240-SUB-MF); BiOp (RPA 4.1 and 6.2.3 adult Chinook outplanting; 4.6 and 6.1.2 upgrades; 4.8 interim fish passage and 4.10-4.12 improved downstream passage including 4.13 COP process; 6.2.2 genetic diversity; and 9.3 and 9.5.1 fish passage and hatchery program RM&E). Goals as adapted from Appendix E of Plan include: 1) All NOR spring Chinook salmon captured at Dexter Ponds Fish Facility will be integrated into the broodstock. A portion of the run will be considered for outplanting above Lookout Point, and Hills Creek dams once effective passage is reestablished. 2) The approach for re-establishing runs above Lookout Point and Hills Creek dams is to continue outplanting primarily adult hatchery spring Chinook salmon into the vacant habitats above the dams until biologically effective, cost-effective and technologically feasible passage success has been demonstrated. Adequate numbers of hatchery fish that are surplus to broodstock needs are typically available every year to support passage studies. A phased-in reintroduction strategy will be developed in consideration of passage actions and timeline. In the interim, these outplanted HMP fish can also be used for RM&E purposes to monitor the downstream survival of fish through the reservoirs, turbines, regulating outlets, etc. Over time, as conditions improve and natural-origin production and capacity increases, hatchery outplants will be discontinued, and natural-origin fish will be the only fish passed above the dams. Further details on these reintroduction efforts using the hatchery programs are being discussed and formalized by the fish co-managers in coordination with the WATER Hatchery Management Team.	Immediate/ ongoing

Proposed Action (PA)	Recovery Plan Goals and Reasonable and Prudent Alternative (RPA)	Timeframe
	3) Genetically assess (e.g. adult pedigree analysis) origin of all NOR Chinook salmon returning to Dexter and Fall Creek fish collection facilities. Consider selectively transporting upstream those fish which originated above the respective dam once effective passage has been demonstrated.	
Collect, hold, transport, and release outplanted fish in a manner that increases the likelihood for spawning success.	Recovery Plan (240-SUB-MF); BiOp (RPA measures 4.1; 4.3; 4.4.; 4.5; 4.7; 6.1.2) Implement best management practices for optimal handling, sorting, and release to support successful research, monitoring, evaluation, and reintroduction. Protocols will be documented in the annual Willamette Fish Operations Plan.	Immediate/ ongoing
	Work with USFS, Services (NMFS and USFWS), and with recommendations from the WATER Technical Team to prioritize, design and construct each release site, which may include infrastructure to minimize stress and injury of adults.	Construction completion June 2013
Ensure that outplanted fish represent the life history characteristics of the natural population and promote successful production.		Immediate/ ongoing
Develop and carry out a thorough RM&E program to monitor the progress of the reintroduction/outplant program.	BiOp (RPA 9.1.5)	Immediate/ ongoing
Develop a strategy for reducing the incidence of hatchery strays on spawning grounds, as appropriate in the future due to increased natural-origin spawning.		Ongoing

3.2) Existing cooperative agreements, memoranda of understanding, memoranda of agreement, or other management plans or court orders under which program operates

1) Cooperative Agreement between the USACE and the State of Oregon (ODFW) for the Operation and Maintenance of Willamette Valley, Cole Rivers, and Bonneville Hatcheries within the USACE, Portland District Hatchery Mitigation Program (Cooperative Agreement; USACE and ODFW 2012).

   Willamette Hatchery is one of several hatcheries funded by the USACE to mitigate for the loss of natural spawning, feeding, and rearing grounds for fish, in addition to lost angling opportunity, caused by construction of multi-purpose dams and reservoirs in the Willamette Valley. The Cooperative Agreement identifies maximum production levels (in pounds) to ensure consistency with mitigation responsibility. The Cooperative Agreement directs ODFW and USACE to meet annually to review and adjust (as appropriate) mitigation production levels. Adjustments will be made in order to: reduce and minimize effects on ESA listed fish; meet mitigation program goals, adjusted to account for effective fish passage, comply with ESA through standards and management outlined in the approved HGMP; and, support re-introduction efforts above WVP dams. The approved HGMP serves as the guiding document for hatchery management and releases consistent with the ESA.

3.3) Relationship to harvest objectives

3.3.1) Fisheries benefiting from the program

The hatchery mitigation and supplementation program contributes to significant sport, commercial and tribal fisheries in the Pacific Ocean, lower Columbia River, lower Willamette River, and mainstem and tributary fisheries. Spring Chinook salmon fisheries occur during the spring and summer in the lower mainstem Columbia and mainstem Willamette, as well as in the Middle Fork Willamette River subbasin. ODFW implemented selected fisheries on marked hatchery spring Chinook salmon in 2002. The fisheries target fin-marked hatchery fish only. Willamette spring Chinook salmon management is based on a subbasin plan and other policy adopted by the Oregon Fish and Wildlife Commission after a lengthy public process. The plan was revised in 1998, in part to address requirements of the ODFW Wild Fish Policy, which adds increased protection for wild fish. In-season regulation of the fishery is based on pre-season estimates of abundance.

Historic harvest rates of Upper Willamette spring Chinook salmon have ranged from 30-50 percent. The fishery management strategy is discussed in detail in the Fisheries Management and Evaluation Plan (ODFW 2001). Exploitation of the hatchery product is limited in order to protect wild spring Chinook salmon. The goal is to limit fishery impacts on wild fish to levels that ensure the survival and rebuilding of these populations. In 2012, the Middle Fork Willamette Hatchery program along with other Willamette

Basin hatcheries contributed to a total commercial and sport harvest of over 21,000 CHS below Willamette Falls including over 17,000 in the lower Willamette River. Approximately 7,500 adults were harvested in upper Willamette River sport fisheries, including an estimated 2,290 adult CHS were harvested in the upper Willamette River tributaries recreational fishery in 2012 (FMEP 2013). The plan estimates that under the current regulation strategy, a 15 percent exploitation rate will achieve this goal even under the most pessimistic assumptions.

3.4) Relationship to habitat protection and recovery strategies

General Habitat Restoration Strategies- ODFW works with land and resource management agencies, landowners, and other environmental interest groups (such as watershed councils) to ensure the maximum available protection to fish habitat is applied. Habitat protection and improvement supports management strategies, resulting in benefit to both hatchery and wild spring Chinook salmon populations. Hatchery fish have an important role in ongoing spring Chinook salmon conservation efforts and recovery planning efforts in the basin (e.g. adult outplanting, juvenile releases above dams).

USACE provides habitat protection and restoration relative to the hatchery program through implementation of the WP BiOp, including the RPA measures described in Section 3.1 of this HGMP.

Recovery strategies relative to hatchery management were discussed briefly in Section 3.1, and greater detail for other management regimes and threats can be found in the Recovery Plan.

3.5) Ecological interactions

Releases of hatchery spring Chinook salmon could potentially increase competition for food with naturally rearing salmonids, including any natural-origin spring Chinook salmon and winter steelhead. These potential interactions, discussed previously in Section 1.9 and 1.10, are considered as minimal threats due to lack of natural production below Dexter Dam and when compared with other limiting factor threats in the Middle Fork Willamette River subbasin and mainstem Willamette in the Recovery Plan. Interactions do not rank as either primary or secondary threats in the Recovery Plan; however, information available to quantify interactions is lacking.

SECTION 4. WATER SOURCE

4.1) Water source, water quality profile, and water-driven limitations to production

Willamette Hatchery has two sources of water, both of which meet or exceed the recommended IHOT water quality guidelines. The first and main water supply is surface water from Salmon Creek, which is not accessible by anadromous fish. This water is

gravity flow and the facility has water rights for up to 82.5 cubic feet per second (cfs). The second source of water is a well that is protected with a backup generator for the pump. This water is primarily used in the hatch house. It is also used for otolith marking, and when water in Salmon Creek is highly turbid, hatchery staff can switch incubators and starter troughs from surface water to well water.

Since its installation in 1994, capacity of the well has declined from 500 to 150 gallons per minute (gpm). An investigation by GeoEngineers (2006) concluded the aquifer source is likely over drafted "by high groundwater pumping rates in the area," and that future declines in capacity could be anticipated unless pumping rates in the area were in better balance with recharge rates. Consequently, expansion of the well system to provide additional water to the hatchery is not considered feasible.

During the winter, Salmon Creek water fluctuates in water quality, and temperature varies between 30 and 45°F. During the summer, Salmon Creek water temperature varies between 45 and 68°F. The well water is a constant 54°F.

Dexter Ponds water comes from an intake on Dexter dam. This intake has a trash rack but is not screened in any way. The water temperatures range from 38°F in the winter to 68°F in the summer months. Daily temperatures do not normally fluctuate more than a degree or two in a 24 hr period.

All hatchery effluent is monitored and reported quarterly under the 0300j permit. All conditions of the permit are administered with ODFW and regulated by ODEQ.

4.2) Measures to minimize take associated with hatchery water withdrawal, screening, or effluent discharge

The screen on the intake does not currently meet NMFS criteria; however, listed species are not known to utilize Salmon Creek upstream of the intake to the hatchery.

The facility operates within the limitations established in its National Pollutant Discharge Elimination System (NPDES) permit.

Table 4.1-1. Monthly Water Temperature Average (°F) at Willamette Hatchery 2001-2012.

	Jan	Feb	March	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Temp												
2001	39	39	42	43	49	52	57	57	53	47	44	41
2002	40	40	41	44	47	52	58	56	52	45	44	43
2003	43	42	44	44	49	56	60	58	54	49	42	42
2004	42	43	44	46	48	53	58	58	53	48	43	42
2005	41	40	44	46	49	52	59	59	53	49	44	41
2006	43	42	42	46	49	54	60	57	53	47	44	42
2007	39	41	43	46	50	54	60	58	53	47	43	41
2008	40	40	41	42	44	47	54	55	51	46	43	38
2009	39	39	40	41	46	52	57	56	52	46	42	37
2010	41	40	41	42	44	48	56	57	53	48	44	43
2011	44	42	NA	45	46	49	54	56	56	48	50	39
2012	40	41	41	43	46	50	55	55	52	47	44	42

SECTION 5. FACILITIES

5.1) Broodstock collection facilities

Broodstock is collected at the Dexter Ponds Facility, a satellite to Willamette Hatchery. The fish voluntarily swim up a fish ladder located at the base of Dexter Dam, then swim through a "V" notched weir into the adult trap. This facility is not considered adequate for meeting the conservation goals and recovery efforts in the subbasin. There is a single adult collection pond at the Dexter Pond Fish Facility. The concrete pond has a volume of 3,848 cubic ft and dimensions of 74 ft long by 13 ft wide by 4 ft high. The pond can accommodate a flow rate of up to 18,000 gpm.

5.2) Fish transportation equipment

The Willamette Hatchery and Dexter Ponds Fish Facility utilize four liberation trucks, with capacities varying from 250 to 3,000 gallons. These trucks are equipped with oxygen and aeration pumps. Most transport times are less than one hour, although a transport time of up to 2.5 hours is applicable to some outplanted adults. IHOT guidelines for transportation are followed.

5.3) Broodstock holding and spawning facilities

Adults are collected at Dexter Dam and transported to the adult Chinook salmon holding facility at the Willamette Hatchery until spawning. The holding facility was constructed in a former earthen rearing pond from the original hatchery. It is inadequate for current adult holding needs at the Willamette Hatchery; and consequently the adults are overcrowded in the pond, not easily captured, and overly stressed which contributes to

high PSM of collected broodstock. The earthen pond is 25 ft wide by 275 ft long and has a depth of approximately 1.5 ft. The flow rate is approximately 1,500 gpm. The existing pond has a design capacity for 800 adults. However, due to current hatchery production levels and high prespawning mortality (PSM) of broodstock, approximately 3,000 adults over-summer in the broodstock pond. Improving the broodstock pond up to current IHOT standards and guidelines would dramatically increase the survival of this ESA-listed broodstock needed for conservation/recovery efforts in the Middle Fork Willamette River, reduce annual transportation costs of adults to the hatchery from Dexter trap, and reduce annual operation costs at the hatchery (i.e. antibiotic treatments).

Adult broodstock held in this pond are injected with antibiotics on a monthly basis. The adult spawning area is located on the side of this pond on a covered deck in a cyclone-fenced area.

5.4) Incubation facilities

The eggs are transported from the adult spawning area to the incubation building in separate buckets. Eggs are incubated in vertical heath style incubator trays. There are 67 stacks of incubators cumulatively allowing for the incubation of 9 million eggs. There are 1,005 units, each of which can accommodate 8,000 eggs. Two water sources (i.e. Salmon Creek and well water) are available to each stack of incubators at a flow rate of 5 gpm. All incubators are equipped with alarms. Ultraviolet purification and a micro-drum filter have been proposed to improve water quality and reduce the presence of disease however no plans have been completed or timeline established.

