UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Northwest Region
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NMFS Tracking
No. 2003/01621

April 1, 2004

MEMORANDUM FOR: File

FROM: D. Robert Lohn, Regional Administrator

SUBJECT: Endangered Species Act Section 7 Biological Opinion, Unlisted Species Analysis, Section 10 Analysis, and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation for Proposed Issuance of a Section 10 Incidental Take Permit to J.L. Storedahl & Sons, Inc., for the Daybreak Mine Expansion and Habitat Enhancement Project Habitat Conservation Plan

The attached document contains a biological opinion (Opinion) prepared by NOAA's National Marine Fisheries Service (NOAA Fisheries) pursuant to section 7 of the Endangered Species Act (ESA) on the effects of the proposed issuance of a section 10 Incidental Take Permit to J.L. Storedahl & Sons, Inc., for the Daybreak Mine Expansion and Habitat Enhancement Project Habitat Conservation Plan. In this Opinion, NOAA Fisheries concludes that the proposed action is not likely to jeopardize the continued existence of Lower Columbia River chinook salmon (*Oncorhynchus tshawytscha),* Columbia River chum salmon (*O. keta*), Lower Columbia River steelhead (*O. mykiss*), or the candidate Lower Columbia River/Southwest Washington coho salmon (*O. kisutch*) that occur in the plan area.

This document also contains a consultation on Essential Fish Habitat (EFH) pursuant to section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA) and its implementing regulations (50 CFR Part 600). NOAA Fisheries concludes that the proposed action may adversely affect designated EFH for two species of Federally-managed Pacific salmon: chinook and coho. Pursuant to Section 305(b)(4)(A) of the MSA, NOAA Fisheries is required to provide EFH conservation recommendations to Federal agencies regarding actions which may adversely affect EFH. While the proposed action may adversely affect, NOAA Fisheries believes that the conservation measures incorporated into the project to address ESA concerns already minimize these effects to the maximum extent practicable and are sufficient to conserve EFH. Therefore, as described in the enclosed consultation, we have no additional recommendations to make at this time.

The point of contact for this consultation is Laura Hamilton of my staff in the Washington State Habitat Office at (360) 753-5820 or laura.hamilton@noaa.gov.

cc: H. Randy Sweet
John Dentler, PLLC

ENDANGERED SPECIES ACT - SECTION 7

BIOLOGICAL OPINION, UNLISTED SPECIES ANALYSIS, SECTION 10 FINDINGS,

and

MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT CONSULTATION

for proposed issuance of a Section 10 Incidental Take Permit to J.L. Storedahl & Sons, Inc., for the Daybreak Mine Expansion and Habitat Enhancement Project Habitat Conservation Plan

Agency:	National Oceanic and Atmospheric Administration National Marine Fisheries Service
Consultation Conducted By:	National Marine Fisheries Service Northwest Region
Date:	April 1, 2004
Issued By:	D. Robert Lohn Regional Administrator
NMFS Tracking No:	2003/01621

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ABBREVIATIONS AND ACRONYMS

afy	acre-feet per year
BMP	Best Management Practice
BO	Biological Opinion
BRT	Biological Review Team
°C	Degrees Centigrade
CFR	Code of Federal Regulation
cfs	cubic feet per second
CM	Conservation Measure
CMZ	Channel Migration Zone
DO	Dissolved Oxygen
EDT	Ecosystem Diagnosis and Treatment
EFH	Essential Fish Habitat
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act of 1973 as amended through 1988
ESU	Evolutionarily Significant Unit
FEIS	Final Environmental Impact Statement
FEMA	Federal Emergency Management Agency
FR	Federal Register
HCP	Habitat Conservation Plan
IA	Implementation Agreement
ITP	Incidental Take Permit
LC	Lethal Concentration
LCFRB	Lower Columbia Fish Recovery Board
LWD	Large Woody Debris
mg/l	milligrams per liter
MPI	Matrix of Pathways and Indicators
MSA	Magnuson-Stevens Fishery Conservation and Management Act
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NTU	Nephelometric Turbidity Units
OHWM	Ordinary High Water Mark
Opinion	Biological Opinion
PFC	Properly Functioning Condition
PFMC	Pacific Fisheries Management Council
ppm	parts per million
RM	River Mile
SEPA	State Environmental Policy Act
SWPPP/ESC	Storm Water Pollution Prevention Plan/Erosion Control
TMDL	Total Maximum Daily Load

TSS	Total Suspended Solids
U.S.C.	United States Code
USFWS	US Fish and Wildlife Service
WDF	Washington Department of Fisheries
WDFW	Washington Department of Fish and Wildlife
WDOE	Washington State Department of Ecology
WDW	Washington Department of Wildlife

1.0 INTRODUCTION

This document contains at section 2.0 NOAA's National Marine Fisheries Service's (NOAA Fisheries) Biological Opinion (Opinion) prepared pursuant to section 7(a)(2) of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. section 1536(a)(2)). This document also contains an Unlisted Species Analysis, and findings required under section 10(a)(2)(B) of the ESA (16 U.S.C. section 1539(a)(2)(B)), regarding the issuance of an incidental take permit to J.L. Storedahl and Sons, Inc. (Storedahl) of Clark County, Washington, for four species of listed and unlisted Pacific salmon for a period of 25 years. The Opinion and findings are based on NOAA Fisheries' and the United States Fish and Wildlife Service's (USFWS, together the Services) separate and collaborative reviews of the conservation, minimization, mitigation, and monitoring measures proposed in the Storedahl's Daybreak Mine Expansion and Habitat Enhancement Project Habitat Conservation Plan (HCP) (Storedahl 2003) and Implementation Agreement (IA), for the East Fork Lewis River, Clark County, Washington.

The ESA consultation is conducted pursuant to section 7(a)(2) of the ESA and its implementing regulations, 50 CFR 402. The Opinion considers the likely effects of the proposed action on the threatened Lower Columbia River chinook salmon Evolutionarily Significant Unit (ESU) *(Oncorhynchus tshawytscha),* Columbia River chum salmon *(O. keta)* ESU, and Lower Columbia River steelhead *(O. mykiss)* ESU, and the unlisted, candidate status Lower Columbia River coho salmon *(O. kisutch)* ESU.

Incidental take of individuals of nine listed and unlisted species (the total number of HCP-covered species) would result from a suite of activities conducted in compliance with the final HCP. By general category, these activities are associated with: (1) the expansion of mining activities over an additional 161 acres within the 289-acre Daybreak site; and (2) habitat enhancement. These two categories of activity are comprised of component activities (detailed in subsections 3.4 through 3.6 of the final HCP) that include: (1) surface overburden removal with dozers or pan scrapers; (2) stockpiling of overburden materials for later use in reclamation activities; (3) excavation of gravel, in phases, to a depth of 30 feet below the working bench elevation using trackhoe excavators or draglines; (4) temporary stockpiling and transportation of mined materials to the on-site processing area; (5) on-site processing of gravel using an improved wash water system; (6) sequential reclamation of mined areas using rejected stockpiles and fines to create shallow water ponds; (7) redistribution of stockpiled topsoil to provide a root zone for reclamation plantings; (8) channel improvements to Dean Creek, an adjacent tributary to the East Fork Lewis River; (9) long-term protection and expanded amounts of valley-bottom forest and aquatic and wetland habitat, and; (10) all other mitigation measures, including monitoring and reporting, described in Chapters 4 and 5 of the final HCP. The USFWS is preparing a companion Biological Opinion/Conference Opinion on the subject section 10 permit application for coverage of five aquatic and terrestrial species under its purview (USFWS 2004), and will be evaluating a separate incidental take permit application from Storedahl.

Section 4.0 of this document satisfies the consultation requirements under the Magnuson-Stevens Fishery Conservation and Management Act (MSA), as amended by the Sustainable Fisheries Act of 1996 (Public Law 104-267). The MSA requires Federal agencies to consult with NOAA Fisheries on activities that may adversely affect Essential Fish Habitat (EFH).

1.1 Background and Consultation History

From 1997 to 2002, the Services provided technical assistance to Storedahl in development of the Daybreak Mine HCP. During the development of the HCP, preliminary drafts were distributed for comments. The September 1999 draft of the HCP was distributed to several state agencies and several local interested parties for comment. Comments from these groups were incorporated into subsequent drafts of the HCP. The May 2001 draft of the HCP was provided to the Washington Department of Fish and Wildlife (WDFW) for another review under a cooperative agreement between the USFWS' Western Washington Office and WDFW. Comments from WDFW's second review were incorporated into the final HCP.

The Services also worked with Storedahl to develop an IA and Environmental Impact Statement (EIS) to accompany the HCP. Storedahl submitted a formal application for an incidental take permit in November 2002, and on November 22, 2002 the Services initiated a 60-day public comment period (67 FR 70408) under the National Environmental Policy Act of 1969, as amended (NEPA). The public comment was extended an additional 30-days, ending February 21, 2003.

During the public comment period on the Draft EIS and HCP, the Service received a total of 45 comment letters including: 12 from government agencies, one from a tribal representative organization, 11 from public organizations, and 21 from individual citizens. Volume II (Response to Comments) of the Final EIS (FEIS) contains copies of all of those letters and the Services' responses. The Service addressed all of the comments and suggestions in writing and responded to many with clarification, elaboration, or inclusion of new information in the final HCP and FEIS.

Storedahl submitted final HCP, EIS, and IA with their formal application for an incidental take permit on October 29, 2003. On November 28, 2003, the Services initiated a 30-day public comment period under NEPA (68 FR 66820). The comment period was extended for 30 days, ending January 28, 2004, in direct response to requests from the public. This resulted in a total comment period of 60 days for the final documents.

1.2 Description of the Proposed Action

NOAA Fisheries proposes to issue a 25-year ITP to Storedahl under ESA section 10(a)(1)(b). Storedahl has prepared a multiple species HCP to comply with the ESA and address floodplain resource management issues. The 25-year plan will cover Storedahl's gravel mining and processing operations at the 300-acre Daybreak Mine located beside the East Fork Lewis River and Dean Creek, a small tributary to the river that runs along the northwest boundary of the site. The HCP is a set of habitat conservation measures and stewardship actions designed to avoid, minimize, mitigate, and monitor the effects of Storedahl's mining and reclamation activities on aquatic habitats in Dean Creek and the East Fork Lewis River. Approval of the HCP is required to issue an Incidental Take Permit (ITP).

Storedahl is a supplier of sand, aggregate and rock products in Southwest Washington and Northwest Oregon. Storedahl mines, processes and transports rock products throughout the lower Columbia region from several mining sites. Existing operations on the Daybreak site are limited to processing of gravel transported from off-site. Future management activities associated with the Daybreak HCP and ITP include those activities described in the HCP, and summarized below.

1.2.1 Overburden Removal

The expanded Daybreak Mine will operate as an open wet-pit excavation. Surface overburden will be removed using dozers or pan scrapers before recoverable deposits are excavated. Overburden will be segregated into two categories: high-grade topsoil, and culled (reject) aggregate material not suitable for processing and sale. Overburden materials will be stockpiled for later use in the reclamation part of the project. Stockpiling will occur on-site, outside of the Federal Emergency Management Agency (FEMA)-designated 100-year floodplain.

1.2.2 Aggregate Processing

After overburden is removed from a working area, aggregate will be excavated from designated areas using a trackhoe excavator and/or a dragline. Gravel will be excavated to depths ranging from 31 to 38 feet below the original ground surface. The water table at the site ranges from approximately 2 to 12 feet below the ground. Therefore, much of the mine excavation will be below the water table, resulting in the formation of a series of ponds of varying depths. Based on known gravel reserve depths and practical constraints, mining depths will likely be limited to approximately 30 feet below the water table.

In compliance with the Revised Code of Washington (RCW) 78.44.141 (4)(iv), mine cutslopes above the seasonal low water table will be between 2 and 3 feet horizontal to 1 foot vertical, or flatter, except in limited areas where steeper slopes are necessary in order to create sinuous topography and to control drainage. Cutslopes below the water table will be approximately 1.5 to 1. The shallower slopes above the waterline are designed to allow human egress and will be reduced even further in places (to 5 to 1 slopes) as part of the reclamation plan. Adjacent pits will be separated by native earthen material that is left in place and will have a minimum width at the top of approximately 20 feet.

Mined materials will be temporarily stockpiled and transported by truck or loader to a conveyor belt, or alternatively, the material will be trucked over temporary haul roads and existing county roads to the processing area within the Daybreak Mine HCP area.

Existing on-site equipment will be used to process the gravel. Both wet and dry aggregate processing is conducted as a pre-existing, nonconforming use according to Clark County's Shoreline Master Program. However, since May 2001, aggregate processing on the site has not included washing and there has been no discharge of process wash water to the ponds. The future difference will be the source of the aggregate and the installation of an improved wash water treatment system. Within three years after initiating the proposed mining operation, a closed-loop clarifier system will be installed, in which process water is recycled internally and process water is not released to the ponds. Flocculated sediments recovered from the process wash water will be used to create shallow water habitat in the reclaimed ponds.

1.2.3 Reclamation and Habitat Enhancement

Prior to expanding mining activity, all existing forested land not proposed for mining (approximately eight acres) will be preserved; 20 acres of active forest restoration will continue in the area south of Bennett Road; and about 53 acres of forest will be planted in areas not proposed for mining. An additional 24 acres of forested wetland and riparian habitat will be preserved south of the haul road and in the area south and west of the existing Pond 5. Storedahl will sequentially reclaim areas that are mined at the end of each mining phase. Following mining, approximately 33 acres will be reclaimed as valley-bottom forest in the area of the haul road and the processing area. An additional six acres of forested wetland and riparian habitat will be created along Dean Creek. Storedahl will create approximately 22 acres of forested wetland as the existing ponds 1 through 4 are narrowed and reclaimed. Along the edges of the new ponds, an additional 32 acres of emergent wetland will be created, and somewhat less than one acre of existing emergent wetland in the expanded mining area will be preserved. At the end of the 25-year-term of the ITP (following reclamation), there will be approximately 64 acres of open water in the new ponds and 38 acres of open water in the reconfigured existing ponds. These activities will result in a total of approximately 114 acres of valley-bottom forest, 52 acres of forested wetland, 32 acres of emergent wetland, and 102 acres of open water on the 300-acre Daybreak site. These numbers compare to current site conditions of 8 acres of upland forest, 24 acres of forested wetlands, 2 acres of emergent wetlands, and 64 acres of open water (see Table 1).

Table 1. Comparison of existing and proposed habitat acreages.	Existing (acres)	Proposed (acres)
Upland Forest	8	114
Forested Wetlands	24	52
Emergent Wetlands	2	32
Open Water	64	102

1.2.4 Mining Sequence

Storedahl will mine in phases, with reclamation and habitat enhancement implemented sequentially on each phase. Seven phases are planned, each expected to have a life span of approximately one to three years. The expected span of the project depends on market demand for aggregate products and the rate at which different areas of the site are mined and subsequently reclaimed. Based on current and projected demand for the aggregate products, the expected span of the mining project ranges from 10 to 15 years.