5.5) Rearing facilities

All Willamette stock spring Chinook salmon are reared at Willamette Hatchery or Dexter Ponds. The Willamette Hatchery has 40-20x80x3-foot raceways, 10-20x100x6-foot raceways, 13 Canadian style starter troughs, and 2 show ponds. The Dexter Pond Fish Facility has 4-18x135x8-foot raceways and a 172x64x8-foot asphalt pond. The Dexter Ponds are also used for acclimation. Some raceways at Willamette Hatchery are utilized for rearing fish from other Willamette basin spring Chinook salmon programs (e.g. Sandy, Marion Forks, Clackamas, and South Santiam hatcheries).

5.6) Acclimation/release facilities

As noted in Section 5.5, the Dexter Pond Fish Facility is used for acclimation. All Middle Fork Willamette stock smolts are transported to the Dexter Ponds Fish Facility and volitionally released to the Middle Fork Willamette River. The fish scheduled for release into the Coast Fork Willamette basin are reared at Willamette Hatchery until release.

5.7) Operational difficulties or disasters

Willamette Hatchery has not had any significant loss of spring Chinook salmon in the last several years.

5.8) Back-up systems and risk aversion measures to minimize the take of listed natural fish

Willamette Hatchery is staffed 24 hours per day to address emergencies or unexpected events. The intake has an alarm system, as do all stacks of incubators, the head box and every starter trough. None of the raceways have alarms. A back up well can be used in the hatch house for the incubators or starter troughs. The well pump is hooked up to a back-up generator.

Fish health monitoring and disease prevention standards consistent with the ODFW Fish Health Management Policy (FHMP) and IHOT protocols are applied at Willamette Hatchery.

Dexter Ponds Facility has alarm systems on all rearing ponds. An emergency procedure between hatchery staff and the USACE has been developed for cleaning the water intakes to the ponds. As a last resort fish would be released to the river. Additional pond alarms are needed.

SECTION 6. BROODSTOCK ORIGIN AND IDENTITY

6.1) Source

Broodstock for the Middle Fork Willamette River spring Chinook salmon hatchery program is collected from adult Chinook salmon returning to the Dexter Ponds Fish Facility on the Middle Fork Willamette River. The majority of adult returns are comprised of hatchery-reared fish (see Table 1.12-1). Hatchery fish returning to the collection facility are mixed and randomly selected for spawning. Natural-origin fish are incorporated into the broodstock as described below in Section 6.2.3.

6.2) Supporting information

6.2.1) History

The original broodstock for Willamette Hatchery was founded entirely from the wild run of spring Chinook salmon in the Middle Fork Willamette River. When the Lookout Point-Dexter Lakes Project was completed in 1954, the wild spring Chinook salmon run returned to the hatchery, providing the basis of the hatchery stock used today. Hatchery-origin fish now likely contain the only genetic remnants of the historic CHS Middle Fork Willamette run available (NMFS 2008). The population was considered extirpated by

ODFW (ODFW and NMFS 2011). Recently, less than 1% of the broodstock has been natural-origin fish (NMFS 2008, citing Schroeder et al. 2006). In addition, successful natural reproduction is minimal (due to poor habitat conditions and lack of downstream passage), and hatchery fish represent nearly all spawners (NMFS 2008).

Since 1990, fish collected at Dexter Pond have been transferred to the Willamette Hatchery (Table 6.2.1-1), and from 1993 through 1999, a portion of the adults collected at Dexter Pond were transferred to McKenzie Hatchery (Table 6.2.1-2). The numbers of fish spawned at these hatcheries and spawning ratios are provided in Tables 6.2.1-1 and 6.2.1-2. A portion of each annual egg take is transferred to the Willamette STEP program and released as unfed fry in the UWR basin. With the exception of STEP egg transfers, eggs collected at Willamette Hatchery have typically remained on-site through at least juvenile development. In some years, eggs from Willamette Hatchery have been transferred to the Gnat Creek Hatchery or to the CEDC programs.

Of the Willamette stock spawned at McKenzie Hatchery in 1993-1999, nearly two-thirds of the eggs produced were transferred back to Willamette Hatchery for rearing and ponding; the remaining eggs were transferred to Gnat Creek Hatchery. Since 1996, production for the CEDC program has been transferred from the Willamette Hatchery to Gnat Creek Hatchery.

Portions of each annual egg take have been transferred to a Willamette STEP program. Eggs are typically reared for 7 to 8 weeks in classroom incubators, and released as unfed fry within the UWR basin.

6.2.2) Annual size

Adult collection goals are based upon annual production goals for the subbasin, anticipated egg transfer needs, and anticipated losses due to diseases and handling to mark fish. To satisfy the current annual smolt and sub-yearling production goals of 1,939,000 smolts and 400,000 sub-yearlings (100,000 of which are released into Hills Creek Reservoir and approximately 300,000 are currently used for RM&E), respectively, the annual egg take objective is 4,000,000 eggs (to account for ELISA sampling for BKD, higher than normal shock losses, and PSM). This equates to an annual broodstock goal of 1,000 males and 1,000 females (2,000 adults total spawned; with up to 3,000 fish collected to account for brood losses).

Table 6.2.1-1. Adult spring Chinook salmon collected at Dexter Pond and transferred to Willamette Hatchery, fish used for broodstock, eggs transferred, and fry ponded (1990–2014).

Brood Year	Adults Transferred from Dexter Pond	Adults Spawned			Egg Take (in 1,000's)	Egg Transfers (in 1,000's)	Fry Ponded	Live Outplants
		# Males	# Females	Spawning Ratio (M:F)				
1990[1]	2,147		516		3,592	0	2,852	0
1991[1]	1,896		976		5,810	400	3,110	0
1992[1]	2,154		557		2,718	0	2,500	0
1993	1,236	214	562	0.38	2,325	0	2,975	0
1994	1,301	231	408	0.57	1,740	0	2,537	0
1995	1,302	374	624	0.60	2,852	0	3,598	0
1996	1,242	288	574	0.50	2,370	496	3,306	122
1997	1,565	448	808	0.55	3,651	400	1,948	0
1998	1,572	634	637	1.00	2,895	0	1,717	0
1999	1,737	652	717	0.91	3,256	0	1,930	0
2000	1,978	724	714	1.01	2,888	853	1,730	0
2001	2,310	544	544	1.00	2,448	0	1,890	0
2002	1,924	772	795	0.97	3,339	0	1,956	0
2003	2,229	784	745	1.05	3,129	0	1,928	0
2004	2,499	832	832	1.00	3,494	0	1,846	0
2005	2,677	735	800	.92	3,073	0	1,782	0
2006	2,279	854	854	1.00	3,280	0	1,977	0
2007	2,336	796	796	1.00	3,223	200[2]	1,797	0
2008	1,691	729	766	.95	3,068	0	2,539	0
2009	1,759	686	686	1.0	2,717		2,181	
2010	2,095	759	759	1.0	2,805		2,354	
2011	1,892	689	748	.92	3,019		2,622	
2012	2,166	619	621	.99	2,213		2,067	
2013	1,830	835	861	.97	3,281		2,266	
2014	2,779	586	596	.98	2,414		1,808	

[1] Prior to 1993, the number of adult males spawned was not recorded.

[2] 200,000 eggs transferred back from Gnat Creek for Willamette's production. Replaced with South Santiam stock.

Table 6.2.1-2. Adult spring Chinook salmon collected at Dexter Pond and transferred to McKenzie Hatchery, fish used for broodstock, eggs transferred, and fry ponded (1993-1999).

Brood Year	Adults Transferred from Dexter Pond	Adults Spawned			Egg Take (in 1,000s)	Egg Transfers (in 1,000s)	Fry Ponded	Live Outplants
		# Males	# Females	Spawning Ratio (M:F)				
1993	1,215	240	492	0.49	1,996	1,411	540	
1994	1,553	270	471	0.57	1,954	1,325	352	
1995	1,594	469	869	0.54	3,694	2,498	692	
1996	1,610	448	889	0.50	3,757	3,618	0	172
1997	1,562	358	698	0.51	3,065	2,955	0	439
1998	1,125	273	300	0.91	1,265	960	0	0
1999	632	171	240	0.71	954	852	0	0

6.2.3) Past and proposed level of natural-origin fish in broodstock

Until 1996, not all hatchery reared spring Chinook salmon were marked with an adipose fin clip, therefore, an unknown proportion of naturally produced fish may have been incorporated into the brood. Since 1996, all hatchery-reared juveniles have been adipose fin clipped, and approximately 30,000 are coded-wire tagged annually. The number of natural-origin fish that have been incorporated has ranged from 0.3 to 10 percent of the brood (Table 6.2.3-1). The current goal is to integrate all unmarked adults into the broodstock due to lack of passage and the limited number of unmarked natural-origin adults returning to the Dexter facility. However, relatively few natural-origin fish return to the Dexter Facility and those that do are currently incorporated into the broodstock.

The Recovery Plan provides recommendations regarding take of unmarked fish for use in the broodstock with the intent to ensure adequate escapement and full seeding of currently accessible spawning areas. For the Middle Fork Willamette, the guideline is as follows:

Protect/maintain local adaptation by maximizing natural spawning opportunities and new targets for integration:

- Integration is desirable to maintain HMP run characteristics
- Integrate appropriate number of natural-origin fish collected at the Dexter Facility. The long-term target rate will be an average of 5% natural-origin adults once natural-origin populations are restored. At present, all natural origin fish are integrated.

Integration targets may be adapted over time to ensure the hatchery program can meet goals for mitigation and conservation/reintroduction needs, as guided by RM&E.

Table 6.2.3-1. Composition of spring Chinook salmon without fin clips that were spawned at Willamette Hatchery, based on the presence or absence of thermal marks in otoliths, 2002–2013. Sources: Kenaston et al. 2009, Cannon et al. 2010, Cannon et al 2011, and C. Sharpe, unpublished data. Wild fish are likely dominated by a mixture of adults resulting from above project spawning, as well as strays from Fall Creek.

	Unclipped			
Year	Wild	Hatchery	Fin-clipped hatchery	Percent Wild in Brood (pNOB)
2002	5	53	1,602	0.3
2003	5	59	1,465	0.3
2004	16	28	1,807	0.9
2005	19	24	1,497	1.2
2006	45	55	1,608	2.6
2007	161	67	1,364	10.1
2008	105	81	1,314	7.0
2009	61	57	1,807	3.2
2010	15	41	1,488	1.0
2011	29	45	1,437	2.0
2012	34	21	1,196	2.7
2013	45	14	2,036	2.2

6.2.4) Genetic or ecological differences

Meaningful genetic or ecological comparisons between hatchery and natural origin fish from the Middle Fork Willamette River have been limited by low abundance of natural origin Chinook in this subbasin. Nevertheless, Johnson and Friesen (2012) found that mean observed heterozygosity at 13 microsatellite markers was higher for the Willamette hatchery population (82%; n = 144) than for natural origin Chinook (62%; n = 12) sampled in 2011. The small sample size of natural origin Chinook in their study precluded allele frequency-based genetic assessment of Middle Fork Willamette spring Chinook salmon.

6.2.5) Reasons for choosing

Middle Fork Willamette River spring Chinook salmon were chosen as the optimal brood source for this program, because they were indigenous to the basin and therefore believed to be the best locally adapted stock available for hatchery production.

6.3) Risk aversion measures to minimize adverse effects to listed natural fish due to broodstock selection practices

The use of Middle Fork Willamette stock (random selection, egg takes throughout run) will reduce adverse genetic or ecological effects and maximize the genetic diversity of the hatchery stock. Currently, any natural-origin fish arriving at Dexter Trap is

incorporated into the broodstock. Disposition of adults in excess to broodstock needs is outlined in Section 7.5, including outplanting efforts to evaluate the potential for natural production upstream of Dexter, Lookout Point, and Hills Creek dams.

SECTION 7. BROODSTOCK COLLECTION

7.1) Life stage to be collected

Returning adults (and jacks) are collected and spawned for broodstock.

7.2) Collection or sampling design

Adults used for broodstock purposes are collected from the Dexter Ponds Fish Facility. Adults are collected in representative numbers throughout most of the run from as early as the 3rd week in May to October. The trap is generally operated once a week during this period, although there are weeks when it is operated more often depending on how many the fish enter the trap and the availability of staff. Fish returning to the trap prior to its opening in late May to mid-June appear to hold in the Middle Fork Willamette River downstream of Dexter Dam and it is likely that sufficient mixing occurs to obtain a broodstock collection that is representative of the entire run. In some years, trap and temperature limitations may result in an overrepresentation of the middle of the run. Fish returning to the collection facility are mixed and randomly selected for spawning, and an appropriate number of natural-origin fish may be incorporated into the broodstock (see Section 6.2.3). Adults arriving at Dexter Ponds in excess of broodstock needs will be outplanted in accordance with Section 15, the spring Chinook salmon outplanting protocols addendum. NMFS and ODFW are also working in collaboration with WATER to complete a reintroduction plan for spring Chinook salmon in the Middle Fork Willamette.

7.3) Identity

(a) Methods for identifying target populations (if more than one population may be present).

Only one Chinook salmon population is present in the Middle Fork Willamette River subbasin.

(b) Methods for identifying hatchery origin fish from naturally spawned fish.

Currently, the goal is for all hatchery-origin spring Chinook salmon to be externally marked with an adipose fin clip and marked with an otolith marker. The fish at Willamette Hatchery are adipose fin-clipped using an automatic marking trailer, and a manual trailer, which is highly effective; nevertheless a small percentage (usually less than 5 percent) are mismarked or the adipose fin regenerates. In the past, approximately

26 and 5 percent of fall and spring release groups, respectively, were wire tagged in addition to receiving the adipose and otolith marks. The internal wire tags and otolith mark allows verification of hatchery origin broodstock to compensate for error associated with adipose regeneration in some hatchery-origin fish (Table 6.2.3-1). Non-fin-clipped fish returning to the hatchery are checked for the presence of a wire tag. All three marks allow hatchery-origin fish to be distinguished from naturally spawned fish. The use of "real-time" genetic identification may be considered as a means of distinguishing unmarked hatchery adults from natural-origin adults.

7.4) Proposed number to be collected

7.4.1) Program goal

The Middle Fork Willamette spring Chinook salmon program goal is to have a broodstock spawning population of up to 3,000 adults (to account for high PSM loss associated with poor broodstock holding conditions), including 50% males and 50% females, with a 1:1 male-to-female spawning ratio depending upon the run size (IHOT 1994). Between 1993 and 2008, the spawning population for Middle Fork Willamette stock spring Chinook salmon (including those transferred to the McKenzie Hatchery in 1993-1999) ranged from 1,088 to 2,336 fish (mean 1,690 fish) with a male to female proportion of 0.38 to 1.05 (mean 0.76; see Tables 6.2.1-1 and 6.2.1-2).

7.4.2) Broodstock collection levels in recent years

Broodstock collection levels from the Dexter Ponds Fish Facility are described in Tables 6.2.1-1 and 6.2.1-2. The adult broodstock collection is higher than expected due to high PSM of broodstock prior to spawning at Willamette Hatchery. The level of natural-origin fish integrated into the hatchery broodstock is presented in Table 6.2.3-1.

7.5) Disposition of surplus of hatchery-origin fish

Surplus fish are disposed of in accordance with ODFW's Fish Hatchery Management Policy (FHMP) (OAR 635-007-0542 through 0548) as modified to meet actions identified in the Willamette BiOp, and Recovery Plan recommendations consistent with survival and recovery of the ESU. Options for use of surplus broodstock include, in priority order:

1. provide fish for tribal ceremonial and subsistence use;
2. outplanting above Hills Creek and Lookout Point dams to provide nutrient enrichment, and support RM&E for passage studies;
3. provide for experimental, scientific or educational uses identified in conservation plans, management plans or other Department agreements;
4. provide for carcass sales to buyers to generate revenue for hatchery operations, as authorized in FHMP;

5. place carcasses in natural spawning and rearing areas to enhance nutrient recycling, consistent with ODEQ requirements, management plans and pathology constraints identified in OAR 635-007-0549;
6. provide fish to charitable food share programs benefiting needy Oregonians;
7. provide fish for animal feed to animal rehabilitation shelters, zoos, or other such operations; and
8. dispose of fish in a landfill or at a rendering plant.

The ODFW Fish Division may approve additional uses or deviations from the stated order of preference to satisfy agreements with management partners, respond to unique situations or respond to unforeseen circumstances. Disposition priorities for outplanting to support passage studies and research are coordinated collaboratively through WATER, to support ongoing mitigation and meet ESA conservation goals consistent with survival and recovery of the ESU. They are documented in the annual Willamette Fish Operations Plan (see 2008 BiOp). ODFW and NMFS are proposing to complete a fish reintroduction plan for the Middle Fork Willamette that will guide outplanting and reintroduction to complement passage actions at the federal hydroelectric-flood control projects.

Since 1993, surplus spring Chinook adults returning to Dexter Ponds have been recycled downstream or outplanted to the Middle Fork Willamette River above Hills Creek Reservoir, the North Fork of the Middle Fork Willamette River, and Salt Creek. Fish are outplanted as part of an ongoing effort to determine the feasibility of re-establishing self-sustaining natural production in the upper basin. A risk/benefit analysis of moving marked and unmarked spring Chinook salmon above USACE flood control projects in the Willamette Valley is described by Ziller et al. (2002). Surplus adults will be outplanted above the dams to help increase naturally spawning populations (see Section 15). In addition, spawned fish carcasses are distributed within the upper Middle Fork Willamette system for nutrient enrichment purposes. Disposition of hatchery-origin adults in excess to broodstock needs is developed annually.

7.6) Fish transportation and holding methods

Refer to sections 5.1 and 5.3 for a description of broodstock handling and holding procedures.

See sections 5.2 and 5.3, for a description of the transport tanks and holding containers that are used. During the collection season CO_2 is used when spring Chinook salmon are to be liberated within a legal fishery, used for sales, food share, or tribal needs. Aqui-SE has been approved for use and is also being used however it is not used when steelhead are present due to recycling to the fishery. To reduce stress associated with transport and protect the mucous layer of transported fish, all tanks transporting fish destined for outplanting will be treated with Nov-Aqua (per manufacturer's recommended dosage).

Fish transport and holding methods for outplanting will be documented in a future plan

developed to guide reintroduction above the project and the annual Willamette Fish Operations Plan (see 2008 BiOp).

7.7) Fish health maintenance and sanitation procedures

Integrated Hatchery Operations Team (IHOT), PNFHPC, and ODFW's FHMP are followed for broodstock fish health inspection and transfer of eggs or adults. Broodstock and eggs receive regular treatments with formalin or hydrogen peroxide to prevent and control fungus outbreaks. In addition, broodstock is injected with antibiotics. If mortality is present, it is removed daily. Pathology checks health status monthly, and high water quality is maintained. The equipment is disinfected with an iodine solution to prevent disease outbreaks. Typical medications used include anesthetics (i.e., MS-222, CO_2), salve (i.e., iodine solution), and antibiotics (i.e., erythromycin, oxytetracycline).

Adult Chinook salmon held for broodstock at Willamette Hatchery must be regularly treated due to the high PSM associated with overcrowding of fish in the inadequate broodstock pond.

7.8) Disposition of carcasses

Spawned carcasses and fish killed for CWT recovery are used for stream enrichment. Some carcasses may be sent to the landfill.

7.9) Risk aversion measures to minimize adverse effects to listed natural fish due to broodstock collection

Spring Chinook salmon broodstock collection at Dexter Ponds occurs throughout most of the run from mid-June to October, and it is possible that fish arriving at Dexter prior to mid-June hold and subsequently mix with fish arriving once the trap is opened. Collection of brood fish is random, with sex ratio and timing representative of the run during trap operation from mid-June through October.

Due to the relatively low numbers of natural-origin returns in the Middle Fork Willamette River (Table 1.12-1), all natural-origin fish entering Dexter Trap are currently incorporated into the broodstock.

The risk of adverse ecological or genetic effects to listed fish will be minimized by hatchery management practices described in this document and the FHMP (see Section 3.2). In addition, hatchery reform measures identified in Section 1.8.1 will be followed.

SECTION 8. MATING

8.1) Selection method

Fish are selected and paired at random in order to minimize selective pressures from hatchery practices. Once collected for brood, unmarked and marked fish are spawned randomly, without respect to origin. Broodstock collection endeavors represent the genetic variability of the stock by taking an unbiased, representative sample with respect to run timing, size, sex, age, and other phenotypic traits identified as important for long-term fitness (IHOT 1994). Only Middle Fork Willamette spring Chinook salmon are used for broodstock. Recent science suggests that non-random mating may be preferable in some instances to mimic mate selection in natural-origin fish. Alternative mating strategies will be reviewed and implemented based on best available science to achieve program objectives.

8.2) Males

The typical spawning sex ratio for this program is a 1:1 male-to-female ratio. However, rarely, a 2:1 male-to-female ratio is used if there is a shortage of males. Precocious males (i.e. jacks) are generally not used, because they cannot be located in the current holding pond. Males are not re-used.

8.3) Fertilization

Broodstock is humanely killed and bled prior to spawning. Kidney tissue is sampled to test for BKD. All spawning containers are disinfected with iodophor between uses or bags are used in the buckets. Eggs from one female are fertilized with sperm from one male. Males are not re-used. Eggs from two females are placed in each Heath tray separated by a divider. Fertilized eggs are subjected to a 10-minute iodophor bath for disinfection in the Heath trays. Trays and egg batches are individually marked so eggs can be discarded if BKD tests are positive.

If the hatchery reduces the number of eggs retained below the amount of green eggs taken, a proportional amount of each male/female cross is culled so that the gene pool of the brood is representative of the parental stock. Exceptions may occur if there is a high degree of disease or epidemics associated with certain parents. If this occurs, offspring of diseased parents may be culled in order to maximize long-term survival of the brood.

In addition to the Department-wide fish disease control and disease prevention programs, Willamette Hatchery and Dexter Ponds Fish Facility monitor fish health, therapeutic and prophylactic treatments, and sanitation activities (IHOT 1994).

8.4) Cryopreserved gametes

No cryopreserved gametes are used for the Willamette spring Chinook salmon (stock 22) program.

8.5) Risk aversion measures to minimize adverse effects to listed natural fish due to

mating

The Middle Fork Willamette spring Chinook salmon hatchery program uses a random spawning selection and a 1:1 male-to-female spawning ratio to avoid intentional selection of physical characteristics such as run-timing or size.

SECTION 9. INCUBATION AND REARING

RM&E identified in Table 1.9-1 recommends performance targets for hatchery rearing and release of hatchery fish. It is anticipated that these benchmarks will be utilized in 2013 and beyond.

9.1) Incubation

9.1.1) Number of eggs taken and survival rates to eye-up and/or ponding

Egg take and survival rates are provided in Table 9.1.1-1.

Table 9.1.1-1. Annual egg take and survival rates to smolt at Willamette Hatchery, 1990-2015.

Year	Egg Take	Bacterial Kidney Disease (BKD) Destroyed	Green-Eyed Survival (%)	Eyed-Ponding Survival (%)	Fry-Fingerling Survival (%)	Fingerling-Smolt Survival (%)	Overall Green Egg - Smolt Survival
1990[1]	3,592,000		84.9	93.6			
1991[1]	5,810,000		82.8	73.7			
1992[1]	2,871,000		87.7	94.8			
1993	3,736,000	625,500	82.2	97.1	96.6	98.8	76.2
1994	3,065,000	18,150	86.7	96.0	97.7	93.0	75.6
1995	5,350,000	616,500	94.0	98.1	95.1	99.5	87.3
1996	5,437,000	433,500	91.6	98.4	97.3	98.8	86.6
1997	6,056,000	1,152,000	94.1	99.2	98.1	98.8	90.5
1998	2,895,000	99,000	96.9	96.9	97.7	99.1	90.9
1999	3,256,000	99,000	97.2	98.3	97.8	97.5	91.1
2000	2,632,000	86,000	93.6	98.4	98.0	96.3	86.9
2001	2,448,000	60,000	89.6	94.4	96.7	97.1	79.4
2002	3,342,000	121,000	92.1	98.2	97.4	95.7	84.3
2003	3,301,000	34,000	89.5	97.5	97.6	95.3	81.2
2004	3,264,000	38,000	94.1	98.4	97.9	98.2	89.0
2005	3,073,000	72,000	92.0	98.3	93.6	98.7	83.5
2006	3,280,000	80,000	93.4	98.9	98.3	98.5	89.4
2007	3,223,000	100,000	84.0	95.8	97.5	99.2	77.8
2008	3,068,000	160,000	88.9	98.5	98.0	98.0	84.1
2009	2,717,000	140,000	93.7	98.5	98.1	98.7	89.4
2010	2,805,000	112,000	94.7	93.4	97.3	92.3	79.4
2011	3,019,000	152,000	96.0	98.4	96.5	95.3	86.9
2012	2,213,000	24,000	93.3	98.0	98.9	99.3	89.8
2013	3,281,188	292,000	72.9	94.8	98.2	99.6	67.6
2014	2,414,394	129,000	77.6	96.5	96.4	98.4	71.0
2015	1,703,087	80,000	78.0	90.8	NA	NA	NA
Average	3,378,910	205,376	89.3	96.0	97.3	97.6	81.3

[1] No eggs were BKD destroyed in the 1990-1992 brood years.