The expanded mining will be conducted in a sequence designed to expedite selected conservation and enhancement measures. Storedahl will conduct those reclamation measures deemed important to minimizing avulsion risks, habitat enhancement, and aesthetics first. Details of the mining sequence can be found on Page 3-121 of the Final HCP (Storedahl 2003).

1.2.5 Final Use

Storedahl will implement, sequentially or at completion of all mining, reclamation and habitat enhancement, establish conservation easement(s) and place the property in the hands of a private, non-profit organization(s) to ensure that the property will enhance the extensive open space and greenbelt reserve along the East Fork Lewis River. The primary use will be for fish and wildlife habitat with a secondary element including limited recreation and education.

Establishment of a mixed forest environment that maximizes vegetative screening, riparian shading, enhanced wetlands, and other habitat values is the major goal of the reclamation plan. Reclamation is planned to be sequential; Storedahl will plant of those areas not scheduled for mining as soon as the site is permitted by the County. This will allow 10 to 15 years to establish a substantial amount of the mixed forest before mining and reclamation are completed. Under the conservation reserve use, the property will have a trail connecting the Clark County parcels to the south and east with the neighboring property to the west. This will provide access for future continuation of the East Fork trail system, while minimizing disruption of the reclaimed habitat.

1.2.6 Integrated Conservation Measures

The Daybreak site conservation plan is comprised of a suite of conservation measures, each of which is fully described in the Storedahl HCP (Storedahl 2003), and the Services FEIS (USFWS and NMFS 2003). The HCP divides the measures into four distinct categories: (1) water quality conservation measures designed to offset or compensate for impacts to surface water quality from mining operations; (2) water quantity conservation measures designed to augment Dean Creek and East Fork Lewis River flows; (3) channel avulsion conservation measures designed to a) prevent avulsion of the East Fork Lewis River into the existing or proposed gravel ponds, and b) offset impacts of an avulsion event, and; (4) species and habitat conservation measures designed to enhance floodplain functions.

Storedahl will implement some measures prior to initiation of mining activities, while other measures will be initiated concurrent with mining activities. The implementation of each conservation measure includes the use of specific monitoring and evaluation measures and consultation with the Services, the Lower Columbia Fish Recovery Board (LCFRB), and other appropriate agencies, such as the Washington State Department of Ecology (WDOE), the WDFW, and Clark County.

1.2.6.1 Water Quality Conservation Measures

1.2.6.1.1 Wash-Water Clarification Process. During the first three years of implementing the HCP, Storedahl will develop a site-specific, closed-loop clarification system to eliminate process water discharge and reduce turbidity. A closed-loop system will remove solids from the process water and re-circulate this water within the closed-loop system. Solids will be removed after they settle out, and a belt press or other suitable system will be used to decrease the water content in the solids. Water from the press will be re-circulated to the treatment system. Ninety-three acre feet per year (afy) of water will be used or lost through processing, conveyance loss, and evaporation of the recycled pond water during the wet processing phase, allowing for the transfer of 237 afy to the state trust. With implementation of the closed-loop clarification system, the water used for processing will be reduced from 93 afy to 45 afy, but an additional 30 afy will be used to irrigate the new upland forest for seven years, allowing the transfer of an additional 48 afy to the state trust. The final design of the closed-loop system will be developed in consultation with the Services and WDOE, and all other appropriate permitting agencies. The closed-loop system will be used to treat all process water from mining and processing activities at the Daybreak site, as soon as approved by the Services and WDOE. Monitoring for this conservation measure will be conducted as described in the Monitoring and Evaluation Measures identified in Chapter 5 of the HCP.

1.2.6.1.2 Storm Water and Erosion Control Plan and Storm Water Pollution Prevention Plan (SWPPP/ESC). The plans that comprise this conservation measure are subject to approval and oversight by WDOE, and are required components of Storedahl's National Pollution Discharge and Elimination System (NPDES) general permit. The complete text of Storedahl's SWPPP/ESC is provided in Technical Appendix D of the HCP (Storedahl 2003). As detailed in the SWPPP/ESC, Storedahl will:

- Sequentially develop and reclaim ponds and create wetlands to minimize the area susceptible to erosion;

- Prevent turbid surface water discharge (from active mining and reclamation sites) from reaching Dean Creek and the East Fork Lewis River by isolating the sites or by conducting mining and reclamation during May through September when surface water is not discharged to Dean Creek via the Pond 5 outlet;

- Use created ponds for settling and detention of storm water;

- Implement operational Best Management Practices (BMPs) to prevent or reduce water pollution including: use of a conveyor to transport mined aggregate whenever possible; maintain a trained, on-site, pollution prevention team; implement preventive maintenance; develop and periodically update a spill prevention and emergency cleanup plan; train employees about the SWPPP/ESC; and inspect on-site erosion and sediment control measures and maintain a log of observations;

- Implement source control BMPs, including temporary and permanent seeding of exposed soils, shaping of slopes above the water to a maximum of 3 to 1 slope, and maintenance of appropriate road surfacing; and

- Implement structural BMPs including measures to divert flows from exposed soils, store flows, and limit runoff and the discharge of pollutants from exposed soils on the site. This will include the use of silt fences, straw bale barriers, drainage ditches, sediment ponds, and rock outlet protection.

1.2.6.2 Water Quantity Conservation Measures

1.2.6.2.1 Donation of Water Rights. Contingent on approval of an application for change of water rights from agricultural to industrial use by WDOE, 237 acre-feet per year (afy) of water rights on the property will be donated to the State Trust for the enhancement of instream flows in the East Fork Lewis River and Dean Creek, in perpetuity. All water rights associated with the property (total of 330 afy) will be transferred to the State Trust for instream flow purposes at the completion of processing operations or the term of the ITP, whichever comes first. The transfer of the water right to the State Trust is based on the condition that the water will be used for instream flow purposes only.

1.2.6.2.2 Water Management Plan. Water from existing Pond 5 will be managed to provide seasonal benefits to Dean Creek. Surface-water discharge between and from the ponds will be controlled by site grading and pond construction (berm construction, outlet elevation, and placement of fine sediments). Surface outflow from Pond 5 will be restricted to a single location and controlled by installation of a gravity-fed outlet structure at the northwest corner of Pond 5. Use of the controlled pond levels and the single release point will direct pond discharge directly to Dean Creek during the fall, winter, and spring. Storedahl will construct an emergency spillway to allow spilling of water from Pond 5 during high-water conditions. The spillway invert elevation will be set to control outflows from the pond and potential inflows from the East Fork Lewis River during floods with less than approximately a 17-year return period.

During warmer months (May through September), Storedahl will close the gravity-fed outlet structure, and will pump an average flow of 0.3 cubic feet per second (cfs) from the bottom of Pond 5 or Pond 3 to augment flow in Dean Creek below J. A. Moore Road. The pump will draw cool water from the bottom of the pond and spill the water onto cobbles and boulders to dissipate energy and aerate the water. The location of the discharge to Dean Creek will depend on where summer flow is subsurface and the permeability characteristics of the channel bed. If the temperature of the pond water discharge exceeds the temperature in Dean Creek during the summer, Storedahl will stop direct discharge to Dean Creek.

1.2.6.3 Channel Avulsion Conservation Measures

Channel avulsion in the East Fork Lewis River is as likely to occur during the next season of high flows as it is at any time during the permit term. The effects of avulsion are detailed below. Knowing the effects of avulsion on listed and unlisted species, Storedahl developed the following measures to minimize and mitigate the effects of take on those species that would follow from the effects of avulsion.

1.2.6.3.1 Conservation and Habitat Enhancement Endowment. Storedahl will establish a conservation and habitat enhancement endowment and contribute up to $1,000,000 into the endowment, control of which will be conveyed to a non-profit organization at the completion of all reclamation and habitat enhancement at the end of the 25-year-term of the ITP. The endowment funds will be generated solely by a surcharge of seven cents on each ton of sand and gravel mined from the Daybreak site and sold by Storedahl. Storedahl will place the endowment funds in a dedicated account to accrue surcharge deposits and earnings or interest. Interest accrual will remain in the dedicated account. The endowment will be irrevocable and can be used only by non-profit organizations for the specified purposes at the completion of the reclamation of disturbed areas as specified in the HCP (or as it may be amended or subject to concurrence of the USFWS and NOAA Fisheries). Should the Daybreak Site be conveyed to a non-profit organization after all mining and conservation measures have been implemented, but before the term of the HCP is complete, then the endowment funds may be used to monitor and, as necessary, adaptively manage the Site under the applicable conservation and habitat enhancement measures on the property. Endowment funds will first be dedicated to habitat monitoring, management, and response to changed circumstances (*e.g*., avulsion) within the HCP area. Any interest, dividends or related income earned on the endowment fund will also be available to supplement the Conservation Easement conservation measure, at the discretion of the endowment trustee and in consultation with the Services and the LCFRB, for enhancement of floodplain ecological functions within the HCP area and the East Fork Lewis River basin.

1.2.6.3.2 Native Valley-Bottom Forest Revegetation. Storedahl will restore approximately 134 acres of native vegetation typical of early-successional mixed conifer and hardwood forest (106 acres) and forested wetland (28 acres). Restoration will occur within the FEMA-designated 100-year floodplain, along the existing and created ponds, and in the upland areas outside the FEMA-designated 100-year floodplain to increase bank resistance and to provide overbank roughness elements in the vicinity of the Daybreak site.

1.2.6.3.3 Floodplain Reestablishment Between Dean Creek and the Created Ponds. The floodplain along the eastern bank of Dean Creek will be reestablished through regrading and contouring to create a series of low terraces to provide overbank functions. Storedahl will plant these terraces with species typical of the native riparian zone to enhance stability and flow resistance during high flows.

1.2.6.3.4 Mining and Reclamation Designs to Reduce the Risk of an Avulsion and to Ameliorate Negative Effects of Potential Flooding or Avulsion of the East Fork Lewis River into the HCP

Area. New ponds created by future gravel extraction at the Daybreak site will be designed and reclaimed in a manner that enhances site stability and creates potential off-channel habitats in the event that an avulsion should occur. Storedahl will substantially alter the existing Daybreak ponds to minimize the potential for avulsion and to reduce potential adverse environmental impacts associated with an avulsion into floodplain gravel pits.

- Ponds developed in Phases 3, 4, 5, 6, and 7 will be excavated or reclaimed so that the length exceeds the width and they will be oriented roughly parallel to the East Fork Lewis River;

- The Phase 1 and 2 excavations will be reclaimed as emergent wetland and valley-bottom forest;

- The slope of the pond margins will vary from 2 to 1 slope to 10 to 1 slope; with at least 50% of the new pond margins shaped to a slope of greater than or equal to a 5 to 1 slope following excavation;

- The existing Ponds 1, 2, 3, and 4 will be significantly shallowed, narrowed, reshaped, and the shoreline revegetated as emergent and forested wetlands;

- The buffers between the existing ponds and the river channel and between the existing ponds and the new ponds will be expanded and vegetated; and

- Native valley-bottom forest vegetation will be established on the pond margins and berms left between the ponds to provide shade and enhance bank stability.

1.2.6.3.5 Contingency Plan for Potential Avulsion of the East Fork Lewis River into the Existing or Proposed Gravel Ponds. Storedahl will implement a contingency plan to prevent and mitigate for avulsion of the East Fork Lewis River into the gravel ponds on the Daybreak site, when it occurs during the permit term. Three sites have been identified that represent the most probable future avulsion paths (Sites G, H, and J on Figure 3-33 of the HCP). As a proactive measure to reduce the likelihood of the river shifting to the relic channel adjacent to site G, Storedahl will place Large Woody Debris (LWD) in rows or debris jams within the floodplain between the river (site C on figure 3-33 of the HCP) and the Storedahl Pit Road.

In addition, sites G, H, and J will be monitored for bank stability conditions, as described in section 5.3.8 of the HCP. If target bank stability conditions are exceeded, Storedahl will implement preventive solutions. Solutions may include biotechnical techniques, hydraulic techniques, and/or structural controls. The specific techniques employed will depend on the nature and location of the identified avulsion threat. Preventive solutions will be designed in consultation with Clark County, WDFW, and all appropriate permitting agencies and approved by the Services prior to construction. Construction activities will be initiated prior to the high flow season (dependent on receipt of all appropriate permits) after the bank stability target conditions are exceeded.

When the East Fork Lewis River avulses into the existing or proposed gravel ponds, mitigation measures will be implemented as part of this conservation measure. These measures include rapid response to:

- Assess the potential for direct take of covered fish species that would be stranded in isolated or shallow water, and coordinate efforts with the Services, WDFW, and the LCFRB to transfer stranded fish back into the main channel, as appropriate;

- Assess the potential of redirecting flow back into the pre-avulsion channel and the associated benefits to the covered species of this action based on the observed conditions and the results of the Ridgefield Pit Study; if the benefits of redirecting the flow are sufficient, engineering solutions will be implemented in consultation with the Services, LCFRB, and other appropriate agencies;

- Assess the potential of enhancing or restoring lost steelhead and chinook salmon spawning habitat based on the observed conditions and the results of the Ridgefield Pit Study, and if appropriate, implement enhancement or restoration of spawning habitat in consultation with the Services, LCFRB, and other appropriate agencies; potential actions could include development of a spawning channel in the abandoned reach (if feasible);

- Modify conservation and monitoring measures that are affected by the avulsion, as appropriate; if avulsion negates or modifies the need for conservation or monitoring measures, then funds for these measures will be redirected to restoration efforts associated with the avulsion event.

1.2.6.3.6 Study of the Ridgefield Pits and East Fork Lewis River. Storedahl will initiate a study to assess the conditions within a recent channel avulsion through the Ridgefield Pits (located south of the Daybreak site) on salmonid habitat in the East Fork Lewis River. Study components will include:

- Fish habitat surveys of the East Fork Lewis River between River Mile (RM) 6 and RM 13;

- Observations of fish use in the East Fork Lewis River between RM 6 and RM 13;

- Monitoring of temperature and dissolved oxygen (DO) in the avulsed reach;

- Assessment of channel shape, pool volume, and sediment infill rates; and

- Participation in and assessment of planned habitat restoration efforts.

1.2.6.4 Species and Habitat Conservation Measures

1.2.6.4.1 Off-site Floodplain Enhancement Labor, equipment, and/or materials will be provided to public and private non-profit groups chosen by the LCFRB and Storedahl to enhance floodplain functions related to protection and recovery of the covered species within the East Fork Lewis River basin in locations outside of Storedahl's Daybreak Mine property boundaries. Storedahl will donate in-kind services (materials, equipment, and/or labor) up to $25,000 per year beginning in the third year of the ITP through year 12 of the ITP for a total value of $250,000. This is in addition to the $1,000,000 conservation endowment. The donated services must be used each or every other year, so that the total value of services provided in any year does not exceed $50,000. The timely use of the labor and/or services will be guaranteed by providing the services to projects that are nominated to Storedahl by the LCFRB for use on projects benefitting ongoing recovery in the East Fork Lewis River basin. All projects will be implemented in accordance with ESA and the section 4(d) rule. Project sponsors will be responsible for permitting, and access and easement agreements.