9.1.2) Cause for and disposition of surplus egg takes

This program takes additional eggs to ensure enough BKD-negative eggs for production is achieved. Any excess eggs or BKD culled eggs are disinfected and sent to the landfill.

9.1.3) Loading densities applied during incubation

Standard loading per Heath tray starts at about 4,500 eggs or average female fecundity. All females are kept separate until pathology can confirm the presence, or absence, of BKD. After shocking and picking, 8,000 eggs are machine-counted into each incubator tray with a flow of 5 gpm.

9.1.4) Incubation conditions

Incubation takes place at Willamette Hatchery. Water flows are monitored visually and low water alarms on each stack of incubators. Water to the incubator trays is monitored for temperature with the use of a seven-day thermograph. The use of well water aids in controlling and alleviating silt problems associated with turbid water conditions in Salmon Creek. Well water is used to otolith mark all the fish. The river water varies from 30°F to 45°F, while well water remains at 54 °F. Dissolved oxygen levels are not routinely monitored. Fish health is monitored daily by the crew and monthly by one of our fish health specialists. If any problems arise, appropriate actions, including drug or chemical treatments are applied.

9.1.5) Ponding

Fry are typically ponded in late December thru February, when 80-90 percent of observed fry have yolk-sac material that is 80-90 percent utilized and contained within body cavity. Size at ponding averages 1,400 fish per lb. Fry are ponded at approximately 1,700 Temperature Units (TUs). Ponding of fry takes place at Willamette Hatchery.

9.1.6) Fish health maintenance and monitoring

All equipment is disinfected with an iodine solution to prevent disease outbreaks and pathogen transmission between stocks on-site. All ponds are pressure-washed and disinfected with iodine solution and allowed to air dry prior to each use.

Fish health is monitored daily by the crew and monthly by a fish health specialist. If any problems arise, appropriate actions, including drug or chemical treatments, will be applied.

The Willamette Hatchery is operated in compliance with ODFW's FHMP and IHOT fish health guidelines.

9.1.7) Risk aversion measures to minimize adverse effects to listed fish during incubation

The protocols listed above to maintain survival across all stages of incubation are followed for eggs of hatchery and natural-origin fish. Maximum and unbiased survival is the goal for both hatchery and natural-origin stock. Consequently, all eggs are handled in a manner to reduce any adverse effects, including differential survival (as it pertains to selecting for traits), altered water quality, etc. All progeny of unmarked parents are retained for release within the Middle Fork Willamette River basin (i.e., not transferred or

destroyed, unless due to positive BKD test results).

9.2) Rearing

9.2.1) Survival rate data

Survival rate data by life stage is provided in Table 9.1.1-1.

9.2.2) Density and loading criteria

Density and loading levels differ by size of fish, size of pond, and time of year, or water temperature. Fingerling densities are generally below 2.5 lbs/gpm in a 20 ft x 80 ft raceway. Maximum smolt density is 4.4 lbs/gpm, although actual densities rarely reach this level.

9.2.3) Fish rearing conditions

At Willamette Hatchery, ponds are monitored daily by hatchery staff. The staff watches for signs of stress, disease, water quality, and general fish health behavior. Pond mortality is picked and recorded daily. Water quality is monitored under the prescribed 300j general NPDES permit. From April through September, water temperatures are usually in the mid-40s to mid-60s F, and from October through March, water temperatures are usually in the mid-30s to mid-40s F. Ponds are cleaned weekly.

Willamette stock springs Chinook salmon destined for release into the Mid Fk are transferred to Dexter Ponds as fingerlings at 100 fish/lb in June and as pre-smolts at 25 fish/lb in November. Fish are then reared at Dexter Ponds to the smolt stage until release in November or February/March/April. The Dexter Ponds Fish Facility has four raceways and one asphalt pond used for rearing. The raceways measure 135 ft by 18 ft by 6 ft, with flows of approximately 5,000 gpm. The asphalt pond is 172 ft by 64 ft by 7.5 ft and uses a flow of approximately 2,300 gpm. Water quality is monitored under the prescribed 300j general NPDES permit.

Willamette stock spring Chinook salmon destined for the Coast Fork Willamette River are reared until smolts at Willamette Hatchery. They are then released into multiple release locations in the Coast Fork of the Willamette basin.

9.2.4) Biweekly or monthly fish growth information

Growth rates are programmed for a specific target weight at release. Table 9.2.4-1 reports target and actual growth rates for Middle Fork Willamette spring Chinook salmon. Fish size is sampled monthly; data are reported on the HMIS database and monthly ponded fish reports. Length frequency data are collected at the time of release.

Table 9.2.4-1. Target and actual (mean) growth rates of Middle Fork Willamette spring Chinook salmon (fish/pound) fall and spring release groups. Willamette stock spring Chinook salmon are transferred to Dexter Ponds in June at 100 fish/lb and reared at Dexter Ponds until release in November or February/March. Actual growth rate data are based on 1998-2008 broods.

	Target Fish Size (number of fish per pound)		Actual Fish Size (number of fish per pound)	
Rearing Period	**Spring Release**	**Fall Release**	**Spring Release**	**Fall Release**
Jan	1,275	1,275	1,150	1,150
Feb	900	900	734	734
Mar	500	500	371	371
Apr	250	250	226	226
May	100	100	120	120
Jun	75	75	94	75
Jul	40	25	42	22
Aug	20	12	28	12
Sep	14	10	21	10
Oct	11.5	8	18	8
Nov	10.5	released	15	
Dec	10		14	
Jan	9.5		12	
Feb	9 (released)		10	
Mar	9 (released)		9	

9.2.5) Monthly fish growth rate

See Table 9.2.4-1. Energy reserve data is not collected.

9.2.6) Feeding protocol

Feeding rates are followed such that fish size at release is within 10 percent of program goal each year. When fish are initially started, they are fed on demand, 6-10 times per day (Table 9.2.6-1). At 500 fish per lb, they may be put on a schedule and fed a set amount per day. Fish are fed multiple times per day, if need to achieve their daily amounts. High quality commercially available fish feeds are used according to manufacturer recommendations.

Table 9.2.6-1. Feed sizes.

Rearing Period	Food Size	Application Schedule (#feedings/day)
Jan-Mar	#0	6-10
Mar-Apr	#1	6-10
Apr-May	#2	6-10
May-Jul	1.2 mm	3-5
Jul-Sep	2.0 mm	3-5
Sep-Release	2.5 mm	3-5

9.2.7) Fish health monitoring, disease treatment, and sanitation procedures

Fish health is monitored on a routine basis at Willamette Hatchery and the Dexter Ponds Fish Facility. Rearing ponds are checked daily for mortality and abnormal fish behavior, and appropriate remedial and preventative measures (e.g., drug or chemical treatments) are taken, as needed. In addition, a routine examination of both healthy and clinically diseased fish is conducted on a monthly basis. Within six weeks prior to any juvenile releases or transfers, a fish health inspection is performed to minimize the likelihood of pathogen transfers to other locations.

ODFW's FHMP and IHOT fish health guidelines are followed to prevent pathogen transmission between and within stocks held at Willamette Hatchery and Dexter Ponds. Specifically, treatments of juvenile fish include oral administration of antibiotics, static formalin treatments, and the use of therapeutic agents that are approved by the FDA, prescribed by a veterinarian, or allowed under an Investigational New Animal Drug Permit.

Disinfectants are routinely used at the rearing facilities. Iodophor treatments are applied to all equipment between uses in different lots or rearing ponds/containers. Rearing units and transport trucks are also routinely sanitized through the use of disinfectants or by cleaning and drying for an extended time period. In addition, all mortalities are promptly removed to minimize disease risk.

9.2.8) Smolt development indices

Physical observation of fish size, coloration, and behavior are the indices used for smoltification, and no ATPase enzyme activities are measured.

9.2.9) Use of "natural" rearing methods

Fish are reared under natural water temperatures. At this time, no other "natural" rearing methods have been implemented at Willamette Hatchery.

9.2.10) Risk aversion measures to minimize adverse effects to listed fish under

propagation

Fish are reared to smolt size and released at a time and manner resulting in prompt outmigration to minimize interaction with natural-origin populations.

SECTION 10. RELEASE

10.1) Proposed fish release levels

The majority of the Middle Fork Willamette spring Chinook salmon production is released into the Middle Fork Willamette River Basin. Approximately 1.7 million smolts are released at Dexter Ponds at a target size of 8-12 fish/lb, depending on release timing (Table 1.11.2-1). Approximately 267,000 smolts are released into the Coast Fork Willamette River basin at a target size of 9.5 fish/lb. The remaining production includes 100,000 fingerlings released into Hills Creek Reservoir and 10,000 unfed fry at various STEP locations within the Willamette River Basin (Table 1.11.2-1).

10.2) Specific locations of proposed releases

In the past, smolt release locations within the Middle Fork Willamette River subbasin have also included the Fall Creek, Hills Creek, and Lookout Point reservoirs, and Salmon Creek. Outside of the Middle Fork Willamette subbasin, past releases were made in the Molalla, South Fork McKenzie, and South Fork Klaskanine rivers. Refer to Section 10.3 for additional details regarding historical release information.

Stream, river, or watercourse:	Middle Fork Willamette River, ODFW Waterbody Code 0200300000
Release point:	Dexter Facility, Rkm 28
Major watershed:	Middle Fork Willamette River
Basin or Region:	Willamette River Basin

Stream, river, or watercourse:	Hills Creek Reservoir, ODFW Waterbody Code 0270700000
Release points:	Boat ramps (up to 3)
Major watershed:	Middle Fork Willamette River
Basin or Region:	Willamette River Basin

Stream, river, or watercourse:	Coast Fork Willamette River, ODFW Waterbody Code 0200200000
Release points:	Various, including access at River Drive and Hwy 99 north of Cottage Grove
Major watershed:	Coast Fork Willamette River

Basin or Region:	Willamette River Basin
Stream, river, or watercourse:	Row River, ODFW Waterbody Code 0200210000
Release point:	Various, including base of Dorena Dam and at East Regional Park
Major watershed:	Coast Fork Willamette River
Basin or Region:	Willamette River Basin
Stream, river, or watercourse:	Mosby Creek, ODFW Waterbody Code 0200211000
Release point:	Various, including upper reach on Weyerhaeuser property and from Blue Mountain Road
Major watershed:	Coast Fork Willamette River (Row)
Basin or Region:	Willamette River Basin

10.3) Actual numbers and sizes of fish released by age class through the program

Actual numbers and sizes of fish released since the 1990 brood year for the Middle Fork Willamette Spring Chinook Salmon Hatchery Program are reported in Tables 10.3-1 and 10.3-2.

Middle Fork Willamette River

Table 10.3-1 shows the history of spring Chinook salmon releases into the Middle Fork Willamette River subbasin, since the 1990 brood year. From 1991 to 1998, subyearling Chinook salmon were released into reservoirs of the mainstem Middle Fork Willamette River: Fall Creek Reservoir, Hills Creek Reservoir, and Lookout Point Reservoir. During the summers of 1996 and 1997, subyearling Chinook salmon were released into Salmon Creek, a tributary to the Middle Fork Willamette River; these releases have since been terminated. Until 2007, smolts were also released into Fall Creek Reservoir. Currently, all smolt releases in the Middle Fork Willamette River subbasin are released at Dexter Ponds. Smolts are also released into the Coast Fork Willamette River basin.

Table 10.3-1. Spring Chinook salmon releases into the Middle Fork Willamette River basin, since 1990 (brood years 1990 to 2006). All data extrapolated from ODFW HMIS database.