1.2.6.4.2 Conservation Easement and Fee-Simple Transfer. Following issuance of the ITP and prior to the commencement of any active mining on the Daybreak Mine Lands, Storedahl will grant a perpetual conservation easement for a portion of the Daybreak Mine Lands to a conservation organization or a government entity approved by the Services. The conservation easement will apply to the 19 acres of the Daybreak property not proposed for mining. The easement will prohibit subdivision, commercial or industrial activity, motorized recreation, and any other activities that are inconsistent with protection and recovery of the covered species.

Within 60 days following completion of reclamation on the remainder of the Daybreak property as set forth in this HCP, Storedahl will, without further consideration, convey fee title to the property to one or more conservation organizations or government entities approved by the Services. Such conveyance may be made in one or more transactions and will encompass the entire 300-acre Daybreak property following completion of all reclamation, or in a series of transactions involving smaller parcels, as reclamation is completed on such parcels, provided that the entire Daybreak property ultimately is so conveyed. Storedahl will ensure, at the time of such conveyance, that the property will be preserved as fish and wildlife habitat in perpetuity, either by means of a conservation easement, or through such other means as the Services may approve at that time. Following fee-simple transfer of the property and granting of the endowment, but no later than the completion of the 25-year-term of the ITP, the Conservation and Habitat Enhancement Endowment will be available for management of the property conveyed under this measure. However, if Storedahl, for reasons beyond its control, is unable to conduct mining activity as anticipated under this HCP, Storedahl will not convey a conservation easement with respect to such lands nor will such lands be conveyed in fee title.

1.2.6.4.3 Riparian Management Zone on Dean Creek. Storedahl will establish a two-zone, 200-foot riparian management area along the left bank (facing downstream) of Dean Creek. The inner zone will be a minimum of 75 feet in width. No excavation for mineral resources will occur in the inner zone. The inner zone will be regraded to create a series of low terraces upwards from the Ordinary High Water Mark (OHWM) to reduce or eliminate the likelihood that Dean Creek will avulse into the Daybreak ponds. Existing native shrubs and trees in the inner zone will be retained, where appropriate, and the entire 75-foot inner zone will be revegetated as native valley-bottom forest or streambank vegetation. The inner management zone is designed primarily to enhance channel habitat and protect Dean Creek during Phase 1 mining impacts. Following Phase 1A and 1B mining in the area adjacent to the inner management zone, the outer management zone of a minimum 125 feet will be filled with imported and/or processing by-product material and then revegetated as native valley-bottom vegetation within five years of implementation of the ITP. After the inner and outer zone are revegetated, no disturbance or heavy equipment operation will be allowed in the entire 200-foot riparian management zone along the left bank of Dean Creek.

1.2.6.4.4 In-channel Habitat Enhancement in Select Reaches of Dean Creek. After Storedahl reestablishes floodplain terraces on the east bank of Dean Creek, habitat in Dean Creek will be re-surveyed and LWD will be added to the pool-riffle reach downstream of the J. A. Moore Road and upstream of the palustrine channel in the downstream reach. Designs for site specific log placements will be developed by year six following issuance of the ITP and other permits (five years after reestablishment of the floodplain terraces), which will allow riparian vegetation sufficient time to develop root systems that will resist lateral scour. Site-specific designs will be developed to improve low-flow habitat quality by enhancing pool scour and to improve winter rearing habitat by increasing cover in pools. In-channel log structures will consist of key pieces of conifer logs that are at least 88 cubic feet in volume (*e.g*., 22-inches diameter and 30-feet long) at a frequency of greater than one piece per 72 feet of channel. Storedahl will submit a plan with details on site-specific log placements to the Services and WDFW for review and approval prior to implementation.

1.2.6.4.5 Shallow Water and Wetland Habitat Creation. Storedahl will create and preserve approximately 84 acres of wetlands, including forested wetland (52 acres) and emergent wetlands (32 acres), on the Daybreak site. Along the wetted edges and in the shallow water, structural elements will be incorporated into the ponds to provide substrate and cover for a variety of organisms, including invertebrates, amphibians, and fish. The structural elements will consist of submerged tree crowns that are 20- to 30-feet long placed along the submerged sloping perimeter of the ponds. The tree crowns will be anchored with rocks to keep them in place and prevent flotation to the surface. Placement will average approximately one tree crown per 100 feet of shoreline, although the spacing will be irregular.

1.2.6.4.6 Control of Non-native Predatory Fishes. The frequency of backwater flood flows from the East Fork Lewis River into Pond 5 will be reduced by reconfiguring the southern and western berms around Pond 5 and by installing a single outlet from Pond 5 for surface water. Concurrently, the quantity of existing and potential habitat available to non-native predatory fishes in the existing Daybreak ponds will be reduced by significantly narrowing ponds 1, 2, 3, and 4. Target harvests of non-native predatory fishes to reduce their numbers in the existing ponds will occur under the direction of WDFW warmwater fish biologists in years 5, 10, and 15 following implementation of covered activities and the issuance of any other required permits. Storedahl will install rock barriers to restrict movement of fish between the existing and created pond.

Educational signs will be installed to warn the public about the dangers of releasing non-native fish species to the ponds and the adjacent stream and river.

1.2.6.4.7 Control Public Access. Storedahl will control public access to the site by decommissioning unnecessary roads, placing vehicle barriers, and developing foot trails. During the operational phase of the mining and processing, on-site security agents will be instructed to restrict trespassing in sensitive areas.

1.2.6.4.8 Monitoring and Reporting. The HCP monitoring and evaluation program (Chapter 5 of the HCP) is designed to: (a) ensure that the HCP's conservation measures comply with appropriate design standards; (b) assess the impacts of the project and associated conservation measures on covered species; and (c) provide information to guide the adaptive management process during the implementation of the conservation measures.

Specifically, monitoring measures in the HCP include: (a) an evaluation of effects of conservation measures on water quality; (b) documentation that wetland plants, ponds, and vegetated areas are constructed, maintained, and reclaimed as stipulated; (c) an assessment of plant survival and vigor and the relative degree of bank stability associated with riparian revegetation and bank stabilization projects; (d) monitoring of channel and habitat changes in Dean Creek that result from stream and riparian conservation measures; and (e) monitoring of changes in the East Fork Lewis River channel migration rate, channel location, and bank stability.

1.3 Description of the Action Area

The action area for this biological and conference opinion, by regulation (50 CFR 402.02), includes "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action." The proposed Federal action, in this case, is the issuance of an ITP under section 10 of the Act. The HCP area (described in detail in the HCP) consists of approximately 300 acres owned by Storedahl, which includes:

- Approximately 101 acres affected by proposed gravel mining in the terrace above the FEMA-designated 100-year floodplain;

- Approximately 87 acres affected by current gravel processing, haul roads, and existing ponds; and

- The remaining 112 acres affected by preservation, site reclamation and rehabilitation.

The action area also includes all locations where actions will take place to minimize or mitigate the effects of Storedahl's mining and reclamation on the covered species. These locations include:

- The mainstem and all side channels of the East Fork Lewis River (inundated at flows less than or equal to the 100-year event), from approximately one mile upstream of the project area (RM 10) downstream to the area of tidal influence (RM 5.9);

- Dean Creek, from J. A. Moore Road to its confluence with the East Fork Lewis River;

- The locations of on-site instream and riparian restoration, enhancement, and monitoring projects;

- The new open water ponds and emergent wetlands formed by mining;

- The existing ponds; and

- All Storedahl lands within the Daybreak Mine site near the East Fork Lewis River at RM 8.0.

1.4 Changed Circumstances

The HCP covers Storedahl's expanded mining and habitat enhancement activities at the Daybreak site under ordinary circumstances. In addition, Storedahl and the Services foresee that circumstances could change during the term of this HCP. "Changed circumstances" mean a change or changes in the circumstances affecting a covered species, or the HCP area, that can reasonably be anticipated by Storedahl and the Services, and that has been planned for in the HCP. Changed circumstances are different than unforeseen circumstances because they can be anticipated, and can include natural events such as wind, catastrophic floods, and channel avulsions. The ITP will authorize the incidental take of covered species under ordinary circumstances as well as these changed circumstances, so long as Storedahl is operating in compliance with this HCP, the ITP and the IA. If additional mitigation measures or costs beyond those provided in this HCP are deemed necessary to respond to any changed circumstances, the Services will not require any such measures or costs of Storedahl without Storedahl's prior consent.

These changed circumstances and supplemental prescriptions are described below and in section 2.1.2.3 of the HCP (Storedahl 2003). The general Habitat Conservation Measures that these measures would supplement are described in the Integrated Conservation Measures (section 1.2.6) of this Opinion.

Wind

Trees damaged or toppled by wind will not be removed within the rehabilitated valley-bottom forest, wetland, and riparian management areas. Damaged or toppled trees that could compromise the integrity of the conservation elements would, if necessary, be relocated and used as aquatic or terrestrial habitat enhancement within the HCP area.

Storedahl will reforest areas damaged by wind in the valley-bottom forest, wetland, and riparian management areas if Storedahl and the Services determine reforestation is necessary to protect water quality or achieve the mitigation objectives of the HCP for one or more covered species.

Flood

The existing gravel ponds and portions of the HCP area are within the FEMA-designated 100-year floodplain of the East Fork Lewis River. All future mining will be located outside of the FEMA-designated 100-year floodplain, where it is at less risk of flooding or erosion. Several conservation measures address potential effects of flooding, including storm water and erosion control (CM-02), channel avulsion conservation measures (CM-04, CM-05, CM-06, CM-07, and CM-08), and control of non-native fish (CM-12). Following flood events, each of these measures will be monitored to ensure they are effective.

Channel Avulsion

Avulsion is defined as "a significant and abrupt change in channel alignment resulting in a new stream or river course." Avulsions can occur during extreme flood events, and their likelihood can be increased due to the presence of gravel mines in the floodplain. In recent years, two instances of avulsion in the vicinity of the HCP area have been documented within the channel migration zone. An evaluation of the future avulsion potential near the HCP area identified the five most likely locations where an avulsion could occur (HCP Technical Appendix C). Five channel avulsion conservation measures (CM-04, CM-05, CM-06, CM-07, and CM-08) address this potential for avulsion.

Permitting by State and Local Agencies

Many of the conservation measures of the Daybreak Mining and Habitat Enhancement project require the subsequent issuance of other Federal or state and local permits. If some conservation measures are not implemented or the project does not proceed, in whole or substantial part, due to the failure of other Federal, state, or local agencies to issue permits necessary to implement the conservation measures or conduct mining as outlined in the HCP, then Storedahl will, in consultation with the Services, implement those measures that are commensurate with the level of take that occurred as a result of the project, and for which Storedahl received incidental take coverages under the ITP. If no mining takes place, it is likely that Storedahl will carry out some of the conservation measures due to reclamation requirements by other agencies for impacts to the environment from previous activities and existing site conditions. If some mining occurs but not as anticipated under the proposed action, then Storedahl will, in consultation with the Services, implement those measures to account for the mitigation of take that was caused by Storedahl's activities.

Eminent Domain Affecting Lands within the HCP Area

The Storedahl HCP area is adjacent to private land and lands owned by local government. The land is transected by utility lines and a county road. It is likely one or more parties have the authority to acquire or affect lands within the HCP area for the purpose of creating or extending the existing road, public utility, or other public purpose. This could occur through eminent domain, or through voluntary transfer by Storedahl under threat of eminent domain. In the event lands within the HCP area are acquired or affected by any exercise of the power of eminent domain, Storedahl will not be obligated by the HCP or ITP to replace any mitigation that would be provided by such lands. The incidental take coverage for such lands and corresponding HCP obligations may, at the discretion of the Services, be negotiated with and transferred to the recipient of such lands.

2.0 ENDANGERED SPECIES ACT BIOLOGICAL OPINION

The purpose of consultation under section 7 of the ESA is to allow the Services to develop a biological opinion as to whether a proposed Federal action will likely result in jeopardy to listed species, or adversely modify or destroy their designated critical habitat.

2.1 Evaluating Proposed Actions

The standards for determining jeopardy as set forth in section 7(a)(2) of the ESA are defined by 50 CFR 402.02 (the consultation regulations). In conducting analyses of habitat-altering actions under section 7 of the ESA, NOAA Fisheries uses the following steps, and when appropriate, combines them with the Habitat Approach (NMFS 1999): (1) Consider the biological requirements of the listed species; (2) evaluate the relevance of the environmental baseline in the action area to the species' current status; (3) determine the effects of the proposed or continuing action on the species; and (4) determine whether the species can be expected to survive with an adequate potential for recovery under the effects of the proposed or continuing action, the effects of the environmental baseline, and any cumulative effects, and considering measures for survival and recovery specific to other life stages. In completing this step of the analysis, NOAA Fisheries determines whether the action under consultation, together with cumulative effects when added to the environmental baseline, is likely to jeopardize the ESA-listed species.

The fourth step above requires a two-part analysis. The first part focuses on the action area and defines the proposed action's effects in terms of the species' biological requirements in that area (*i.e.*, effects on essential habitat features). The second part focuses on the species itself. It describes the action's effects on individual fish, or populations, or both, and places these effects in the context of the ESU as a whole. An ESU is considered a distinct population segment which can be afforded the protections of the ESA, based on its importance to the species genetic diversity. If jeopardy would result, step 5 is the identification by NOAA Fisheries of possible reasonable and prudent alternatives for the action that avoid jeopardy.

2.1.1 Biological Requirements

The first step in the jeopardy analysis is to define the species' biological requirements. The biological requirements are those conditions necessary for Lower Columbia River (LCR) chinook, Columbia River (CR) chum, Lower Columbia River (LCR) steelhead, and Lower Columbia/Southwest Washington (LC/SW) coho to survive and recover to adequate naturally-reproducing population levels, at which time protection under the ESA would become unnecessary. Adequate population levels must safeguard the genetic diversity of the listed stocks, enhance their capacity to adapt to various environmental conditions, and allow them to become self-sustaining in the natural environment.

For actions that affect freshwater habitat, NOAA Fisheries usually describes the habitat portion of a species' biological requirements in terms of a concept called properly functioning condition (PFC). Properly functioning condition is defined as the sustained presence of natural, habitat-forming processes in a watershed that are necessary for the long-term survival of the species through the full range of environmental variation (NOAA Fisheries 1999). Properly functioning condition, then, constitutes the habitat component of a species' biological requirements. Pacific salmonid survival in the wild depends upon the proper functioning of ecosystem processes, including habitat formation and maintenance. Restoring functional habitats depends largely on allowing natural processes to increase their ecological function, while at the same time removing adverse effects of current practices or conditions.

Biological requirements for all anadromous salmonids include adequate substrate, water quality, water quantity, water temperature, water velocity, cover/shelter, food, riparian vegetation, space and safe passage conditions. Good summaries of the environmental parameters and freshwater factors that comprise habitat for salmonids can be found in: Barnhart 1986; Bjornn and Reiser 1991; Botkin *et al.* 1994; Groot and Margolis 1991; NRC 1996; NOAA Fisheries status reviews (see Table 2 in this Opinion); Meehan 1991; Nehlsen *et al.* 1991; Stouder *et al.* 1997; and Spence *et al.* 1996.