Release Location	Brood Year	Release Date	# Fish Released	# lbs. Released	Fish/ lb.
Fall Creek Reservoir	1990	5/21-5/31/91	953,154	4,913	194.0
	1991	5/11/92	1,000,632	6,804	147.1
	1992	5/18/93	800,450	3,343	239.4
	1993	5/17/94	652,210	3,793	172.0
	1994	5/16/95	329,951	1,470	224.5
		5/17/95	591,316	2,674	221.1
	1995	5/7-5/8/96	1,000,460	4,915	203.6
	1996	5/12-5/14/97	1,000,595	4,029	248.3
	1997	2/3/99	90,722	9,969	9.1
	1998	3/1/00	90,675	10,075	9.0
	1999	7/3/00	56,580	690	82.0
		2/28/01	71,297	8,802	8.1
	2000	03/05/02	83,700	9,000	9.3
	2001	02/26/03	94,176	10,270	9.2
	2002	03/03/04	93,312	9,720	9.6
	2003	03/02/05	92,250	9,455	9.8
	2004	03/01/06	92,416	9,460	9.8
	2005	02/28/07	95,041	8,205	11.6
	2008	11/21-27/09	6,250	780	8.0
		1/9-23/10	3,750	469	8.0
Hills Creek Reservoir	1991	5/11/92	49,930	375	133.1
	1994	5/17/95	50,142	183	274.0
	1995	6/21/96	50,160	528	95.0
	2002	06/26/03	51,800	400	129.5
	2004	09/15/05	45,885	1,480	31.0
	2006	07/09/07	99,990	990	101.0
	2007	6/19/08	30,086	200	150.4
	2008	6/10/09	171,234	1,057	162

Release Location	Brood Year	Release Date	# Fish Released	# lbs. Released	Fish/ lb.
		1/29/10	26.798	3,573	7.5
		2/2-3/10	54,549	7,273	7.5
	2009	6/15-29/10	100,964	688	146.8
	2010	6/11/11	80,744	673	120
Lookout Point Reservoir	1991	5/11/92	249,793	1,055	236.8
	1993	5/17/94	598,466	4,178	143.2
	1994	6/19/95	20,642	175	118.0
	1995	5/7/96	250,240	1,430	175.0
	1996	5/14-6/27/97	415,830	11,800	35.2
	1997	5/4/98	247,650	1,905	130.0
	2000	10/18/01	36,244	1,237	29.3
	2008	6/18/09	311,600	2,000	155.8
	2010	5/19/11	105,840	588	180
		6/10/11	100,800	800	126
Middle Fork Willamette River	1990	8/20/91	51,929	2,610	19.9
		11/14/91	356,657	50,238	7.1
		3/4/92	284,423	35,114	8.1
		3/2-3/3/92	775,214	60,963	12.7
	1991	3/15-3/16/93	683,278	62,510	10.9
		8/19/92	49,938	2,378	21.0
		11/9/92	265,326	48,241	5.5
		3/15/93	382,024	44,944	8.5
	1992	11/7/93	278,005	42,770	6.5
		2/28/94	308,727	40,094	7.7
			694,973	42,022	16.5
	1993	2/8-3/9/95	1,187,412	133,546	8.9
		7/28-7/29/94	190,106	3,571	53.2
	1994	3/5-3/19/96	541,025	64,949	8.3
		2/7/96	776,465	96,083	8.1
		2/15/96	69,539	8,585	8.1

Release Location	Brood Year	Release Date	# Fish Released	# lbs. Released	Fish/ lb.
	1995	6/21/96	191,279	1,993	96.0
		2/6-2/28/97	151,248	126,033	1.2
	1996	2/5-3/3/98	552,403	61,177	9.0
		5/13/97	600,440	1,195	191.8
		11/3/97	253,303	32,721	7.7
	1997	6/26-6/30/98	252,041	3,991	63.2
		11/3/98	251,210	30,692	8.2
		2/5-3/5/99	517,427	57,711	9.0
	1998	6/30/99	188,961	2,730	69.2
		11/1/99	252,380	31,160	8.1
		1/26/00	448,376	45,752	9.8
		3/6/00	658,097	77,021	8.5
	1999	11/1/00	252,353	31,717	8.0
		2/5/01	545,578	59,302	9.2
		3/1/01	660,307	69,519	9.5
		7/3/00	250,170	2,805	89.2
	2000	10/19/01	311,603	34,242	9.1
		2/1/02	529,151	62,253	8.5
		03/05/02	420,340	50,674	8.3
		03/19/02	221,735	20,550	10.8
	2001	11/01/02	318,306	42,718	7.5
		01/30/03	550,014	57,714	9.5
		03/03/03	658,047	73,415	9.0
	2002	11/03/03	316,777	40,929	7.7
		02/05/04	550,674	67,817	8.1
		02/11/04	213,287	22,287	9.6
		03/04/04	421,849	47,439	8.9
	2003	11/0104	311,571	41,677	7.4
		02/04/05	537,418	51,134	10.5
		02/25/05	220,765	21,207	10.4
		03/07/05	415,525	48,759	8.5
	2004	11/01/05	322,847	40,868	7.9

Release Location	Brood Year	Release Date	# Fish Released	# lbs. Released	Fish/ lb.
		02/01/06	546,076	48,888	11.2
		02/23/06	242,316	29,443	8.2
		03/08/06	488,922	48,503	10.1
	2005	11/01/06	323,675	41,443	7.8
		01/29/07	541,562	45,395	11.9
		03/01/07	622,017	64,766	9.6
	2006	11/01/07	317,029	42,307	7.5
		2/1/08	542,487	53,029	10.2
		3/5/08	764,476	78,568	9.7
	2007	11/3/08	155,738	20,989	7.4
		11/18/08	122,337	18,726	6.5
		2/2/09	648,414	63,014	10.3
		3/2/09	717,590	78,467	9.1
	2008	11/3/09	324,204	42,501	7.6
		1/28/10	684,014	58,363	10.0
		3/10/10	378,389	25,811	14.7
		3/10/10	243,053	28,262	8.6
		4/2/10	240,200	25,499	9.4
	2009	11/1/10	314,450	39,683	7.9
		1/28/11	331,983	28,768	11.5
		1/28/11	207,486	21,086	9.8
		2/11/11	654,437	73,615	8.9
		4/13/11	236,542	27,927	8.5
	2010	5/11/11	5,940	33	180
		11/1/11	315,787	40,410	7.8
		2/3/12	315,787	6,199	11.6
		3/6/12	359,607	24,294	14.7
		3/6/12	208,236	27,802	7.5
		4/17/12	241,040	29,217	8.3
Salmon Creek (below hatchery)	1994	6/19/95	16,402	139	118.0

Release Location	Brood Year	Release Date	# Fish Released	# lbs. Released	Fish/ lb.
	1996	6/27/97	100,738	988	102.0
Dexter Res	2008	11/11-24/09	5,138	641	8.0
		12/1-15/09	5,058	655	7.7
		1/5-26/10	7,500	936	8.0

Out-of-Basin Transfers

Currently, there are no out of basin transfers (besides the small STEP fry releases) from Willamette Fish Hatchery except inter-hatchery transfers for incubation or rearing.

Salmon and Trout Enhancement Program (STEP) Releases

Approximately 10,000 unfed Middle Fork Willamette spring Chinook salmon fry are released into the Willamette River basin each year as part of the STEP program for educational purposes. Actual release numbers and release locations are provided in Table 10.3-4. Release locations are typically within the Middle Fork Willamette River subbasin, but also include other Willamette subbasins. Alton Baker Canal is in the mainstem Willamette subbasin just downstream from the confluence of the Coast Fork and Middle Fork Willamette rivers.

Table 10.3-2. Numbers of unfed fry STEP releases by release location for brood years 1997-2008.

Brood Year	Alton Baker Canal	Willamette R & Tributaries	Coast Fork Willamette R	Middle Fork Willamette R	Lost Creek	Total
2000	10,000					10,000
2002	6,820		100	80		7,000
2003	6,895		80	125		7,100
2004	10,581			169		10,750
2005	6,798			102		6,900
2006	8,300					8,300
2007	8,300					8,300
2008[1]	8,925			56,000		64,925
2009	8,800					8,800
2010	5,800					5,800
2011	6,779	210[2]	225		112	7,326
2012	10,368	674[2]	605			11,647

[1] In 2008, eyed eggs, rather than unfed fry, were released.
[2] Long Tom River

10.4) Actual dates of release and description of release protocols

Smolt release dates are described above in Tables 10.3-1 and 10.3-2.

Fish are released from Dexter in early February, March, April and November. Actual release dates are variable to take advantage of freshets as well as considerations of fish size and pathology recommendations. Fish are volitionally released during high flow events when available to increase the likelihood of rapid downstream migrations and to decrease the likelihood of interactions with wild fish.

Sub-yearlings are released in Hills Creek and Lookout Point Reservoirs in June and November, respectively. Research fish have been released into Hills Creek Reservoir and Lookout Point Reservoir in April and May.

As part of the STEP program, approximately 12,000 eyed eggs are transferred to various classrooms in October. After a brief classroom rearing period, approximately 10,000 unfed fry are released in December into various locations throughout the Willamette River basin. The majority of the STEP releases have been localized to Alton Baker Park, on the mainstem Willamette in Eugene, Oregon (Table 10.3-2).

10.5) Fish transportation procedures

The Willamette Hatchery and Dexter Ponds Fish Facility utilize four liberation trucks, with capacities varying from 250 to 3,000 gallons. These trucks are equipped with oxygen and aeration pumps. Integrated Hatchery Operations Team (IHOT) guidelines for

transportation are followed for transport of fish from Willamette Hatchery to other locations, such as Dexter Ponds.

10.6) Acclimation procedures

Fish are reared at the Willamette Hatchery to the fingerling and pre-smolt stages before being transferred to Dexter Ponds in June and November, respectively. These fish are then reared to the smolt stage at the Dexter Ponds facility and volitionally released November or February/March and April.

10.7) Marking

All juvenile spring Chinook salmon released for this program are externally marked with an adipose fin clip to identify hatchery fish among all returning adults. Fish are adipose fin-clipped between May and July each year using both an automatic marking trailer and a manual trailer. All hatchery-reared smolts are also marked with an otolith mark, which distinguishes them from naturally produced spring Chinook salmon, as a check against poor or missed marks and to allow for the identification of system strays. All spring Chinook salmon smolt production will continue to be adipose fin-clipped and otolith-marked.

Of those spring Chinook salmon smolts reared at Dexter Pond and released directly into the Middle Fork Willamette River, 26 and 5 percent of the fall and spring release groups, respectively, receive a CWT in addition to the adipose clip and otolith mark. It is currently expected that a minimum of 50,000 smolts per brood year will continue to be coded wire-tagged (USACE 2007, NMFS 2008).

10.8) Disposition plans for surplus juvenile fish

Juvenile spring Chinook salmon production for the Middle Willamette is within amounts listed in the 2012 Cooperative Agreement. In general, OAR 635-007-0545 directs disposition of surplus hatchery juveniles:

Best management practices may dictate that, based on known and anticipated disease or predation losses, fish in excess of planned production goals may be reared well past the initial ponding date. Hatchery managers, in coordination with hatchery coordinators and Fish Division staff, will establish these numbers for each facility based on survival estimates compiled by ODFW Fish Health section. Surpluses held to meet production goals should be disposed of at the earliest point in the rearing cycle. At the point in the rearing cycle that the risk of these known hazards is past, these surpluses should be removed from the production cycle. Consistent with subsection (7), disposition of surplus fish from harvest hatchery programs shall be determined by Regional and Fish Division staff on an individual basis, with emphasis on minimizing conservation risks while providing angling opportunities where possible (e.g., stocked in closed water bodies).

10.9) Fish health certification procedures

The fish health monitoring plan is identical to that developed for the Columbia Basin anadromous salmonid hatcheries (IHOT 1994):

- All fish health monitoring will be conducted by a qualified fish health specialist.
- Annually examine broodstock for the presence of viral reportable pathogens. Number of individuals examined, usually 60 fish, will be great enough to assure a 95 percent chance of detection of a pathogen present in the population at the 5 percent level. American Fisheries Society "Fish Health Blue Book" procedures will be followed.
- Annually screen each salmon broodstock for the presence of *R. salmoninarum* (R.s.). All Chinook salmon will be sampled for R.s. as part of the positive egg culling program.
- Conduct examinations of juvenile fish at least monthly and more often as necessary. A representative sample of healthy and moribund fish from each lot of fish will be examined. The number of fish examined will be at the discretion of the fish health specialist.
- Investigate abnormal levels of fish loss when they occur.
- Determine fish health status prior to release or transfer to another facility. The exam may occur during the regular monthly monitoring visit, i.e. within 1 month of release.
- Appropriate actions including drug or chemical treatments will be recommended as necessary. If a bacterial pathogen requires treatment with antibiotics, a drug sensitivity profile will be generated when possible.
- Findings and results of fish health monitoring will be recorded on a standard fish health reporting form and maintained in a fish health database.
- Fish culture practices will be reviewed as necessary with facility personnel. Where and when pertinent, nutrition, water flow and chemistry, loading and density indices, handling, disinfecting procedures, and treatments will be discussed.

10.10) Emergency release procedures

Contingency plans are in place to deal with chemical spills or water system failures. In the event of a complete water system failure, fish programmed for release into the Middle Fork Willamette River and Coast Fork River would be released into the river after Regional or Manager approval. In the event of a partial water system failure or a chemical spill upstream, fish would be saved according to the following priorities:

1. Chinook salmon broodstock
2. Eggs and Fry
3. Fingerlings
4. Smolts

10.11) Risk aversion measures to minimize adverse effects to listed fish due to fish releases

All hatchery spring Chinook salmon smolts released into the Middle Fork Willamette River are liberated during the natural peak outmigration periods (February-April, and November). An attempt to release fish during periods of higher flow is made to encourage downstream movement. Releases are volitional to eliminate the inundation of the natural population with hundreds of thousands of hatchery smolts all at once. Smolts are released at an appropriate size to encourage emigration and reduce contact time with naturally produced juvenile Chinook salmon.