The East Fork Lewis River within the action area serves as a rearing, spawning and migration area for juvenile and adult species considered in this Opinion. The biological requirements that the proposed project would affect are substrate, water quality, water quantity, water temperature, food, safe passage conditions and riparian vegetation.

2.1.2 Status and Generalized Life History of Covered Species

NOAA Fisheries also considers the current status of the listed species, taking into account population size, trends, distribution, and genetic diversity. To assess the current status of the listed species, NOAA Fisheries starts with the determinations made in its decision to list the species for ESA protection and also considers new data available that is relevant to the determination.

Eight aquatic species and one terrestrial species have been proposed for coverage and conservation under the ESA through the provisions of the Storedahl HCP and IA (Storedahl 2003). Of the eight fish species, four species are under NOAA Fisheries jurisdiction. These species are listed in Table 2 along with their pertinent history of ESA decisions, designations of critical habitat, and status reviews. The effects of the proposed action on all other aquatic and wildlife species are addressed in the USFWS Biological Opinion and Conference Report (USFWS 2004).

Table 2. References to Federal Register Notices and Status Reviews Containing Additional Information Concerning Listing status, Biological Information, and Critical Habitat Designations for Listed Species Considered in this Opinion.

Species	**Listing Status Reference**	**Critical Habitat Reference**	**Biological Information**
Lower Columbia River (LCR) chinook salmon (*Oncorhynchus tshawytscha*)	Threatened Species, (March 24, 1999, 64 FR 14308)	No Critical Habitat Designated	Myers *et al.*1998
Columbia River (CR) chum salmon (*O. keta)*	Threatened Species, (March 25, 1999, 64 FR 14508)	No Critical Habitat Designated	Johnson *et al* 1997
Lower Columbia River (LCR) steelhead *(O. mykiss)*	Threatened Species, (March 19, 1998, 63 FR 13347)	No Critical Habitat Designated	Busby *et al.* 1996
Lower Columbia/Southwest Washington (LC/SW) coho salmon *(O. kisutch)*	Candidate Species, (July 25, 1995, 60 FR 38011)	No Critical Habitat Designated	Weitkamp *et al.* 1995

2.1.2.1 Lower Columbia River Chinook Evolutionarily Significan Unit

West coast chinook salmon have been the subject of many Federal ESA listing actions, which are summarized in the proposed rule (March 9, 1998, 63 FR 11482) and in a final rule for listing chinook ESUs in Washington and Oregon (March 24, 1999, 64 FR 14308). A complete status review conducted by NOAA Fisheries (Myers *et al.* 1998) identified fifteen ESUs from Washington, Oregon, Idaho, and California. Based on this review, and after receiving additional comments and information, LCR chinook salmon were listed as a threatened species under the ESA on March 24, 1999 (64 FR 14308).

2.1.2.1.1 Status. In Washington State, the LCR chinook salmon ESU includes all naturally spawned chinook populations from the mouth of the Columbia River to the Cascade Crest and includes spring-run and fall-run populations. The NOAA Fisheries draft updated status review of chinook salmon, *Preliminary conclusions regarding the updated status of listed ESUs of West Coast salmon and steelhead* (NMFS 2003a), indicates that LCR fall chinook salmon populations are currently dominated by large scale hatchery production, relatively high harvest (200 million fish from outside the ESU have been released since 1930 (Myers *et al.* 1998)) and extensive habitat degradation due to hydropower development projects, urbanization, logging and agriculture. Spring-run populations are largely extirpated as the result of dams which block access to their high elevation habitat. Abundance trend indicators for most of the populations are negative, especially if hatchery fish are assumed to have a reproductive success equivalent to that of natural origin fish. There have been at least six documented extirpations of populations in this ESU, and other extirpations may have been masked by naturally spawning hatchery fish (*Ibid.*).

There are two distinct spawning populations of fall-run chinook salmon, early and late. The early segment spawns in October, while the late segment spawns in November through January. The early run fish are often referred to as “tules” distinguished by their dark skin coloration and advance state of maturation at the time of river entry (*Ibid.*). The late fall run fish are much less mature when they enter the spawning streams, and are referred to as “brights.” These fish are the more desirable sport catch.

The abundance of natural origin spawners range from completely extirpated for most of the spring-run populations to over 6,500 for the Lewis River bright population. The majority of the fall-run tule populations have a substantial fraction of hatchery origin spawners in the spawning areas and are hypothesized to be sustained largely by hatchery production. It is important to note that estimates of the fraction of hatchery origin fish are highly uncertain since the hatchery marking rate for LCR fall chinook is generally only a few percent and expansion to population hatchery fraction is based on only a handful of recovered marked fish (NMFS 2003a). Naturally reproducing (but not necessarily self-sustaining) populations of LCR chinook salmon include the Lewis and Sandy River “bright” fall runs and the “tule” fall runs in the Clackamas, East Fork Lewis and Coweeman Rivers. Natural production of LCR chinook salmon has been substantially reduced over the last century and long- and short-term trends in abundance of individual populations are negative (*Ibid.*).

The Lewis River late-fall chinook population is the healthiest in the ESU and has a reasonable probability of being self-sustaining (*Ibid.*). However, the population is geographically confined to a reach that is only a few kilometers in length and is immediately below Merwin Dam on the North Fork Lewis River, where it is affected by the flow management of the hydrosystem. This limited spatial distribution is a potential risk factor (*Ibid.*).

2.1.2.1.2 Life History. Chinook salmon are the largest of the Pacific salmon, and can achieve weights of over 100 pounds, the average being closer to 22 pounds. Owing to their large body size, the presence of deep holding water and sufficient discharge are vital for upstream migration. Larger body size also allows the fish to utilize larger spawning gravel and cobble substrates (Raleigh *et al.* 1986). The species’ distribution historically ranged from the Ventura River in California to Point Hope, Alaska in North America (Healey 1991). Additionally, chinook salmon have been reported in the Mackenzie River area of northern Canada.

Of the Pacific salmon, chinook salmon exhibit arguably the most diverse and complex life history strategies. Healey (1981) described 16 age categories for chinook salmon, seven total ages with three possible freshwater ages. This level of complexity is roughly comparable to sockeye salmon (*O. nerka*), although sockeye salmon have a more extended freshwater residence period and utilize different freshwater habitats (Miller and Brannon 1982, Burgner 1991). Two generalized freshwater life-history types were initially described by Gilbert (1912): "stream-type" chinook salmon reside in freshwater for a year or more following emergence, whereas "ocean-type" chinook salmon migrate to the ocean within their first year. Healey (1991) has promoted the use of broader definitions for "ocean-type" and "stream-type" to describe two distinct races of chinook salmon. This racial approach incorporates life history traits, geographic distribution, and genetic differentiation and provides a valuable frame of reference for comparisons of chinook salmon populations.

The generalized life history of Pacific salmon involves incubation, hatching, and emergence in freshwater, migration to the ocean, and subsequent initiation of maturation and return to freshwater for completion of maturation and spawning. Juvenile rearing in freshwater can be minimal or extended. Additionally, some male chinook salmon mature in freshwater, thereby foregoing emigration to the ocean. The timing and duration of each of these stages is related to genetic and environmental determinants and their interactions to varying degrees. Salmon exhibit a high degree of variability in life-history traits; however, there is considerable debate as to what degree this variability is the result of local adaptation or the general plasticity of the salmonid genome (Healey 1991, Taylor 1991). More detailed descriptions of the key features of chinook salmon life history can be found in Myers et al. (1998) and Healey (1991).

The incubation time of chinook salmon embryos varies with water temperature. Chinook eggs hatch in about 159 days at 3°C, and in 32 days at 16°C (Healey 1991). Prior to emerging, the young remain in the gravel for two to three weeks after hatching (Wydoski and Whitney 1979). Many variations in juvenile life history are possible within the fall run alone. Some juvenile fish may move into the ocean quickly, while others depend on extended rearing in the streams or estuaries (Reimers 1973). Environmental cues such as streamflow reductions, food supply, changes in photo-period, and temperature increases are all factors that lead to the evolution and expression of particular juvenile outmigration timing (Myers *et al.* 1998). Chinook salmon in the Lewis River mature, on average, at ages 3 and 4, which is somewhat younger than other populations in Washington (Myers *et al.* 1998). In the Pacific Northwest, chinook salmon are the least abundant of the Pacific salmon species; nevertheless, this species is important economically for commercial and sport harvest (Wydoski and Whitney 1979).

2.1.2.1.3 East Fork Lewis River Chinook Salmon Population. A run of native spring chinook salmon existed at one time in the mainstem Lewis River, but dam construction has drastically reduced the population. Few if any native spring chinook salmon return to the East Fork Lewis River specifically, and there have only been occasional hatchery releases into the East Fork Lewis River from a variety of stock sources (WDF and WDW 1993). The East Fork Lewis River was historically used primarily by fall chinook (Fulton 1968). Fall chinook salmon escapements in the East Fork Lewis River averaged 598 between 1967 and 1991 (WDF and WDW 1993) and 248 between 1991 and 2000 (NMFS 2003a).

Spring-run chinook salmon, which are believed to be strays from the North Fork Lewis River (*Ibid.*) return to the East Fork Lewis River between May and July, hold in deep pools, and spawn during August and September. Fall-run chinook return during September and October and spawn predominately during October and November, but late spawning may occur into January. Approximately 22 miles of the East Fork Lewis River are available for spawning by chinook salmon. In particular, fall chinook salmon spawn in a 4.2-mile section of the East Fork Lewis River from Daybreak Park (RM 10.2) upstream to Lewisville Park (RM 14.4) (EnviroScience 1996). The upstream barrier to chinook salmon migration in the East Fork Lewis River is Lucia Falls (RM 21.3) (Rawding 1999). Juvenile chinook salmon in the East Fork Lewis River system generally emerge from the gravels between December and May. Little is known about chinook salmon rearing behavior in the East Fork Lewis River, but some juveniles may move to the ocean quickly, while others rear in streams and estuaries for up to a year (Myers *et al.* 1998). Those that over-winter in freshwater tend to be found in deep pools in the mainstem and interstitial spaces of the substrate (*Ibid.*).

2.1.2.2 Lower Columbia River Steelhead Evolutionarily Significant Unit

Steelhead trout display perhaps one of the most the most diverse life history pattern of all Pacific salmonids. Their native distribution extends from the Alaska Peninsula to northern Mexico. Two different genetic groups (coastal and inland) of steelhead are recognized in North America (Busby *et al.* 1996). British Columbia, Washington, and Oregon have both coastal and inland steelhead, while Idaho has only the inland form and California steelhead stocks are all of the coastal variety (*Ibid.*). Within these groups, steelhead trout are further divided based on the state of sexual maturity when they enter freshwater. Stream-maturing steelhead (also called summer steelhead) enter freshwater in an immature life stage, while ocean-maturing (or winter steelhead) enter freshwater with well developed sexual organs (*Ibid.*).

2.1.2.2.1 Status. LCR steelhead were listed as threatened under the ESA on March 19, 1998 (63 FR 13347). Only naturally spawned populations (and their progeny) residing downstream of impassable barriers are listed. The NOAA Fisheries updated draft status review of steelhead (NMFS 2003a) could not conclusively identify a single population in the ESU that is naturally self-sustaining. Most of the 23 populations (Myers *et al.* 2002) in the ESU are in decline and are at relatively low abundance (no population has a recent mean greater than 750 spawners). In addition, many of the populations continue to have a substantial fraction of hatchery origin spawners and may not be naturally self sustaining. Exceptions are the Kalama, Toutle, and East Fork Lewis winter-run populations, which have few hatchery fish spawning on the natural spawning areas. However, these populations have relatively low recent mean abundance estimates, with the largest being the Kalama River population (geometric mean of 728 spawners) (NMFS 2003a).

Several factors are responsible for the decline of LCR steelhead including habitat degradation, overharvest, predation, hydroelectric dams, hatchery introgression, and the eruption of Mount Saint Helens. Habitat degradation or elimination is mainly due to urbanization, forestry, water diversions, and mining. There is strong concern about the pervasive influence of hatchery stocks within the ESU. There is no tribal or direct commercial fishery on steelhead although incidental catch of wild steelhead may occur in the lower Columbia River fall gill-net fishery (WDF and WDW 1993, NMFS 2003a).

2.1.2.2.2 Life History. Steelhead spawn in mainstem rivers and their tributaries. Preferred spawning substrate consists of predominantly large gravel, with some small cobble (Caldwell and Hirschey 1989). Pauley *et al.* (1986) found steelhead spawning in gravel ranging from 1.3 to 11.4 centimeters in diameter. Adult fish waiting to spawn or in the process of spawning are vulnerable to disturbance and predation in areas without suitable cover that could be provided by undercut banks, submerged vegetation, deep water or turbulence.

Incubation rates vary with water temperature, but typically fry emerge 40 to 80 days after spawning. Juvenile steelhead in the East Fork Lewis River system generally emerge from the gravels between April and July. Dissolved oxygen levels at or near saturation with no temporary reductions in concentration below 5 parts per million are most suitable for incubation (Stolz and Schnell 1991). Everest and Chapman (1972) found age-0 steelhead residing over cobbles in water velocities of less than 0.5 feet per second and depths of 15 to 30 centimeters. Juvenile steelhead also utilize stream margins and submerged rootwads, debris and logs for shelter and cover while rearing (Bustard and Narver 1975).

At the watershed level, steelhead stock abundance is limited by rearing conditions in fresh water. Factors affecting the abundance of juveniles include quantity and quality of suitable habitat, abundance of food resources and ecological interactions with other fish and animals (State of Washington 1998). Both winter- and summer-run juvenile steelhead rear in freshwater for one or more years before undergoing a physiological change to become smolts and migrating to the ocean (Stolz and Schnell 1991). In the Lewis River specifically, most juvenile steelhead migrate after 2 years of rearing in freshwater (WDF 1990). Juvenile downstream migration for steelhead smolts occurs from April through June, with peak migration, in general, occurring in mid-April (Wydoski and Whitney 1979). During their first summer, steelhead fry prefer habitat along the stream margin, where velocity and depth are low. As they grow, the young fish move into deeper, swifter water, using both riffle and pool habitat (Roper *et al.* 1994). Juvenile steelhead over-winter in the interstitial spaces of the substrate or in pools with cover provided by LWD. Juvenile steelhead utilize rearing habitats in the East Fork Lewis River and possibly within certain small tributaries, such as Mason Creek and perhaps Dean Creek. Estuaries provide important nursery and schooling environments for juvenile salmon. This transition zone allows outmigrant salmonids to physiologically adapt to the seawater conditions (Seattle Regional Water Authority 1998). Most steelhead from Washington streams remain at sea for 22 months (after two years of rearing in freshwater) prior to returning to freshwater to spawn (Meigs and Patzke 1941). A significant difference between the life history of steelhead and Pacific salmon is that not all steelhead adults die after spawning. Steelhead are capable of repeat spawning, although the incidence is relatively low and specific to individual streams. Steelhead will rarely spawn more than twice before dying. Repeat spawning in Washington ranges from 4.4 to 14.0% of total spawning runs (Wydoski and Whitney 1979).

Winter-run steelhead return to the Lewis River basin from December through April and summer-run adults return between May and November (WDF and WDW 1993). Summer-run steelhead are known to arrive at spawning sites months before spawning, or they hold in mainstem rivers for weeks to months before moving into smaller tributaries to spawn (Bjornn and Reiser 1991). Large wood, instream boulders, and other structures create the necessary slow water and pool habitat needed for resting and cover during migration (Spence *et al.* 1996). The use of cold-water pools for resting could also potentially conserve energy needed for subsequent spawning by lowering the metabolic expenditures of the fish (*Ibid.*). This can be especially important for summer-run fish, because they can enter the river up to ten months prior to the spawning season. Steelhead, unlike salmon species, also need suitable habitat for feeding during their adult freshwater phase. Preferred feeding areas are slower velocity water adjacent to faster water. These areas carry food items to the fish with little need for energy expenditure by the fish (*Ibid.*). In the Lewis River, most steelhead migrate to sea after rearing for two years in freshwater habitat (WDF 1990).

2.1.2.2.3 East Fork Lewis River Steelhead Population. The East Fork Lewis River system supports wild and hatchery summer- and winter-run steelhead stocks (WDF and WDW 1993). The two stocks are differentiated by the timing of adult returns, but share common juvenile behavior patterns. The hatchery populations have advanced spawning times, which are believed to reduce their interactions with the wild fish. Winter-run steelhead return to the Lewis River basin from December through April, and summer-run adults return between May and November (*Ibid.*). Spawning occurs in the first part of January for the hatchery fish, and the native fish spawn from early March to late May or June (Rawding 1999). The available spawning habitat for steelhead was expanded in 1982 when Sunset Falls (RM 32.7) was notched to facilitate passage. Redds have been observed from the mainstem above Mason Creek (RM 7) to the headwaters above the last road (RM 40) (Rawding *et. al* 2001). Based on a 2000 WDFW trapping project, 45% of the steelhead smolts originated from the area above Lucia Falls (RM 21.3) and 55% below the falls. Most of the stream above Lucia Falls is dominated by a canyon characterized by riffles with infrequent pools and a moderate slope. This type of undisturbed channel provides excellent steelhead rearing habitat (Rich *et al.* 1992). Currently, approximately 12% of the spawning in the East Fork Lewis River occurs upstream of Sunset Falls (WCC 2000), which is not accessed by other anadromous salmonids. The reach below the Lewisville Bridge (RM 13) is characterized by deposition of fine materials and lower velocity, with gradients of less than 1.5%. Steelhead rearing habitat in this reach is likely less than in the canyon reach due to steelhead preference for the upper canyon-type channel (Scully and Petrosky 1991) and habitat degradation. Steelhead are not believed to have utilized Dean Creek for spawning either historically (Bryant 1949) or recently (WDF and WDW 1993), although the pool-riffle segment of Dean Creek could provide small amounts of steelhead spawning habitat.

The East Fork Lewis River summer-run steelhead stock is primarily comprised of non-native hatchery origin fish, with some natural spawning (WDFW 1994). The hatchery fish originate from Elochoman, Chambers Creek, Cowlitz, and Skamania hatchery brood stocks (WDF and WDW 1993). Historically, an average of approximately 89,000 summer-run steelhead smolts were released annually into the East Fork Lewis River system, although current stocking is around 40,000 smolts (Rawding 1999). The escapement goal for the East Fork Lewis River summer-run steelhead is 814 wild adults (WDF and WDW 1993). The number of summer-run steelhead returning to the East Fork Lewis River is relatively unknown, although WDFW conducts summertime snorkel surveys in index reaches. Based upon index counts, the Lower Columbia Steelhead Conservation Initiative reported that between 1996 and 1998 the average annual escapement of summer-run steelhead to the East Fork Lewis River was 80 wild fish and 167 hatchery fish (State of Washington 1998). WDFW's EDT (Ecosystem Diagnosis and Treatment) estimate of historical abundance was 422 spawners each year.

The East Fork Lewis River winter-run steelhead is of mixed hatchery and native origin. To supplement the naturally reproducing fish, approximately 100,000 hatchery-origin smolts are planted annually. Annual escapements of wild winter-run steelhead have ranged from 75 to 182 fish (1985-1994) (NMFS 2003a), which is well below the escapement goal of 204 fish (WDF and WDW 1993). The EDT estimate of historical annual abundance was 3,131 spawners.

The East Fork Lewis River is a popular sport-fishing stream, known for the large size of its fish. Average yearly sport harvest in the 1980s was 2,730 steelhead in the mainstem East Fork Lewis River alone, not including tributaries and the North Fork Lewis River (WDF 1990). The current management goal is to maximize harvest of hatchery fish and allow escapement of wild fish. There have been catch-and-release restrictions on wild summer-run steelhead since 1986, and wild winter-run fish since 1991 (Rawding 1999). Fishing for hatchery-reared steelhead occurs in the river from mid-April through May with a limit of two fish per day (WDFW 2000). Information from 1990 indicates the harvest rate of hatchery fish was estimated to be 40% of the total hatchery fish entering the East Fork Lewis River system (WDF 1990). Popular fishing locations for steelhead within the project location include the pool underneath the bridge at Daybreak Park (approximately RM 10) and the pools at the Ridgefield Pits area (approximately RM 8).

2.1.2.3 Columbia River Chum Evolutionarily Significant Unit

This species has the widest natural geographic and spawning distribution of any Pacific salmonid, primarily because its range extends further along the shores of the Arctic Ocean than other salmonids. Chum salmon (*Oncorhynchus keta)* have been documented to spawn from Korea and the Japanese island of Honshu, east, around the rim of the North Pacific Ocean, to Monterey Bay in California. Presently, major spawning populations are found only as far south as Tillamook Bay on the Northern Oregon coast. Chum salmon may historically have been the most abundant of all salmonids. Neave (1961) estimated that prior to the 1940s, chum salmon contributed almost 50% of the total biomass of all salmonids in the Pacific Ocean.

Chum salmon spawn primarily in freshwater, and apparently exhibit obligatory anadromy, as there are no recorded landlocked or naturalized freshwater populations (Randall *et al.* 1987). The species is known for the enormous canine-like fangs and striking body color (a calico pattern, with the anterior two thirds of the flank marked by a bold, jagged, reddish line and the posterior third by a jagged black line) of spawning males. Females are less flamboyantly colored and lack the extreme dentition of the males.

2.1.2.3.1 Status of the Evolutionarily Significant Unit. In December 1997, the first ESA status review of west coast chum salmon (Johnson *et al.* 1997) was published. It identified four chum ESUs, including the Columbia River ESU. In March 1998, NOAA Fisheries published a Federal register notice describing the four ESUs and proposed a rule to list two--Hood Canal summer-run and Columbia River--as threatened under the ESA. In March 1999, the two ESUs were listed (March 25, 1999; 64 FR 14508). In January 2003, NOAA Fisheries reconvened a Biological Review Team (BRT) to update the status of listed chum salmon ESUs coastwide (NMFS 2003a).

Chum in the Columbia River once numbered in the hundreds of thousands of adults and, at times, approached a million. The total number of chum salmon returning to the Columbia in the last 50 years has averaged perhaps a few thousand, returning to a very restricted subset of the historical range.

Chum are not adept at surmounting migration obstacles and the Bonneville Dam prevents chum salmon from accessing habitat further upstream. This barrier, combined with loss of habitat in the estuary and associated areas, and with population declines, prompted NOAA Fisheries to conclude that this ESU is at risk of becoming endangered. The updated status review of chum salmon (*Ibid.*) concluded that significant spawning occurs in only two of the 16 historical populations, meaning that 88% of the historical populations are extirpated, or nearly so (*Ibid.*). The populations that remain are small, and overall abundance for the ESU is low. The two extant populations are in the Grays River and the Lower Gorge (including Hardy Creek, Hamilton Creek, Ives Island, and the Multnomah area). Encouragingly, there has been a substantial increase in the abundance of these two populations and the new (or newly discovered) I-205 population. Whether this large increase is due to any recent management actions or simply reflects unusually good conditions in the marine environment is not known at this time, but the result is encouraging, particularly if it were to be sustained for a number of years (*Ibid.*).

In the mainstem Columbia River, commercial and sport fisheries do not target chum salmon. However, approximately five percent of the chum salmon are incidentally harvested during the late coho salmon gill-net fishery (WDF and WDW 1993, NMFS 2003a). NMFS (2003a) estimated that the recent annual abundance of chum salmon in the Columbia River was 755 natural origin spawners. Based on WDFW's EDT analysis, there was an historical annual abundance of approximately 283,400 natural origin spawners in the ESU (*Ibid.*).

2.1.2.3.2 Life History. Chum salmon spend more of their life history in marine waters than other Pacific salmonids. Chum salmon, like pink salmon, usually spawn in coastal areas, and juveniles out migrate to seawater almost immediately after emerging from the gravel that covers their redds (Salo 1991). This ocean-type migratory behavior contrasts with the stream-type behavior of some other species in the genus *Oncorhynchus* (*e.g.*, coastal cutthroat trout, steelhead, coho salmon, and most types of chinook and sockeye salmon), which usually migrate to sea at a larger size, after months or years of freshwater rearing. This means survival and growth in juvenile chum salmon depends less on freshwater conditions than on favorable estuarine and marine conditions.

Another behavioral difference between chum salmon and species that rear extensively in freshwater is that chum salmon form schools, presumably to reduce predation, as their movements are synchronized to minimize predation (Miller and Brannon 1982).

The chum spawning season in the Columbia River basin is November through December (WDF and WDW 1993). Preferred spawning areas are in groundwater-fed streams or at the head of riffles (Grette and Salo 1986). Chum salmon spawn in shallower, low-velocity streams and side channels more frequently than most other salmon species (Johnson *et al.* 1997). As with all other salmonids, the length of embryo incubation is influenced primarily by water temperature. Health of the emergent chum fry, as with the other salmonid species, is also dependent on DO, gravel composition, spawner density, stream discharge, and genetic characteristics (Salo 1991).

In Washington, downstream chum salmon migration occurs from late January to May (Johnson *et al.* 1997). Chum emigration is associated with increasing day length and warming of estuarine waters. Estuarine survival appears to play a major role in determining subsequent adult return to freshwater (*Ibid.*). Simenstad *et al.* (1982) reported that eelgrass (*Zostera* spp.) habitats might be particularly preferred. Simenstad *et al.* (*Ibid.*) found chum salmon generally moved offshore at a size of 50-160 mm fork length. Chum salmon mature at 2 to 6 years of age (Salo 1991).

2.1.2.3.3 East Fork Lewis River Chum Salmon Population. Chum salmon were once widespread in the lower Columbia River tributaries and are believed to have historically used the East Fork Lewis River (Rawding 1999). Early hatchery production in the Lewis River basin included chum salmon up until 1940, which resulted in a large hatchery population. Today, chum salmon are a rarity in the Lewis River system, including the East Fork Lewis River (NMFS 2003a). Factors that contributed to this population decline include predation by hatchery chinook and coho salmon, habitat alteration and destruction, and lack of hatchery input (*Ibid.*).

Chum have only been observed in the East Fork Lewis River occasionally since the 1950s (Rawding 1999). However, 69 chum fry were captured in a smolt trap just upstream of Mason Creek near RM 6 in the spring of 2001 (Rawding *et al.* 2001). Based on trap efficiency estimates, WDFW estimated that 2,060 chum smolts passed this trap. This indicates that at least some successful chum spawning occurred in the East Fork Lewis River the previous fall. Since then, successful chum spawning has been documented in an artificial spawning channel constructed in 2002 (Fish First 2002).

2.1.2.4 Lower Columbia River/Southwest Washington Coho Evolutionarily Significant Unit

Coho salmon (*Oncorhynchus kisutch*) is a widespread species of Pacific salmon, occurring in most major river basins around the Pacific Rim from Monterey Bay in California north to Point Hope, Alaska, through the Aleutians, and from Anadyr River south to Korea and northern Hokkaido, Japan (Laufle *et al.* 1986).

2.1.2.4.1 Status. The status of coho salmon for purposes of ESA listings has been reviewed many times, beginning in 1990. The first two reviews occurred in response to petitions to list coho salmon in the Lower Columbia River and Scott and Waddell creeks (central California) under the

ESA. The conclusions of these reviews were that NOAA Fisheries could not identify any populations that warranted protection under the ESA in the LCR (Johnson *et al.* 1997 and June 27, 1991, 56 FR 29553), and that Scott and Waddell creeks' populations were part of a larger, undescribed ESU (Bryant 1994; April 26, 1994, 59 FR 21744).

A review of West Coast (Washington, Oregon, and California) coho salmon populations began in 1993 in response to several petitions to list numerous coho salmon populations and NOAA Fisheries' own initiative to conduct a coastwide status review of the species. NOAA Fisheries was unable to identify any remaining natural populations in the Lower Columbia River/Southwest Washington ESU that warranted protection under the ESA. However, there was sufficient concern regarding the overall health of the ESU and it was added to the candidate list (Weitkamp *et al.* 1995; July 25, 1995, 60 FR 38011).

The coho salmon BRT met in January 2003 to discuss new data received and to determine if the new information warranted any modification of the original BRT conclusions. The BRT's preliminary report (NMFS 2003a) indicates that the vast majority (over 90%) of the historical populations in the LCR appear to be extirpated, or nearly so. The most serious overall concern is the nearly total absence of naturally produced spawners throughout the ESU, with attendant risks associated with a small population, loss of diversity, and fragmentation and isolation of the remaining naturally produced fish. Twenty-one of 23 historical populations appear to be extirpated and the LCR coho ESU is dominated by hatchery production. There are no populations with appreciable natural production (*Ibid*.). A study by the National Research Council (NRC 1996, cited in NMFS 2003a) indicated that 97% of 425 fish surveyed on the spawning grounds were first-generation hatchery fish. The BRT concluded that the naturally spawned component of the Lower Columbia River ESU is "in danger of extinction" (NMFS 2003a).

2.1.2.4.2 Life History. From central British Columbia south, the vast majority of coho salmon adults are 3-year-olds, having spent approximately 18 months in fresh water and 18 months in salt water (Sandercock 1991). The primary exceptions to this pattern are "jacks," sexually mature males that return to freshwater to spawn after only five to seven months in the ocean.

With the exception of spawning habitat, which consists of small streams with stable gravels, summer and winter freshwater habitats most preferred by juvenile coho salmon consist of quiet areas with low flow, such as backwater pools, beaver ponds, dam pools, and side channels (Reeves *et al.* 1989, cited in NMFS 2003a). Habitats used during winter generally have greater water depth than those used in summer, and also have greater amounts of LWD. West Coast coho smolts typically leave freshwater in the spring (April to June) and re-enter freshwater when sexually mature from September to November and spawn from November to December and occasionally into March (Sandercock 1991). Stocks from British Columbia, Washington, and the Columbia River often have very early (entering rivers in July or August) or late (spawning into March) runs.