SECTION 11. MONITORING AND EVALUATION OF PERFORMANCE INDICATORS

11.1) Describe plans and methods proposed for monitoring and evaluation of "Performance Indicator" identified for the program, and indicate whether funding and support logistics are available.

Monitoring and evaluation activities listed for Willamette Hatchery facilities are developed, reviewed, and partially funded through the Cooperative Agreement between the Corps and ODFW for the hatchery mitigation program.

A detailed RM&E plan has been developed for the WHMP including the Middle Fork Willamette CHS component (Peven and Keefe 2010). The process, objectives, standardized protocols, and an analytical framework provides a reference guide to the range of RM&E monitoring and evaluation strategies.

11.2) Risk aversion measures to minimize adverse genetic and ecological effects to listed fish due to monitoring and evaluation activities

The program does anticipate that additional incidental take will result from monitoring and evaluation activities, but the type and level of take is to be determined on a case by case basis for uncertainty monitoring. It is recommended that annual take statements are developed and approved/denied along with the annual review of RM&E proposals by WATER. Sections 7-10 of this HGMP describe risk aversion measures in place within the hatchery program for minimizing impacts to the wild CHS population. Take of listed species by the hatchery program is discussed in section 2.2.3.

Table 11.1-1. Strategies and methods for monitoring and evaluation of performance indicators.

Category	Standard	Indicator	Monitoring and Evaluation Strategies and Methods
Legal Mandates	**Standard 1.1:** Meet production levels for mitigation, fisheries, and spring Chinook salmon conservation consistent with survival and recovery of the ESU, as determined by NMFS through approval of this HGMP	**Indicator 1.1.1:** Produce up to 1,672,000 spring Chinook smolts for release into the Middle Fork Willamette basin and 267,000 spring Chinook smolts for release into the Coast Fork Willamette basin. In addition, program releases 100,000 fingerlings into Hills Creek Reservoir (200,438 lbs)	- Not applicable.
	Standard 1.2: Program goals are aligned with authorized federal, state, regional, and local fisheries conservation and restoration initiatives.	**Indicator 1.2.1:** Program complies with the Willamette BiOp (NMFS 2008), and where appropriate is consistent with the objectives and strategies recommended by the Recovery Plan (ODFW and NMFS 2011), as it informs the best scientific and commercial data available. The HGMP will be submitted to NMFS for approval.	- Not applicable.
Harvest	**Standard 2.1:** Provide sufficient hatchery broodstock to mitigate lost production above Dexter, Lookout Point, Hills Creek dams to meet harvest goals while minimizing impacts to natural-origin Chinook salmon. Take of ESA-listed fish associated with harvest is covered through the Fisheries Management and Evaluation Plan (FMEP) for upper Willamette spring Chinook salmon (ODFW 2001).	**Indicator 2.1.1:** Number of hatchery spring Chinook salmon available for harvest in ocean, Columbia River, Willamette River, and Middle Fork Willamette River sport and commercial fisheries.	- Harvest monitoring will be conducted through catch analysis for commercial and sport fisheries via the FMEP, and reported in the annual baseline monitoring reports.

Category	Standard	Indicator	Monitoring and Evaluation Strategies and Methods
Conservation	**Standard 3.1:** Maintain heterozygosity in hatchery broodstock and avoid genetic drift to the extent possible by integrating all unmarked (assumed natural-origin) broodstock. (Note: Hatchery-origin fish likely contain the only genetic remnants of the historic CHS Middle Fork Willamette run available (NMFS 2008). ODFW considers the population extirpated (ODFW and NMFS 2011). Recently, less than 1% of the broodstock has been natural-origin fish (NMFS 2008, citing Schroeder et al. 2006)).	**Indicator 3.1.1:** Maintain characteristics as similar as possible to natural-origin with respect to age at maturity, run timing, sex ratio, size, fecundity, etc.	- Identify, monitor, and report integration levels (pNOB). - Complete census of spring Chinook salmon broodstock to determine origin and compare pNOB to program goals at recurring intervals. Examine otoliths from all unclipped broodstock for absence of a thermal mark indicating the fish was naturally produced.
	Standard 3.2: Reduce potential for negative ecological interactions between hatchery and naturally produced juveniles.	**Indicator 3.2.1:** Specific interactions to look for are: Evidence of residualism or delayed migration that could result in competition for food and space; disease prevalence in hatchery fish that could be transferred to naturally produced fish, and risk of hatchery smolt predation on natural-origin recruit Chinook fry. **Indicator 3.2.2:** Flow management to promote efficient downstream migration of hatchery smolts, protect eggs deposited during spawning and provide juvenile rearing habitat.	Monitor hatchery fish for size and behavior comparison to naturally produced yearling migrants. Use mark-recapture and trapping technologies to determine growth rate and migration patterns. Conduct observational studies (e.g., seining) to determine migration patterns and evaluate number of residuals.
	Standard 3.3: Produce and release sufficient numbers of fish to support successful outplanting upstream from Lookout Point and Hills Creek Dam for RM&E and reintroduction efforts. The intent is to inform passage studies to aid in formulation of passage alternatives, potential design of passage alternatives,	**Indicator 3.3.1:** Abundance and productivity of hatchery returns available for outplanting are adequate to determine: spawning success (including PSM), SAR, recruits per spawner (productivity), adult migration and spawn timing, number of juveniles emigrating	- Reintroduce/outplant fish into historic habitat upstream of dams. - Coordinate with CRFM studies to ensure outplant program is adequate to meet RM&E and ultimately reintroduction needs.

Category	Standard	Indicator	Monitoring and Evaluation Strategies and Methods
	and reintroduction protocols and strategies.	from spawning areas, and genetic diversity. Thus, the target is 1,350 adults (675 females) outplanted above Lookout Point and in the North Fork Middle Fork Willamette River, and 1,100 adults (550 females) outplanted above Hills Creek Dam.	
	Standard 3.4: Meet or exceed benchmarks for rearing and releasing high quality fish to minimize impacts on naturally produced fish.	**Indicator 3.4.1:** Performance targets for benchmarks for rearing and release as indicated in Table 1.9-1.	- Document variables in Table 1.9-1 and compare to established targets to determine if hatchery operations need to be adjusted.
	Standard 3.5: Monitor benchmarks to help minimize impacts of adult returns on naturally produced populations to meet spring Chinook salmon conservation needs consistent with survival and recovery of the ESU, and where appropriate, to aid in recovery goals.	**Indicator 3.5.1:** Performance targets for benchmarks for returning hatchery fish as indicated in Table 1.9-2.	- Document variables in Table 1.9-2 and compare to established targets to determine if hatchery operations need to be adjusted.
	Standard 3.6: Monitor benchmarks and protocols for broodstock.	**Indicator 3.6.1:** Performance targets for benchmarks for hatchery broodstock as indicated in Table 1.9-3.	- Document variables in Table 1.9-3 and compare to established targets to determine if hatchery operations need to be adjusted.
	Standard 3.7: The proportion of hatchery-origin adults spawning with natural-origin adults (pHOS) in Fall Creek (subpopulation of the MF Willamette) (calculated to include fish both above and below Fall Creek Dam) is less than 10%.	**Indicator 3.7.1:** Continue to outplant only unclipped (not adipose fin-clipped) CHS collected at Fall Creek trap above the dam. If natural-origin CHS returns are forecasted to be less than 200 CHS, then additional hatchery CHS may be outplanted if deemed necessary. NMFS, ODFW, and Corps will coordinate on any hatchery CHS releases**.**	-Complete spawning ground surveys to assess redd numbers, location, and number of natural origin and hatchery origin spawners.
	Standard 3.8: The proportion of hatchery-origin adults spawning with natural-origin adults (pHOS) in the MF Willamette River above	**Indicator 3.8.1**: The threshold for discontinuing hatchery CHS outplanting above Dexter/Lookout Point	Complete spawning ground surveys to assess redd numbers, location, and number of natural origin and hatchery origin spawners.

Category	Standard	Indicator	Monitoring and Evaluation Strategies and Methods
	Dexter/Lookout Point Dams will be less than 10% once survival conditions improve and natural production increases in the future.	Dams will be when a self-sustaining population of more than 400 natural-origin female CHS are collected and outplanted above the dams annually. **(**Note that habitats below Dexter Dam do not support natural production of spring Chinook salmon. The goal is to focus on natural production and pHOS goals in core areas upstream from Lookout Point Dam.)	
Life History Characteristics	**Standard 4.1:** Seek to maintain life history characteristic of broodstock as similar as possible to natural-origin spring Chinook salmon.	**Indicator 4.1.1:** Life history characteristics of the broodstock including: morphometrics (length and weight), sex ratio, average number of eggs per female by age class, age structure, adult migration, and spawn timing (Table 1.9-3).	- Sample both hatchery and natural-origin broodstocks for indicator variables. - Assess the relationship between fecundity and female size in hatchery and natural-origin broodstocks. - Compare variables between hatchery and natural-origin broodstocks and assess patterns over time to evaluate divergence. - Once natural origin populations are re-established - evaluate genetic differences between hatchery and natural-origin broodstocks through genetic monitoring as part of a basinwide monitoring program (e.g. analyze hatchery and natural origin samples from each hatchery including the Middle Fork Willamette every 4 years as part of a rotating sample design). This action will be delayed until adequate numbers of NOR are produced in the Middle Fork.
	Standard 4.2: Rear and release hatchery spring Chinook salmon to minimize impacts to naturally produced juvenile spring Chinook salmon.	**Indicator 4.2.1:** Hatchery fish will be released in time and space that minimizes the interaction with listed fish.	-Manage growth rates, release size, and release timing to rear hatchery fish similar to naturally produced fish. - Monitor phenotypic characteristics of hatchery fish during rearing and release. - Use mark-recapture techniques to evaluate behavior of migrants

Category	Standard	Indicator	Monitoring and Evaluation Strategies and Methods
			and compare run timing and migration patterns between hatchery and naturally produced smolts.
	Standard 4.3: Release hatchery fish that are ready to migrate	**Indicator 4.3.1:** Timely migration of all hatchery fish released as indicated by: residualism rates, rates of outmigration, precocial rates, and proportion of fish that migrate per day.	- Use volitional release to encourage fish to move with the outmigration window for naturally produced fish. - Use mark-recapture and trapping/in-water observation techniques to determine migration timing of hatchery fish. - Evaluate smoltification and sexual maturity through, for example, direct observation or monitoring of hormone levels in hatchery fish.
Genetics	**Standard 5.1**Appropriately manage the genetic risks of hatchery CHS spawning in the wild consistent with the conservation and recovery of a self-sustaining, natural population. Currently, natural-origin returns occur primarily in Fall Creek. Returns of unmarked adults to Dexter trap have been exceptionally low. Minimize outplanting of hatchery CHS above Fall Creek Dam. Manage hatchery CHS for reintroduction above Dexter/Lookout Point Dams.	**Indicator 5.1.1:** As described in the Recovery Plan (ODFW and NMFS 2011), manage the current MF Willamette hatchery stock to meet mitigation goals, but do so in a manner that the genetic and demographic impacts of program do not pose unacceptable risk to extant NOR fish populations or compromise long term productivity of a reintroduction stock that would preclude success of conservation reintroduction/supplementation program above MF Willamette dams.	- Complete spawning ground surveys to assess redd numbers, location, and number of natural origin and hatchery origin spawners.
	Standard 5.2: Broodstock collection does not adversely impact the genetic diversity of the naturally spawning population, to the extent possible. See Note in Standard 5.1.	**Indicator 5.2.1:** To the extent possible, maintain genetic composition of natural and hatchery stocks.	- Currently, all unmarked adults returning to the Dexter Trap are incorporated into the broodstock due to lack of safe and effective passage through the flood control/hydroelectric projects. Natural production is lacking below Dexter Dam.