The length of incubation for coho salmon embryos ranges from 35 to 101 days (Laufle *et al.* 1986). Egg mortality occurs at stream temperatures above 13.3 °C (Spence *et al.* 1996). After hatching, larval fish typically spend two to three weeks in the gravel before they emerge in early March to mid-May (Laufle *et al.* 1986; McMahon 1983). Newly emerged fry usually congregate in pools in their natal stream. As juveniles grow, they disperse and aggressively defend their territory, which results in displacement of excess juveniles downstream to potentially less favorable habitat (Wydoski and Whitney 1979). This aggressive behavior may be an important factor that maintains the numbers of juveniles within the carrying capacity of the stream. Once territories are established, individuals typically rear in selected areas of the stream, feeding on drifting benthic organisms and terrestrial insects until the following spring (Hart 1973). Complex woody debris structures and side channels are important habitats for coho salmon, particularly during the summer low-flow period, and during the winter (Grette and Salo 1986). In the winter, this complex habitat can provide low velocity refuge from high flows. These studies suggest that the abundance of juvenile coho is often determined by the combination of limited space, food, and temperature interactions in the freshwater environment. Emigrating yearling coho tend to move quickly through the estuary compared to other salmonid species (Emmett *et al.* 1991).

2.1.2.4.3 East Fork Lewis River Coho Salmon Population. Native coho populations were historically abundant, with as many as 2,000 spawners in the Lewis River (Weitkamp *et al.* 1995). However, coho salmon that presently return to the East Fork Lewis River are believed to be primarily the progeny of hatchery fish (Johnson *et al.* 1997). Recent information, based on smolt trap data, indicates some natural production of coho continues in Cedar Creek, a tributary of the East Fork Lewis River (D. Rawding, pers comm, cited in NMFS 2003a). However, there is no certainty that this subpopulation is self-sustaining (NMFS 2003a), or of its relationship to historically native coho.

Two hatchery coho salmon stocks are present in the East Fork Lewis River, north-turning (N-Type) and south-turning (S-Type) stocks. Because of the direction the fish turn after entering the ocean, N-Type contribute more heavily to the northern ocean fisheries, and the S-Type contribute primarily to the ocean fisheries south of coastal Oregon. Adult S-Type coho return to the Lewis River system between August and November, slightly earlier than N-Type coho, which return between October and January. Like chinook and steelhead, coho require deep pools with cover for resting and sufficient flow for upstream movement. Coho spawn in mainstem habitats and small tributaries, such as Mason Creek and Dean Creek. Coho spawning occurs from October through December in the Lewis River system (WDF and WDW 1993). Fry emergence of S-Type is also slightly earlier than the N-Type fish.

Currently, S-Type and N-Type stocks are both managed as hatchery stocks in the Lewis River system, with over a million hatchery juveniles released into the East Fork Lewis River (*Ibid.*). Type-N escapements averaged around 18,000 during 1982 through 1986. S-Type annual returns average around 5,000 fish. There are approximately 22 miles of habitat available for coho spawning in the mainstem East Fork Lewis River, and an additional 26 miles of tributaries (EnviroScience 1996). Coho have been stocked in Dean Creek, and redds have been observed during WDFW spawning surveys (EnviroScience 1996).

2.1.3 Environmental Baseline

Regulations implementing section 7 of the ESA (50 CFR 402.02) define the environmental baseline as the past and present effects of all Federal, state, or private actions and other human activities in the action area. The environmental baseline also includes the anticipated effects of all proposed Federal projects in the action area that have undergone section 7 consultation, and the effects of state and private actions that are contemporaneous with the consultation in progress.

The environmental conditions near the project site have been severely altered since Euro-American settlement. Habitat changes that have contributed to the decline of covered species in the action area include: (1) reduced biological, chemical, and physical connectivity between streams, riparian areas, floodplains, and uplands; (2) elevated fine sediment yields; (3) reduced instream LWD; (4) loss or degradation of riparian vegetation; (5) altered stream channel morphology; and (6) altered base and peak stream flows.

Currently, land uses in the East Fork Lewis River basin are primarily agricultural, logging, rural residential development, and gravel mining. Riparian areas and stream channels in the action area have been damaged by activities related to these land uses throughout the watershed (USFWS and NMFS 2003). Chapter 3 of the HCP (Storedahl 2003) and Chapter 3 of the Services' FEIS (USFWS and NMFS 2003) provide comprehensive descriptions of the baseline conditions in the action area.

2.1.3.1 East Fork Lewis River

The East Fork Lewis River originates in the foothills of the western Cascades, draining an area of 212 square miles (Figure 3-2). The river flows westward for 43 miles, joining the Lewis River approximately three miles upstream from the Columbia River. The Columbia River then empties into the Pacific Ocean 87 miles downstream. The lower 5.9 miles of the East Fork Lewis River is tidally influenced (Hutton 1995a), but the tidal influence can extend as far as RM 7.3 when flooding coincides with high tide (FEMA 1991). The HCP area is located in a flat alluvial valley adjacent to RM 8 on the East Fork Lewis River.

The flow regime of the East Fork Lewis River is dominated by fall and winter rain events. The average discharge at the Heisson gage, approximately 12 miles upstream of the HCP area, is 738 cfs. Flows are generally lowest during August, which has a mean monthly flow of only 83 cfs. Flows are generally highest in December and January, when soils are saturated and rain-on-snow events occur. The mean annual discharge of the East Fork Lewis River at the Daybreak site is estimated to be 967 cfs, and average monthly flows range from 108 cfs in August to 1,909 cfs in December (Figure 3-9 in the HCP). In February 1996, a combination of heavy rainfall and snowmelt produced record setting discharges at many stations in the southern half of the state. At the Heisson gage, the February 1996 event was estimated to have a maximum discharge of 28,600 cfs and a recurrence interval of 500 years (Wiggins *et al.* 1997).

Approximately 56% of the upper East Fork Lewis River watershed is owned and managed by private forest products companies for timber production, 23% by the Washington Department of Natural Resources (WDNR), and the balance by the USDA Forest Service (WCC 2000). Habitat conditions in the East Fork Lewis River have been substantially affected by past actions. Repeated large-scale stand-replacement fires burned large portions of eastern Clark County between 1902 and 1952, and these disturbances resulted in impacts on the hydrology, structure, composition, and age-class distribution of the plant communities, as well as riparian and instream habitats along the East Fork Lewis River (*Ibid.*). The largest fire, the Yacolt Burn, occurred in 1902 and covered an estimated 238,900 acres of state, private and Federal lands. Large fires burned repeatedly over portions of the same area, and some areas have burned over five times, with the last major fires occurring in 1952 (*Ibid.*). Sediment loading, high stream temperatures, insufficient canopy cover, large peak flows, and soil productivity were probably at their worst soon after the large fires. Major flood events occurring in 1931 and 1934 were probably associated with rain-on-snow precipitation events that coincided with major fires. These floods have been linked to the scour and deposition of gravel spawning habitat in the middle section of the East Fork Lewis River (USDAFS 1995 as cited in WCC 2000). According to the Washington Conservation Commission (WCC 2000), "snag habitat, number of pieces of LWD per mile of stream, and the vegetation structure, composition, and age-class distribution remain well outside historical conditions today, and are projected to remain outside historical conditions well into the future."

In 1854, nearly the entire valley bottom between RM 6 and RM 10 was described as wetlands, and the upstream portion of the reach included an extensive system of channel braids (Collins 1997). By 1937, diking and levees had resulted in a single-thread channel, and all that remained of the former channel braids was a system of floodplain sloughs (*Ibid.*). Conversion of the channel from braided to a single thread morphology has substantially reduced the complexity of habitat and largely eliminated side-channel and backwater habitats (Norman *et al.* 1998), while providing agricultural and development property. Currently, Clark County has one of the fastest growing human populations in the state. The effects of development include increased runoff volumes and flood peaks and decreased baseflows in tributary streams, removal of riparian vegetation, and tributary downcutting and bank erosion as a result of altered hydrological conditions. In several places, roads and bridge crossings now confine the migration boundaries of the East Fork Lewis River. In addition, several public and private roads restrict the potential migration of the river in the project vicinity and, just upstream of the Daybreak site, the Daybreak Bridge directs the East Fork Lewis River flow toward the south valley wall.

Mining of copper and gold near the headwaters of the East Fork Lewis River began in the 1890s, but came to an abrupt end following the Yacolt Burn in 1902. The East Fork Lewis River's gradient abruptly decreases in the vicinity of the Daybreak site to less than one percent, resulting in the deposition of coarse sediment transported by the river from upstream areas. This deposition has resulted in an area rich in gravel resources. It is not known when aggregate mining first began in the lower East Fork Lewis River, but gravel mining began in about 1940 in most Washington river basins (Collins 1997). Several historical mines were located within the hydrologic floodplain of the lower East Fork Lewis River, including County 1 and 2, Mile 9 Pit, and the Ridgefield Pits. The existing Daybreak ponds are located within the FEMA-designated 100-year floodplain of the East Fork Lewis River (USFWS and NMFS 2003). Mining on the present site began around 1968 and continued until approximately 1995. Sand and gravel processing has continued since the late 1960s to the present time. North of the Daybreak Site and adjacent to Dean Creek an adjoining property owner operates an open pit which has historically mined gravels from the lower member of the Troutdale formation. Although other mines are located on the high terraces above the East Fork Lewis River, no other mines are known to exist or are in the planning stage within the geomorphic floodplain of the river.

The HCP area is located near a natural gradient break in the river profile. At RM 10.2 to RM 7.0, the transition to a much lower gradient results in reduction of the sediment transport capacity of the river. The natural trend for sediment deposition along the river in this location results in a relatively high lateral channel migration rate. Historical gravel mining activities in the vicinity of the proposed project have influenced the morphology of the East Fork Lewis River as a result of two avulsions into abandoned gravel pits located within the channel migration zone. The first documented avulsion involved the Mile 9 Pit in November 1995. The Mile 9 Pit is located approximately one-half mile upstream of the Ridgefield Pits (Figure 3-4 in the HCP). This event caused the channel to shift to the south, abandoning approximately 1,700 feet of channel (Norman *et al.* 1998).

The second documented avulsion involved the Ridgefield Pits in November 1996. The channel avulsed into the southeastern corner of the southern Ridgefield Pit 1. This changed the course of the river, which was formerly flowing to the north along the southern boundary of the Daybreak site. After the avulsion, the channel flowed through a complex of six deep pools formed by former ponds and approximately 3,200 feet of channel was abandoned (*Ibid.*). Since this time, the upper two pools have filled with deposited sand and gravel, and the upper approximately 900 feet of the avulsed reach has naturally changed to a shallow riffle with a connected off-channel pool (Storedahl 2003).

The avulsion of the East Fork Lewis River into the Ridgefield Pits has resulted in changes to the river's profile, lateral migration rate, sediment transport, and water temperature. The pools formed by the former Ridgefield Pits have a larger surface area than the previous channel, resulting in higher inputs of solar radiation and transfer of heat from the air (*Ibid.*). Natural infill and geomorphic recovery of the Ridgefield Pits was projected to take several decades, at which time the probability of channel migration in the East Fork Lewis River would be expected to increase (Norman *et al.* 1998). An increase in the rate and/or magnitude of channel migration would result in an increased probability of bank erosion, which could lead to a potential avulsion into the existing Daybreak ponds.

The East Fork Lewis River has not been dammed and has no significant surface water diversions in the upper portion of the watershed. Lucia Falls (at RM 21.3) blocks access to anadromous salmonids except for summer steelhead. Sunset Falls (at RM 32.7) was notched in 1982, to allow summer steelhead to access habitat upstream of the falls. Artificial passage problems within the watershed include culverts, road crossings, and small dams, which are believed to obstruct access to more than 10 miles of habitat (LCFRB 2003).

The majority of salmonid spawning habitat in the East Fork Lewis River is upstream of the Daybreak Park bridge. Approximately 1.25 miles of potential spawning habitat exists in the East

Fork Lewis River, between the upstream extent of the tidal influence zone (approximately RM 5.9) and the mouth of Dean Creek. Spawning habitat also exists upstream of the confluence with Dean Creek and the downstream end of the avulsed reach. Further upstream, gravel substrates are lacking where sand substrates dominate the Ridgefield Pit reach, although spawning habitat has become reestablished in the upper portion of the avulsed reach.

Because water quality exceedances for temperature, pH, and fecal coliform have been recorded in the East Fork Lewis River from Moulton Falls (RM 24.6) to the mouth, WDOE listed this reach as impaired under section 303(d) of the Clean Water Act (WDOE 1996). The 1998 section 303(d) list included only exceedances for temperature and fecal coliform for the same reach of river (WDOE 2001). The observed impairments are believed to be the result of agricultural practices, failing or improperly located septic systems, construction, land clearing, and grading (Hutton 1995b).

High temperature during summer months is one of the most important water quality issues in the lower East Fork Lewis River (WCC 2000). Summer maximum water temperatures in the East Fork Lewis River generally increase as one moves downstream, due to a combination of reduced streamside shading and higher air temperatures (Hutton 1995b).

Fecal coliform indicates the presence of potential pathogens in water. Fecal coliform are bacteria that live in the guts of warm-blooded animals and are present in bird, livestock, and human feces. By themselves, fecal coliform are not typically pathogenic or indicative of poor water quality for fish, but if they are present there is a greater chance that human health could be compromised by disease-causing bacteria, viruses, and parasites that are also likely present. The lower East Fork Lewis River was on the 1996 section 303(d) list for pH based on two exceedances of the criterion (pH between 6.6 and 8.5) in 1989 and 1990 (WDOE 1996), but lack of exceedances from 1991 to 1997 resulted in its exclusion from the 1998 candidate section 303(d) list for pH (WDOE 1998, 2001). The overall lack of pH problems in the East Fork Lewis River basin indicates that the area is fairly well buffered by natural geochemical processes (Hutton 1995b).

The LCFRB is in the process of completing a Recovery Plan for ESA listed salmon species in the East Fork Lewis River and has identified five major habitat limiting factors that are common to all streams within the Lewis River and East Fork Lewis River basin (LCFRB 2003):

- Inadequate abundance of LWD in streams, particularly larger key pieces, which are needed to develop pools, collect spawning gravels, and provide habitat diversity and cover for salmonids;
- Dysfunctional riparian conditions and loss of riparian function affecting water quality, erosion rates, streambank stability, and instream habitat conditions;
- High summer maximum water temperatures;

- Low summer flows that limit the rearing habitat and access, and increased winter peak flows that alter instream habitat; and

- Loss of historical off-channel and floodplain habitat, limiting rearing and over-wintering habitat for juvenile salmonids.

2.1.3.2 Dean Creek

A small tributary, Dean Creek, borders the HCP area to the northwest. The drainage area of Dean Creek at the Daybreak site is approximately 3.6 square miles, and the monthly flow pattern is believed to be similar to that of the East Fork Lewis River. High flows occur during the winter months of November to February, while low flows occur during the late summer months of July and August. A more detailed analysis of Dean Creek flows is provided in Appendix C of the HCP (Storedahl 2003).

In the summer, flows in Dean Creek near the J. A. Moore Road become subsurface. The gradient of the stream changes rapidly where the stream enters the relatively flat East Fork Lewis River valley. Coarse gravel and cobble-sized materials are deposited, providing a porous medium for water to flow through. The stream is confined between low levees just downstream of the J. A. Moore Road bridge, and coarse bed material is frequently removed by Clark County to maintain the hydraulic capacity of the stream channel under the bridge (EMCON 1998). Historically, the stream likely braided across the valley floor at this point, but the flow is now confined by bank hardening at the J. A. Moore Road bridge, and its position is confined between the Storedahl and Woodside properties. Periodic dredging of the channel above and below J. A. Moore Road by Clark County and discontinuous small levees have likely been instrumental in keeping the Dean Creek channel in its current location. In addition, a parallel ditch has been dug to the west of the channel below J. A. Moore Road, which routes overbank flows away from the existing home and dairy farm on the adjacent Woodside property.

The channel morphology of Dean Creek is pool-riffle with gravel-cobble substrate from the J. A. Moore Road crossing downstream approximately 1,350 feet, where the stream channel bends sharply to the west. From the sharp bend to the west downstream to the outlet of Pond 5, the channel morphology is palustrine. This reach has a sand-silt bed and is predominantly pool (65% by length). Downstream of Pond 5, Dean Creek's approximately 1700-foot reach to its confluence with the East Fork Lewis River is braided and mostly ponded behind beaver dams. A private access road on a property to the west of the project area fords the stream causing the stream to back up and eventually overtop the road. The lower 0.5 mile of stream is dominated by beaver activities and the flow alternates between impounded areas and grassy channels, which change location frequently in response to beaver dam-building. The lower reach of Dean Creek can also back up due to high flow events in the East Fork Lewis River, especially when high flows coincide with high tides. Although a beaver dam is located at the mouth of Dean Creek, the stream potentially has spawning habitat suitable for coho salmon, steelhead, and cutthroat trout.

The original condition of Dean Creek prior to Euro-American settlement is unknown. However, numerous remnant channels are evident on aerial photographs, some of which appear to have merged with Mason Creek to the west. The surrounding forest likely transitioned from somewhat drier conditions on the well-drained alluvial fan to wetland conditions on the valley floor. The distinct break in slope from the alluvial fan about 500 feet below J. A. Moore marks where this transition would likely have occurred. Numerous beaver dams were likely present within these lower reaches of Dean Creek prior to settlement by Euro-Americans, which would have promoted the development of wetlands and impounded water.

Under present conditions, lower Dean Creek apparently has unsuitable water temperatures for salmonids in summer months. Exceedances of 23°C (potentially lethal to salmonids) were recorded at the outlet from Pond 5. Water temperature in Dean Creek upstream of the Daybreak site is warmer than 18°C on many days during the summer, and in late summer, there is typically no water in Dean Creek between the J.A. Moore Road Bridge and the outlet of Pond 5. It also appears that DO levels decline to levels stressful to fish (less than 8.0 milligrams per liter (mg/l)) during summer months in the wetted portion of Dean Creek downstream of the J. A. Moore Road bridge.

Historically, turbid wash-water from gravel processing at the Daybreak site discharged to Dean Creek. However, Storedahl discontinued wet processing and the discharge of process wash water to the pond system in May 2001. A private excavation site upstream of the J. A. Moore Road, adjacent to Dean Creek, also likely contributed turbidity to the creek from surface runoff. However, mining has stopped at this site since July 2003. Currently, high turbidity in Dean Creek is likely to be episodic from upstream sources and in association with high runoff periods, as it is in the other basin tributaries.

2.1.3.3 Daybreak Ponds

Previous mining of the Daybreak site resulted in the formation of five ponds (approximately 64 acres) and an active gravel-processing area (approximately 23 acres) used for storing and processing material imported from off-site and stockpiling the material for future sale. The processing area includes the Storedahl Pit Road, storage areas for excavation equipment, aggregate processing equipment, processed sand and gravel, fuel storage tanks, parking areas, temporary haul roads, and an office, scales, and maintenance shop.

The five ponds are in various stages of reclamation, or perform important functions for the processing of imported raw materials. These ponds range in depth from approximately 8 to 22 feet deep. Water flows into the ponds primarily as groundwater seepage, although Pond 5 periodically receives inflow from Dean Creek during winter high flows. The ponds are hydraulically interconnected by overflow channels, culverts, or permeable rock barriers. Water leaves the ponds by surface-water overflow, groundwater seepage, and evaporation. The water surface in the existing ponds generally corresponds to the local groundwater table.

Temperatures in the ponds follow patterns typical of water bodies in temperate climates. In winter and spring, depth profiles of temperatures are nearly uniform. In summer, the deeper ponds (Ponds 3 and 5) become stratified. Surface water temperatures in Pond 5 during mid-August were well above 20°C but were approximately 12°C near the bottom (22 feet depth). The shallower ponds (Ponds 1, 2, and 4, which are all less than 15 feet deep) show little stratification. Water temperatures in the ponds typically exceed 18°C in summer months throughout the shallower ponds and near the surface in the deeper ponds (greater than 20 feet depth). However, colder water remains at depth within the deeper ponds as a result of stratified conditions in the summer.

When water bodies become stratified due to temperature, DO levels at depth often decline dramatically, as oxygen consumed in decomposition processes is not replaced by either photosynthesis or mixing with more oxygenated water (Wetzel 1983). Dissolved oxygen levels in the ponds are generally above 10 mg/l in the spring, but as the deeper ponds stratify in the summer, DO levels are depleted below the surface stratification.

In the summer, the pH levels in a pond or lake can fluctuate widely over the course of one day. It is typical for ponds to have high pH levels in their surface waters during the afternoon at the peak of photosynthetic activity and then to have relatively low pH levels in the early morning after a night of respiration and decomposition (*Ibid.*). During the summer, the pH in the existing Daybreak ponds can exceed 8.5, apparently a natural fluctuation resulting from algal production, respiration, and decomposition.

Turbidity in the ponds is strongly affected by wet processing of aggregate on the site and the amount of silts and clays associated with the aggregate. During wet processing, recycled process wash water is discharged to Pond 1 to settle fine sand and silt. Although most of the sediment settles out in Pond 1, the other ponds receive suspended sediment as water flows sequentially from Pond 1 through Ponds 2, 3, and 5 prior to discharging from Pond 5. The turbidity levels of the water discharged to Pond 5 during wet processing are monitored monthly for compliance with Storedahl's NPDES general permit (WAC-50-1359). According to the permit, turbidity levels of the discharge must remain less than 50 Nephelometric Turbidity Units (NTU). This level allows for subsequent dilution as the discharged water mixes with the flow of the East Fork Lewis River. Past control of turbidity at the outlet has relied on long settling times (passive treatment) for the recycled process water prior to its release at Pond 5 and/or on alteration or cessation of processing operations. These methods provided limited control to maintain operations and reduce turbidity, and when turbidity became too high, Storedahl shut down operations and allowed the ponds to settle for a period of months, prior to restarting the processing operation. Storedahl installed a new system in June of 1999 to treat the wash water with a flocculant at the discharge to Pond 1 to increase the removal of fine sediments and to improve water clarity. This process resulted in a substantial reduction in the turbidity of the process water, *i.e.*, to one-fifth of the NPDES limit. Wet processing and the discharge of process wash water was discontinued at the site in May 2001. However, the ponds continue to receive stormwater runoff.

Turbidity is also affected by hydraulic interactions with Dean Creek. During heavy storm runoff, Dean Creek has been observed to discharge turbid water into a relatively less turbid Pond 5.

During more normal flow periods, when flow from Pond 5 into Dean Creek occurs, there is potential for increased turbidity in Dean Creek. Storedahl's NPDES permit specifies limits for turbidity levels in the discharge, and the operation is monitored for compliance with requirements of the permit. Any turbidity increases over the past two years in Dean Creek, due to discharge from Pond 5, have been well below regulatory limits, and are approximately equal to the 5.5 NTU water quality criterion for the watershed (USFWS and NMFS 2003).

In the Daybreak ponds, four non-native fish species have been observed. These include largemouth bass, black crappie, bluegill, and brown bullhead (Storedahl 2003).

2.1.4 Relevance of the Baseline to Status of Species

Based on the best available information on the status of LCR chinook, CR chum, LCR/SW coho, and LCR steelhead, including population status, trends, and genetics, and the environmental baseline conditions within the action area, NOAA Fisheries concludes that not all of the biological requirements of the listed species within the action area are being met under current conditions. The survival and recovery of these species depends on their ability to persist through periods of low natural survival due to ocean conditions, climatic conditions, and other conditions outside the action area. For instance, ocean conditions are a key factor in the productivity of Pacific salmon populations. Stochastic events in freshwater (flooding, drought, snowpack conditions, volcanic eruptions, etc.) can also play an important role in a species' survival and recovery, but those effects are often localized, compared to the effects associated with the ocean.

Freshwater survival is particularly important during the periods of low natural survival outside the action area, because enough juvenile salmon must be produced so that a sufficient number of adults can survive to complete their oceanic migration, return to spawn, and perpetuate the species. Variation in the freshwater and marine environments substantially affects Pacific salmon populations. Therefore, it is important to maintain or restore PFC to sustain the salmon populations through these low survival periods. Accordingly, any further degradation of the baseline, or delay in improvement of these conditions, would probably further decrease the likelihood of survival and recovery of the listed species under the environmental baseline conditions.

2.1.5 Effects of the Proposed Action

Effects of the action are defined as "the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated or interdependent with the action, that will be added to the environmental baseline" (50 CFR 402.02).

Direct effects are immediate effects of the project on the species or its habitat, result from the agency action, and can include effects of interrelated and interdependent actions. Future Federal actions that are not a direct effect of the action under consideration (and not included in the environmental baseline or treated as indirect effects) are not evaluated. Effects of the action are analyzed together with the effects of other activities that are interrelated to, or interdependent with the proposed action.

Interrelated activities are those that are part of a larger action and depend on the larger action for their justification" (50 CFR 403.02). Interdependent actions are those that have no independent utility apart from the action under consideration (50 CFR 402.02). Guidance developed by NOAA Fisheries to assist biologists conducting interagency consultation suggests that as a practical matter, the determination of whether other activities are interrelated to, or interdependent with the proposed action, should be made using the "but for" test. That is, whether the potentially interrelated or interdependent activities would occur but for the occurrence of the proposed action. If the activity in question would not occur but for the occurrence of the proposed action, then the effects of the action in question must be analyzed with the effects of the proposed action.

Indirect effects are caused by the proposed action, are later in time, and are reasonably certain to occur (50 CFR 402.02). Indirect effects can occur outside of the area directly affected by the action. Indirect effects can include the effects of other Federal actions that have not undergone section 7 consultation, but will result from the action under consultation. These actions must be reasonably certain to occur, or be a logical extension of the proposed action.

2.1.5.1 Direct and Indirect Effects of the Action

NOAA Fisheries will consider any scientifically credible analytical framework for determining an action's effect. The following analysis examines the effects by species and life history stage of the activities associated with Storedahl's gravel mining, processing and reclamation activities adjacent to the East Shore Lewis River. The analysis is organized as presented in the HCP (Storedahl 2003), through an examination of the effects of covered activities on each species life stage and habitat, and the effects of covered activities on the conservation and recovery of habitats and the processes that create them.

Covered activities have been analyzed for their general environmental and species-specific effects in the FEIS prepared by the Services (USFWS and NMFS 2003) and the HCP prepared by Storedahl in collaboration with the Services (Storedahl 2003). These analyses are incorporated herein by reference and listed in the following table. Taken as a whole, these and other analyses listed below are the best available science used in the preparation of this Opinion. Table 3 lists analyses by covered activity and source document.

Table 3. Storedahl activities proposed for coverage under an ITP and source documents describing the effects of those activities on species to be covered under an ITP.

Covered Activities	Source document describing effects of activities
Overburden Removal and Aggregate Mining/Processing	Storedahl HCP Chapter 6 (Sections on Groundwater, Surface Water Quality/Quantity, Riverine Habitat, Wetland Habitat and Predation) FEIS, section 3.0 Affected Environment and Environmental Consequences, subsections 3.2 - 3.6 (Physical Setting, Floodplain, Surface Water, Groundwater, Biological Environment)
Reclamation and Habitat Enhancement	Storedahl HCP Chapter 6 (sections on Groundwater, Surface Water Quality/Quantity, Riverine Habitat, Wetland Habitat and Predation) FEIS, section 3.0 Affected Environment and Environmental Consequences, subsections 3.2 - 3.6 (Physical Setting, Floodplain, Surface Water, Groundwater, Biological Environment)
Integrated Conservation Measures	Storedahl HCP Chapter 6 (sections on Groundwater, Surface Water Quality/Quantity, Riverine Habitat, Wetland Habitat and Predation) FEIS, section 3.0 Affected Environment and Environmental Consequences, subsections 3.2 - 3.6 (Physical Setting, Floodplain, Surface Water, Groundwater, Biological Environment)
Monitoring and Reporting	Storedahl HCP Chapter 5 FEIS, section 3.0 Affected Environment and Environmental Consequences, subsections 3.2 - 3.6 (Physical Setting, Floodplain, Surface Water, Groundwater, Biological Environment)

The effects of the proposed project on the four species of salmon include the following:

- Gravel extraction below the water table would indirectly impact aquatic habitat in nearby streams, *e.g.*, Dean Creek or the East Fork Lewis River, by altering groundwater flow patterns and converting groundwater to surface water, thereby altering groundwater flow rates and biota of hyporheic groundwater.

- The quantity of water released to nearby streams, *e.g.*, Dean Creek or the East Fork Lewis River, would change as a result of altered groundwater flow paths, infiltration, runoff, direct interception of precipitation by surface waters, and rates of evaporation and evapotransporation.

- Surface water temperatures in Dean Creek or the East Fork Lewis River may increase as a result of the increased area of open water exposed to solar radiation.

- The alteration of DO concentrations in released surface water and/or ground water may affect salmonid feeding and growth rates in Dean Creek or the East Fork Lewis River.

- The accidental release of petroleum products from machinery and spills could be toxic to salmonids and their prey base.

- Excavation of gravel below the groundwater surface and aggregate processing would increase the amount of suspended sediment in the ponds and outflow during active mining periods and may affect salmonid feeding and growth rates in Dean Creek or the East Fork Lewis River.

- Turbid water within ponds may limit primary productivity in Dean Creek or the East Fork Lewis River by impairing light penetration, precluding the growth of aquatic plants that replenish DO concentrations through photosynthesis.

- The continued or increased release of turbid surface water and/or ground water could affect salmonid migratory and social behavior and foraging opportunities in Dean Creek or the East Fork Lewis River .

- Chemical additives used to accelerate the settling of fine-grained sediments and reduce turbidity can be toxic to aquatic organisms, and affect the fertility and ability of reclaimed flocculated sediments to support wetland vegetation.

- Deep ponds may stratify, exacerbating surface temperature increases and reducing DO levels in the lower strata (hypolimnion), and potentially affecting the feeding and growth rates of salmon.

- Creation of off-channel pond habitat would support the production of non-native species.

- The meandering alluvial East Fork Lewis River is reasonably certain to avulse through ponds created by mining, altering riverine habitat (e.g., rapid upstream and downstream bed scour, channel abandonment, changes in stream morphology, water temperature, and ecology), trapping salmonids, and interrupting the sediment transport regimes.