Category	Standard	Indicator	Monitoring and Evaluation Strategies and Methods
	Standard 5.3: Integrate all returning NOR broodstock (see Standard 3.1), increasing integration to a rate averaging 5%, consistent with the long-term goal in the Recovery Plan, as appropriate in the future if natural-origin populations are restored.	**Indicator 5.3.1:** To the extent possible, maintain genetic diversity (heterozygosity) of broodstock similar to natural-origin fish.	- Adhere to integration targets identified in this HGMP.
Operation of Artificial Production Facilities	**Standard 6.1:** Willamette Hatchery facilities are operated in compliance with all applicable fish health guidelines and facility operation standards and protocols such as those described by IHOT, PHFHPC, and INAD.	**Indicator 6.1.1:** Annual reports indicating compliance.	- Routine annual fish health monitoring of fish rearing in the hatchery and broodstock. - Determine if pathogen levels are consistent with expected targets and standards.
	Standard 6.2: Willamette Hatchery effluent will not negatively impact natural populations.	**Indicator 6.2.1:** All facilities are operated under permits issued by ODEQ, and monitored to comply with the permit, to maintain Oregon water quality standards for protection of aquatic life.	- Conduct routine monitoring of discharge water and stream water downstream of discharge. - Compare water quality parameters to Oregon water quality standards.
	Standard 6.3: Water withdrawals and instream water diversions will not impact any ESA-listed natural populations.	**Indicator 6.3.1:** Install and maintain criteria fish screens for water intakes where appropriate consistent NMFS criteria.	-Conduct routine visual monitoring of screens to evaluate fish attraction to screens and potential for injury.
	Standard 6.4: Release only fish that are pathogen-free or have been certified by a state pathologist, and that will not increase levels of existing pathogens in natural populations.	Indicator 6.4.1: Certification of juvenile fish health immediately prior to release, including pathogens present and virulence.	
Ecosystem Function	**Standard 8.1:** Provide nutrient enrichment and food web benefits in natural spawning streams in the Middle Willamette River Basin, if any exist in the future.	Indicator 8.1.1: Pathogen-free (or as approved by ODFW Fish Pathology) hatchery fish may be placed in streams for nutrient enrichment.	- Track the number and location(s) of carcasses distributed for nutrient enrichment. - Monitor the ability to consistently respond to planned nutrient enrichment needs as appropriate for Oregon watersheds.

Category	Standard	Indicator	Monitoring and Evaluation Strategies and Methods
		Indicator 7.1.2: Any hatchery carcasses placed for nutrient enrichment will comply with ODFW and ODEQ guidelines for disease control and water quality.	ODFW's Fish Pathology Department screens carcasses for possible diseases and gives final approval for all nutrient enrichment projects prior to project initiation.

SECTION 12. RESEARCH

The baseline RM&E, funded by the USACE through the Cooperative Agreement, follows the most recent science to ensure that methods used to achieve the objectives are consistent with current state of science on hatchery reform in the Pacific Northwest. Three overarching objectives were developed that encompass all program elements of the WHMP:

- develop and maintain hatchery broodstocks to meet mitigation, conservation, and recovery goals and to comply with existing genetic guidelines as specified in hatchery-program specific Hatchery and Genetic Management Plans (HGMPs);
- rear and release high quality hatchery fish to minimize impacts on naturally-produced fish and to promote conservation and recovery of listed species; and
- manage adult returns to minimize impacts on naturally produced populations and to aid in recovery goals while achieving harvest goals

Proposed RM&E

- Identify, monitor, and report integration levels of natural-origin broodstock (pNOB)
    - Every year HRME staff recover otoliths from every unclipped fish used in broodstock. The otoliths are examined for thermal marks to account for unmarked hatchery fish. The number of unclipped non-thermally marked broodstock is used to calculate pNOB.
- Describe biological metrics and spawning success for returning CHS (e.g., number, geographic and temporal distribution, size, age, sex, stray rates, prespawn mortality rate, redd counts)
    - Every year HRME staff conduct comprehensive spawning ground surveys to count redds and sample carcasses. Surveys begin well before spawning commences and are conducted essentially weekly until spawning ceases. The redd distribution and counts are used to infer spawner spatial and temporal distribution and spawner abundance. Carcass sampling permits estimates of the following: spawner origin (hatchery or wild) based on fin clips and otolith marks; spawner size; spawner age (from scale samples and CWT recovery); sex; stray rates (by

recovery of CWTs from hatchery fish); and prespawn mortality rate (by inspection of female carcasses). Spawning ground surveys are conducted in the mainstem river reach between Dexter Dam and Jasper and in Little Fall Creek. However, because little natural production occurs below Dexter Dam, the most critical survey reaches are above project dams and include Fall Creek above Fall Creek Dam, the North Fork Middle Fork above Lookout Point Dam, and the Middle Fork Willamette above Hills Creek Dam.

- Monitor broodstock to ensure naturally-produced life history characteristics are maintained for CHS

    - Every year HRME staff sample broodstock to estimate size distribution and age structure and compare those metrics to those of natural-origin spawners. In addition, the collection of fish for broodstock is tracked so that the timing that broodstock are actually collected can be compared to the timing that fish, especially wild fish, enter the trap. The intent is to ensure that broodstock collection reflects run timing of wild (unclipped) fish. Similarly, the timing that broodstock are actually spawned is compared to spawn timing of naturally-spawning fish to ensure that the program maintains spawn timing similar to that in the river.

- Monitor broodstock to meet hatchery production requirements

    - A well-established estimate of fecundity is used to project the number of females needed, based on the expected program size established by ODFW the previous year. Only that number of females plus an estimated number needed to account for estimated prespawn mortality and culling of eggs from diseased spawners are collected as brood.

    - Hatchery staff coordinates with ODFW Fish pathology to monitor disease issues and incorporate antibiotic and prophylactic formalin treatment as necessary.

    - Hatchery and HRME staff collaborate during broodstock collection and spawning to coordinate sampling for coded wire tags, otoliths scales, genetics, and biological data.

- Monitor distribution and abundance of hatchery fish spawning with naturally produced fish (pHOS)

    - Estimates of reach-specific pHOS are made every year using data obtained during spawner surveys (described above).

    - Estimates of reach-specific pHOS are aggregated for larger river reaches and the subbasin as a whole by weighting the reach-specific pHOS estimates using spawner distribution (peak redds/survey reach) as the weighting factor.

- Release hatchery fish that are ready to migrate

    - Smolts are released after final rearing and acclimation at the Dexter Fish Collection Facility at a time and size known to be associated with active smolt migration. A "prelibation" sample is taken just prior to release to establish size distribution, mark/tag retention, and condition factor.

- Results of the annual RM&E are summarized in a comprehensive annual report. The level of task execution will be dependent upon available funds.

SECTION 13. ATTACHMENTS AND CITATIONS

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SECTION 14. CERTIFICATION LANGUAGE AND SIGNATURE OF RESPONSIBLE PARTY

"I hereby certify that the information provided is complete, true and correct to the best of my knowledge and belief. I understand that the information provided in this HGMP is submitted for the purpose of receiving limits from take prohibitions specified under the Endangered Species Act of 1973 (16 U.S.C.1531-1543) and regulations promulgated thereafter for the proposed hatchery program, and that any false statement may subject me to the criminal penalties of 18 U.S.C. 1001, or penalties provided under the Endangered Species Act of 1973."

Name, Title, and Signature of Applicant:

Certified by_____ Date: _____

SECTION 15. OUTPLANTING PROTOCOLS ADDENDUM

15.1 Background and purpose

The USACE's Dexter, Lookout Point, Hills Creek, and Fall Creek dams in the Middle Fork Willamette River subbasin were completed in the 1950s and 1960s. These dams have blocked access to more than 80 percent of historic Chinook salmon habitat in the subbasin in order to help provide flood damage reduction to the Willamette Valley. It is thought that historically the Middle Fork Willamette subbasin may have supported the largest spring Chinook salmon run of any subbasin above Willamette Falls (Hutchinson et al. 1966). The NMFS 2008 BiOp RPA includes improvements to dam passage as part of the actions needed to avoid jeopardy or adverse modification of critical habitat for UWR Chinook. The Upper Willamette Conservation and Recovery Plan for Chinook Salmon and Steelhead (ODFW and NMFS 2011) identified access to historical spawning habitat as a key factor limiting natural production and recovery of Middle Fork Willamette spring Chinook salmon. Other limiting factors identified include habitat and flow alterations, and hatchery practices that influence genetics and productivity.

To achieve viability goals for spring Chinook salmon populations in the Middle Fork Willamette subbasin, the Recovery Plan recommends reducing extinction levels to low risk. Recovery scenarios in the plan call for reducing the conservation gap between current abundance and desired abundance by reducing limiting factor threats. In addition to identifying biological criteria and data, NMFS identified threats criteria that must be met for delisting to occur, including habitat impacts, overutilization, disease/predation, regulatory inadequacy, and "other" factors.

Re-establishing productivity of CHS in areas currently above USACE facilities is a specific recommendation in the Recovery Plan (ODFW and NMFS 2011) and a requirement of the WP BiOp (NMFS 2008), assuming it is feasible. See RPA measures cited in Section 3.1. Volitional passage past Lookout Point, Dexter, and Hills Creek dams is lacking for fish in the Middle Fork Willamette but upstream passage is currently addressed for adults by operation of the Dexter adult collection facility, which may be rebuilt if it is determined if a feasible downstream fish passage solution is found. Using broodstock from the Willamette HMP to initiate this effort is predicated on the success of outplanting efforts using hatchery fish. Structural/operational feasibility for downstream passage will be determined by a series of USACE system configuration studies designed to determine the feasibility of reestablishing naturally self-sustaining populations in river reaches above the USACE Willamette dams (Section 3.0 in USACE 2007). The USACE is evaluating downstream passage actions and alternatives to address this limiting factor per RPA 4.10-4.12 (NMFS 2008), related to RM&E per RPA 9.3, and using the COP process described in RPA 4.13 and decision-making processes described in RPA measures 1.3-1.4. Adult collection and transport above the dam will assist in avoiding jeopardy and passage research.

The USACE and ODFW consider "outplanting" and "reintroduction" as complimentary and overlapping activities. Outplanting refers to the release of adult hatchery spring Chinook salmon (or in some cases, natural-origin fish) into river reaches upstream of

USACE dams for the following fishery management purposes: providing ocean-derived nutrients (as eventual carcasses) to localized food webs, providing subsequent juvenile production via outplanting for WP BiOp RM&E purposes (e. g. to evaluate downstream survival of fish through the reservoirs, turbines, regulating outlets, etc.) as well as an historical prey base. In contrast, reintroduction is considered an experimental fixed-start and fixed-term conservation supplementation program of moving defined numbers of hatchery-origin and/or natural-origin fish into reaches upstream of the Lookout Point and Hills Creek dams for the specific objective of reestablishing a portion of the naturally self-sustaining population in the subbasin.

The approach for using HMP fish to re-establish natural production above Lookout Point and Hills Creek dams is to outplant adult hatchery spring Chinook salmon into the vacant habitats there. Few natural origin returns (NORs) are available to initiate a re-introduction effort. However, since the hatchery program stock is abundant and was derived from the endemic Middle Willamette stock, HMP fish are provisionally the best available to initiate reintroduction. As noted in previous sections, adequate numbers of HMP fish that are surplus to broodstock needs are typically available every year to provide enough fish to seed habitat above the dams. Furthermore, NMFS has recommended that the USACE's spring Chinook salmon hatchery programs will play an important role in recovery (ODFW and NMFS 2011) of UWR spring Chinook salmon, particularly because the Willamette spring Chinook salmon stocks are suitable for use in outplanting and reintroduction efforts. This hatchery supplemented re-introduction strategy would likely have to continue for at least 10 years (two generations) given the problems that have been identified to date with adult trap and haul facilities, downstream passage challenges, invasive species and prespawning mortality.

Over time, as NOR returns hopefully start to increase from these reintroduction and passage improvement efforts and return to the collection facilities or base of the dams, these NOR fish would comprise most of the fish transferred above the dams, with the HMP component becoming less and less of an above-dam component. One marker of a successful reintroduction program above the dam would be when NOR returns are sufficient to fully seed the above-barrier habitat without the supplementation of hatchery fish. Further details on these reintroduction efforts using the hatchery programs are being discussed and formalized by the fish co-managers in consultation with the Hatchery Management Team.

Beidler and Knapp (2005) summarized the CHS outplanting efforts in the Willamette basin through 2005. Efforts will be initiated to outline a reintroduction strategy that describes the protocol for collecting, transporting, and releasing hatchery or natural-origin CHS into historical habitat and outplanting and reintroduction efforts with other hatchery operations. Development of the plan and reintroduction success is reliant on implementation of passage actions as outlined in the BiOp and as determined feasible through the COP process. The reintroduction plan will incorporate conservation and reintroduction role of the hatchery program as outlined in the recovery plan Appendix E. The reintroduction plan will complement and dovetail with BiOp actions to provide safe passage at Lookout Point, and Hills Creek projects as described in: RPA measures 4.1 and 6.2.3 for Adult Chinook Outplanting; RPA measure 4.8 for interim operational

measures for safe passage; implementation of RPA 9.3 fish passage RM&E through sub-actions identified in RPA measures 4.10-4.11; and RPA 4.12 for Long-Term Passage Solutions, including 4.12.2 related to downstream passage improvements at Lookout Point Dam after analysis of alternatives in the COP process (RPA 4.13) and decision-making in the WATER process (RPAs 1.3 and 1.4).

15.2 Program goals and objectives for outplanting and reintroduction

These goals and objectives are consistent with the overall goals of the Middle Fork Willamette Spring Chinook Salmon Program as described in Section 1.7 of the HGMP.

Main Goal: Manage the Middle Fork Willamette Spring Chinook Salmon Program and returns to fish collection facilities in the Middle Fork Willamette Basin to meet spring Chinook salmon conservation needs, consistent with survival and recovery of the ESU, including assisting in establishing and maintaining a viable population of naturally reproducing spring Chinook salmon in the Middle Fork Willamette basin, while continuing to meet harvest management objectives and the USACE's mitigation responsibility.

Objective 1: Evaluate the potential to establish a naturally reproducing population of spring Chinook salmon in historic habitat upstream of dams in the Middle Fork Willamette basin to increase natural production, avoid jeopardy or destruction or adverse modification of critical habitat, and aid in the recovery of UWR spring Chinook salmon.

- Release hatchery-origin fish into historical habitat upstream of Lookout Point and Hills Creek dams in the Middle Willamette basin to evaluate and design passage facilities, to provide safe passage for native fish in compliance with the WP BiOp, and where appropriate, be consistent with the recommendations of the Recovery Plan.
- Release hatchery-origin or a combination of hatchery and natural-origin fish into inaccessible habitat, with the long-term intention of releasing only naturally produced fish. If safe and effective downstream passage is provided and results in self-sustaining naturally produced populations of spring Chinook salmon above the dams, transition to outplanting only natural-origin adults.

Objective 2: Meet legal and policy standards, including those identified in the approved HGMP.

Objective 3: Ensure that outplanted fish represent the life history characteristics of the natural population and promote successful production.

Objective 4: In the long-term, reassess and potentially reduce mitigation production of hatchery fish in the Middle Willamette Basin if sustainable natural production increases. Potentially provide a sustainable harvest on naturally produced spring Chinook salmon.

15.3 Outplanting strategies

15.3.1 Protocols for Outplanting Adults

The following sections describe the proposed long-term protocols for the spring Chinook salmon reintroduction and outplanting program.

1. Target Number of Fish to Release

Proposed Operation. The program involves releasing fish according to the general targets identified in Table 15.3-1 which represent numbers adequate to support passage RM&E, nutrient enrichment, and bull trout conservation goals in the subbasin.

Table 15.3-1. Proposed number of adult spring Chinook to be outplanted

Location	Target Number of Fish	Origin	
		Hatchery	Natural
Middle Fork Willamette, upstream of Hills Creek Reservoir	1,100	X	0
North Fork and Middle Fork Willamette and tributaries upstream of Lookout Point Reservoir	1,350	X	

Detailed protocols for the disposition of excess hatchery fish are established in Section 7.5. Outplanting targets will be updated annually, based on predicted run size, results of RM&E, and the construction of new infrastructure affecting the ability to collect or release fish in the Middle Fork Willamette subbasin. Because returns may fluctuate annually, the plan for outplant releases also incorporates variability in outplanting numbers. The annual plan will outline release targets for each location based on expected returns to the Middle Fork Willamette River based on returns to Willamette Falls and the Dexter Trap.

Long-term Strategy

- Maximize adult survival to spawning and adjust target releases accordingly (based on reductions in pre-spawning mortality and improvements in survival at other life stages).
- Reduce the numbers or ratio of hatchery-origin fish released above Hills Creek and Lookout Point dams with establishment of self-sustaining populations of natural-origin adults or through selective passage of fish that originated above the projects. Eventually, release only natural-origin fish in these areas.
- Eliminate the need to outplant hatchery-origin adults in areas upstream of dams. In the long term, collect and release only natural-origin adults collected at Dexter Ponds into habitat upstream of each dam.

2. Sex and Age Composition of Outplanted Fish

Proposed Operation. To the extent possible, ensure a sex ratio or adequate numbers to seed

habitats and maximize reproductive success and, if necessary, adjust for known differences in pre-spawning mortality between males and females. Ensure an adequate number of adults are outplanted to seed available habitat.

3. Run Representation of Outplanted Fish (seeding rate by run size by month)

Proposed Operation. Continue to collect adult fish at the Dexter Ponds Fish Facility. The USACE is considering plans to rebuild Dexter Ponds to improve attraction flows and reduce adult handling via automated sorting (NMFS 2008). The annual fish disposition table will be adapted over time based on RM&E results to determine when, and under what conditions, to outplant fish to each location.

Long-term Strategy. Collect fish on a regular basis throughout the run and outplant when collected, ensuring temporal outplants are representative of run strength. However, pre-spawning mortality of early-released fish may be high and thus should be monitored to ensure effectiveness of this strategy. Natural origin adults originating from above the project and not integrated into the broodstock will be passed as soon as possible to areas above the project. This protocol will be reviewed once successful passage has been re-established.

4. Handling Protocols for Outplanted Fish

Proposed Operation. Continue to use Dexter Ponds as the collection location for fish to be outplanted. Outplant fish that are in good physical conditions (i.e., no lesions, fungus, etc) have a high likelihood of surviving to spawn to support fish passage studies. Carbon dioxide will continue to be used as anesthetic, because summer steelhead that are available to anglers for harvest are also present. Additional adults not outplanted may be placed as carcasses (nutrient enrichment) at a later date. Fish will be handled as gently as possible during processing and loading onto the truck, attempting to minimize stress and skin abrasions associated with handling.

Handling protocols will be updated when a new facility is constructed.[1] In addition, the following guidelines will be followed:

- Sorting of adult spring Chinook for brood production and outplanting shall be completed in a manner that minimizes stress and injury.
- All efforts should be made to sort adult fish a single time.
- Healthy fish will be used for both broodstock collection and outplanting efforts if available.
- Sorting shall be completed to separate by species or origin (hatchery or wild) and to ensure an adequate sex ratio for outplanting and brood production.

The fish disposition table will be used to guide the management of anadromous and resident fish as they are encountered in the adult fish traps. To ensure captured fish are not overly stressed or injured, protocols are needed on how long trapped fish are held prior to transport, broodstock

[1] Protocols will need to be refined that set specific time frames for how many times a day the trap is checked, how long fish will remain in the trap, and how long fish are in anesthetic.

collection, or recycling for fisheries. The following protocols will be incorporated into overall protocols for the Dexter Fish Facility.

- Once fish are sorted, they will spend no longer than the allotted time based on best management practices, facility limitations, and holding tank criteria prior to being transported to their destination.
- Subject to adequate funding and staffing, the fish trap will be checked at least twice a day, first in the morning, and then in the late afternoon to avoid having fish spend too much time in the trap and to assess the overall density of fish within the trap.
- Fish will be removed and placed in holding tanks with density ≤ 25 gallons of water per fish.
- Oxygen levels in the holding tank water should not exceed saturation (100%) or drop below 7 parts per million (7 mg/L).

Long-term Strategy. The Dexter adult fish facility will be used for collection of broodstock, passage above Dexter Dam, and for reintroduction efforts above Lookout Point and Hills Creek dams in the Middle Fork Willamette River. Most outplanted fish should be in good physical condition if available (i.e., no lesions, fungus, etc) to increase the likelihood of surviving to spawn. If natural-origin adults are passed, they will be passed regardless of their physical condition. During initial processing/sorting, CO_2 will be used as anesthetic because summer steelhead are also present, which are recycled into the fishery. During secondary processing prior to outplanting, alternate anesthetics (MS-222 or Aqui-S, if approved) will be used if fish will not be subjected to a fishery. Fish will be moved out of the trap quickly and frequently. The facility will be designed to minimize stress to fish, thus, all activities should complement this by minimizing any fish handling that may need to occur (e.g. multiple crowds). Protocols for facility operation will be outlined and updated as needed to ensure best handling and transport practices are utilized.

5. Antibiotic Treatment Protocols for Outplanted Fish

Proposed Operation. Use of antibiotics on outplanted fish is acceptable when released into areas closed to angling. The impacts of antibiotic treatment need to be further evaluated, but preliminary results in other basins indicate that a single treatment is not adequate to significantly reduce pre-spawning mortality.

Long-term Strategy. Experiment with eliminating prophylactic antibiotic treatment, and reduced dependence on antibiotic treatments. If Dexter Ponds is rebuilt, it should allow for use of alternate anesthetic, water-to-water transfer, and automatic sorting. Presumably, the reduced stress associated with the new facility would reduce or eliminate the need for treatment. However, antibiotic treatment during holding may be required.

6. Transport Protocols for Outplanted Fish

Proposed Operation. Fish will be loaded at recommended loading density of approximately 25 gallons per fish (40 fish/1000 gallon; 50 fish/1200 gallon), although densities will be reduced if water temperatures are high. All transport tanks will be treated with Nov-Aqua to reduce stress during transport. Tanks will be aerated during transport, if possible. Trucks equipped with

chillers will operate them to prevent or reduce warming during transport and minimize change in temperature between the tank and in the release stream, to the extent possible. If the receiving water is warmer, fish are acclimated prior to release as specified in Section 2.3.1 of the main report. In addition, fish handling will cease once temperatures reach 70°F.

All truck drivers will complete an adult Chinook salmon outplant form to document oxygen levels, temperatures in the tank and release stream, immediate mortalities, loading densities, and release method. These data will be used to enable better monitoring of outplanted fish.

Table 15.3-2 Approximate hauling times and distances from Dexter Ponds to release sites

Release Site	Distance (miles)	Transport time (minutes)
Middle Fork Willamette, upstream of Hills Creek reservoir	50	120
North Fork Middle Fork Willamette, upstream of Lookout Point reservoir	36	90
Salt Creek, upstream of Lookout Point reservoir	40	90

[a] Transport time does not include loading time. Source: Modified from 2007 ODFW HGMP.

7. Release Protocols for Outplanted Fish

Proposed Operations

- Release sites. Continue to use the existing and new release sites, but identify potential new release sites that have adequate temperatures, are located near suitable holding areas, and are not located near areas with heavy human use to reduce harassment potential. Work with private landowners or the Forest Service to develop these areas into suitable release sites.
- Release methods. Have a minimum of a 12-inch opening on all release trucks. Discontinue use of collapsible tubes and use 16- to 20-inch smooth walled PVC pipe to convey fish from the truck to the stream. Set pipes at proper discharge angle and use discharge chutes. Use a water spout to flush fish from the truck. Avoid abrupt changes in temperature. Release fish early in the day whenever possible. If receiving waters are known to be too warm at certain times of year, release fish when or where waters are cooler. See Section 2.3.1 in the main report for more specific protocols. Investigate the options to improve survival such as holding fish in a hatchery pond and treating with antibiotics until they are ready to spawn, at which time they would be released. Releasing ripe fish may limit numbers outplanted and potentially reduce pre-spawning mortality.
- Monitoring. Fish liberation truck driver and/or trained volunteer will observe released fish and document any mortality and unusual behavior for 30 minutes after release.

Long-term Strategy

- Release sites. All fish would be released at sites that were selected based on suitable habitat and temperature.
- Release methods. All fish would be released using smooth-walled pipe as described above.
- Monitoring. Fish liberation truck driver and/or trained volunteer would observe released fish for mortality and unusual behavior immediately after release.

The Role of RM&E in Outplanting and Reintroduction

The RM&E program will be closely tied to the system configuration feasibility studies conducted under the Configuration and Operation Plan. Some elements of the RM&E program, such as those related to determining the feasibility of fish passage, will be conducted as part of the feasibility studies. Still other elements including long-term field evaluations and research will be implemented under the purview of the Configuration and Operation Plan.

Many of the hatchery reform actions are based upon an adaptive management strategy and are dependent on several factors: (1) availability of program funds appropriated by Congress or provided by others; (2) completion of more detailed evaluation to determine the feasibility of implementation of significant structural or operational modifications; and (3) continued RM&E to inform decisions on the biological feasibility of reintroduction of spring Chinook salmon above USACE dams (e.g. Lookout Point, Hills Creek) and reservoir complex. Consequently, actions to address ESA requirements in the Middle Willamette subbasin and the Willamette Basin, as a whole, will evolve and be refined over time. Hatchery reform, management, and operations are only one part of an integrated strategy under development for the recovery of listed species in the basin. The potential for changes in infrastructure and operations of the dam and reservoir system plus habitat restoration needs in the basin are anticipated to be extensive, but the total funding available to the USACE, ODFW, and others for implementing changes is limited. Thus, an adequate RM&E program coupled with adaptive management is necessary to establish and maintain clear priorities for use of the available funds.