- Bank protection activities would interrupt the natural functions of gravel recruitment, LWD recruitment, and creation of off-channel habitats by limiting lateral channel migration.

Steelhead and chinook salmon use habitat in the East Fork Lewis River for migration, spawning, and rearing. Coho and steelhead could potentially use habitat in Dean Creek and in the East Fork Lewis River for migration, spawning, and/or rearing. Despite the uncertain probability of direct and indirect effects to salmonids as a result of expanded mining outside the FEMA-designated 100-year floodplain, Storedahl, in consultation with the Services, developed a variety of conservation measures to benefit, or reduce the likelihood and severity of impacts to, aquatic habitat and biota. The 17 conservation measures listed below in Table 4 are described in more detail in Chapter 4 of the HCP and in section 1.2.6 of this Opinion.

Table 4. Description and benefits of conservation measures in the Storedahl HCP.			
	Conservation Measure	**Description**	**Benefit**
		Water Quality Conservation Measures	
CM-01	Wash water clarification process	Install and operate a closed-loop wash water clarification process.	• Substantially reduce or eliminate turbidity discharged from the process water and the discharge of process water to receiving waters; • Increase transparency of pond water, which could potentially increase the photosynthesis/respiration quotient and increase associated DO concentrations; and • Precipitate dissolved phosphorus, resulting in decreased algal growth, decreased deposition of organic matter, and decreased depletion of DO in the ponds from resultant decomposition.
CM-02	Storm Water and Erosion Control Plan and Storm Water Pollution Prevention Plan	Implement a Storm Water and Erosion Control Plan and a Storm Water Pollution Prevention Plan to minimize impacts on surface water.	• Isolating impacts to surface water from mining and reclamation operations; • Containing and pretreating surface runoff and associated sediment inputs to streams through the use of bioswales; • Revegetating bare soils; • Preventing and managing oil and fuel spills; • Installing a conveyor to transport mined aggregate; • maintaining asphalt/gravel surfacing on active roads; • Having a water truck and, as, necessary, a street sweeper on-site; • Decommissioning unused haul roads; and • Specifying conditions that would result in the suspension of operations.

Water Quantity Conservation Measures			
CM-03	Donation of water rights	Contingent on approval of an application for change of water rights by WDOE, and the implementation of a closed-loop wash water system, donate a portion of the water rights to the State Trust at the completion of conversion to a closed-loop system with the balance being donated at the term of the ITP.	• Augment groundwater discharge to the East Fork Lewis River.
CM-04	Water management plan	Complete restoration work to control the water flow from Pond 5, establish a temporary seasonal pump station, and implement a water management plan.	• Minimize water use from the ponds; • Restrict inflow of Dean Creek to Pond 5; • Restrict outflows from Pond 5; • Manage pond water levels; and • Augment Dean Creek summer low flows and irrigate revegetated buffer along upper Dean Creek.
Channel Avulsion Conservation Measures			
CM-05	Conservation and habitat enhancement endowment	Create up to a $1,000,000 endowment.	The endowment is authorized to: • Provide for habitat monitoring, management, and response to changed circumstances (*e.g*., avulsion); and • Supplement CM-12 (Conservation Easement) by providing excess funds from the endowment, at the discretion of the trustee and in consultation with the Services, for enhancement of floodplain functions in the lower East Fork Lewis River basin.

CM-06	Native valley-bottom forest vegetation	Establish an early-successional mixed conifer and hardwood forest within the FEMA-designated 100-year floodplain, along the existing and created ponds and in the upland area.	• Increase resistance to channel migration; • Provide terrestrial wildlife habitat for nesting, dispersal, and foraging; • Enhance ecological watershed functions; • Provide shade to help moderate water temperatures; • Help control erosion from surface runoff; • Provide a future source of roots and LWD and resultant habitat complexity; • Improve habitat for amphibians, birds, and aquatic organisms; • Increase availability of terrestrial invertebrate prey items for fish; • Enhance linkages among upland and aquatic ecosystems; and; • Extend the greenbelt of restored habitat along the East Fork Lewis River corridor.
CM-07	Floodplain reestablishment between Dean Creek and the created ponds	Create floodplain terraces for overbank flow and augment the buffer between Dean Creek and the created ponds with soil excavated from the mining area.	• Enhance the interactions between the stream and its floodplain; • Enhance topsoil to support successful revegetation; and • Reduce the likelihood of movement of Dean Creek into the new ponds.

CM-08	Mining and reclamation designs	* Forego mining in areas outside the FEMA-designated 100-year floodplain that are not separated from the river by established roads; * Conduct approximately 86% of all surface excavations outside of the area defined by 140 years of historical observations, and reclaim all excavated areas within this area to forested or emergent wetland; * Reduce existing open water areas from approximately 64 acres to approximately 38 acres by significantly narrowing and reshaping the existing ponds; * Create a wider (approximately 5 acres) vegetated buffer between the existing ponds and river channel and between the proposed and existing ponds (approximately 9 acres);	• Reduce the likelihood of an avulsion and ameliorate negative effects of potential flooding or avulsion of East Fork Lewis River into the HCP area.

CM-08 (cont.)		* Minimize the size of created open water areas and configure new ponds parallel to the river channel; * Establish shoreline vegetation communities similar to natural off-channel habitats; * Stabilize pond bank areas that are most susceptible to headcutting; * Establish a valley bottom forest (CM-06) to reduce erosion potential; and * Adaptively manage reclamation activities based on study results of CM-10.	
CM-09	Contingency plan for potential avulsion of the East Fork Lewis River into the existing or proposed gravel ponds	* Design and implement a contingency plan. * In consultation with the Services, hardening of potential avulsion points and hydraulic toe protection of the Storedahl Pit Road, with removal upon completion of reclamation commitments.	• Reduce the potential for an avulsion of the East Fork Lewis River into the Daybreak site; and • Mitigate for negative effects in the event that an avulsion occurs into the ponds.

CM-10	Study the Ridgefield Pits and East Fork Lewis River	Investigate the nearby Ridgefield pits: * Assess the influence of pools on fish habitat and fish use; * Assess the influence of pools on East Fork Lewis River water temperatures and DO; * Assess pool volume, channel shape, and sediment infill rates.	Provide information to refine the contingency plan to minimize negative effects of potential future avulsions into the Daybreak site.
Species and Habitat Conservation Measures			
CM-11	Off-site floodplain enhancement	Provide labor, equipment, and/or materials to public and private non-profit groups.	• Enhance floodplain functions related to protection and recovery of the covered species within the East Fork Lewis River basin.

CM-12	Conservation easement and fee-simple transfer	Establish a conservation easement on a discrete parcel of the Daybreak property not proposed for mining or processing and establish and similar conservation easement on the remainder of the property after the completion of reclamation activities. Transfer all Daybreak property (with conservation easement) in fee to one or more public or non-profit organizations together with the endowed funds from CM-05 at the completion of all reclamation.	• Preserve the property as fish and wildlife habitat in perpetuity.
CM-13	Riparian management zone on Dean Creek	Establish a forested two-zone, 200-foot riparian management area along the southwest bank of Dean Creek.	• Provide shade to help minimize water temperatures; • Enhance bank stability and promote undercut bank habitat in Dean Creek; • Help control erosion from surface runoff; and • Provide a future source of roots and LWD for habitat complexity.

CM-14	In-channel habitat enhancement in select reaches of Dean Creek	Improve habitat quality and bank stability using natural materials and bio-stabilization.	• Reduce the rate of localized bank erosion and sedimentation; • Improve off-channel and instream fish habitat for resident and anadromous species; • Help maintain clean gravel substrates; • Improve low-flow habitat quality by supporting a narrower, deeper channel; and • Help prevent potential channel migration into the proposed mining and reclamation site.
CM-15	Shallow water and wetland habitat creation	Create approximately 84 acres of forested and emergent wetland habitat.	• Provide habitat for Oregon spotted frogs; • Provide potential habitat for a variety of juvenile fish; and • Create increased trophic complexity.
CM-16	Control of non-native predatory fishes	* Narrow existing ponds; * Reconfigure western berm and install a single outlet from Pond 5; * Target harvest of non-native predatory fishes in the existing ponds; * Install rock barriers between the created and existing ponds; and * Install educational signs.	• Reduce quantity of existing and potential habitat available to non-native predatory fish; and • Reduce the frequency of backwater flood flows into Pond 5.
CM-18	Control public access	Decommission unnecessary roads, create foot trails, and instruct on-site security agents to restrict trespass to sensitive areas.	• Control and minimize destructive vehicle and foot traffic to riparian habitats; and • Control and minimize access to covered species from potential poachers.

2.1.5.2 Groundwater

The general direction of groundwater flow at the Daybreak site parallels the direction of flow in the East Fork Lewis River. Groundwater flow at the site may also move in unpredicted ways through undetected preferential paleochannel pathways. The new ponds are not expected to have a substantial impact on groundwater flow, as compared to existing conditions, since most of the site's subsurface flow is already refracted and/or intercepted by the existing ponds. Although the area of the ponds will increase in the future, the new ponds will not intercept a significantly different volume of groundwater from upgradient.

Storedahl's flow net analysis describes groundwater inflow to the ponds. The boundaries of groundwater flow to the ponds were Dean Creek, the north valley wall, and the East Fork Lewis River. Storedahl's post-mining groundwater contour maps show that the future flow patterns will not be substantially altered from existing conditions. In general, groundwater will continue to flow towards and parallel to the East Fork Lewis River, with some unknown portion moving along preferential paleochannels. Groundwater inflow into the ponds is expected to be essentially the same for existing and future conditions. Two minor variations might be (1) the refraction of some flow to the south (toward the East Fork Lewis River) at the southeast corner of Pond 1, due to the placement of relatively fine-grained materials within that pond; and (2) alterations to localized areas of groundwater emergence in the East Fork Lewis River channel, due to the interception of groundwater currently flowing underneath Dean Creek by the new ponds. Since the ponds will not be dewatered to excavate gravel, the groundwater elevation will not drop substantially during mining. Completed ponds will fill with water to the approximate level of the groundwater table (at the downgradient end of each pond) associated with the shallow alluvial aquifer; *i.e.*, hyporheos.

The creation of additional ponds will not measurably affect net groundwater contributions to the East Fork Lewis River. However, potential impacts to subsurface groundwater flow paths may cause: (1) changes to upstream or downstream localized groundwater emergence areas; (2) localized water temperature changes caused by altered groundwater emergence areas; and (3) delay of groundwater flow and greater dampening of temporal groundwater patterns. Average groundwater seepage rates from the alluvial aquifer into the East Fork Lewis River at RM 10.6 and RM 6.5 were 0.58 and 1.59 cfs per mile, respectively, based on field data collected during a relatively low-flow period in October 1987 (Storedahl 2003). These seepage velocities are expected to remain at 4.5 to 12 feet per day and consequently the travel time of any seasonally warmer water leaving the pond via groundwater seepage to the East Fork Lewis River is calculated at 70 to 200 days. Additional incident precipitation will increase the levels of the ponds, resulting in an increase in head and consequently a potential increase of groundwater outflow during the winter, depending on the amount of water being held for later programmed release to Dean Creek.

Temperature monitoring in Pond 5, the river, and a piezometer located downgradient from Pond 5 has shown that travel time and the dampening effects of the alluvial aquifer result in groundwater flow that is cooler through the hyporheos, than in the pond or the river during the late summer. Furthermore, the discharge of groundwater from the ponds is calculated at 0.9 cfs under current and future conditions, or less than one percent of the mean monthly flow in the East Fork Lewis

River. Therefore, no change is projected in temperature in the East Fork Lewis River as a result of the project.

Although changes in groundwater movement and water quantity are expected to be minimal, the HCP includes conservation measures to slightly increase flows in Dean Creek and the East Fork Lewis River because existing low flow conditions in these channels could negatively impact several of the covered species. Increased summer flows in the East Fork Lewis River and Dean Creek could benefit migrating and holding steelhead and chinook, chum, and coho salmon and increase the amount and quality of rearing habitat for steelhead and chinook and coho salmon. Conservation measures included in the HCP (Chapter 4) to address these water quantity concerns include:

- CM-03: Donation of Water Rights. Storedahl's 330 acre feet per year (afy) water right, currently used for irrigation, will be transferred to the State Trust for instream flow enhancement. This transfer will increase the amount of local groundwater discharge that flows into the East Fork Lewis River by an estimated 1.1 cfs during the May through September irrigation season. Because irrigation water is used during the summer, the transfer of this water right will enhance flows in the streams during the period of low flow. The addition of 1.1 cfs to the East Fork Lewis River will not be substantial, since low flows in the river average about 50 cfs (Storedahl 2003).

- CM-04: Water Management Plan. The pond elevations will be managed to provide water for late summer discharge to Dean Creek. An average of 0.3 cfs of cooler water from the bottom of Pond 3 or 5 will be released as surface water to Dean Creek during May through September.

The primary effect of the conservation measures will be to slightly increase flows to Dean Creek and the East Fork Lewis River. Secondarily, the conservation measures will reduce water temperatures in the section of Dean Creek adjacent to the Daybreak ponds. The measures are expected to have little effect on temperatures in the East Fork Lewis River, due to dampening effects of the alluvial aquifer matrix, time of arrival of groundwater seepage, and because the flow contributed by the ponds and Dean Creek is low relative to mainstem flows (the average managed discharge rate from the Daybreak Ponds to Dean Creek will be approximately 0.3 cfs). The measures are also expected to have little effect on temperatures in Dean Creek downstream of the Pond 5 outlet. In this reach, the stream passes through a beaver pond complex, which has naturally warmer water temperatures as a result of low velocities and increased open water.

2.1.5.2.1 Hyporheic Flow. Based on a limited suite of field data and generally accepted engineering practices for water-supply groundwater investigations, the HCP suggests that the only newly excavated area expected to intercept hyporheic flow will be the shallow emergent wetland areas east of existing Pond 1. Groundwater that will be intercepted by the proposed ponds will primarily flow from the upgradient alluvial aquifer and upland sources and thus will not be hyporheic. Based on the predicted groundwater flow paths, hyporheic flow intercepted in the eastern portion of the mine expansion area will continue to flow primarily toward the existing ponds.

NOAA Fisheries, on the other hand, believes that the spatial resolution of the HCP's groundwater study is too coarse for characterization of the hyporheic zone, and that hyporheic flow could extend further from the current East Fork Lewis River channel than predicted in the HCP. However, the disagreement over the delineation of the hyporheic zone may be irrelevant due to the likelihood that there are already highly disrupted subsurface flow pathways and emergence locations caused by the Daybreak Ponds and existing East Fork Lewis River avulsion-induced channel instability. Subsurface flow is already refracted around the Daybreak Ponds and/or converted to surface flow or evaporated.

Regardless of the accuracy of the HCP's groundwater and hyporheic flow analyses, changes in flow pathways remain unpredictable, since groundwater or hyporheic flow is not uniform. Specifically, the additional amounts of fine-grained materials in the reclaimed ponds may alter the relative permeability or hydraulic conductivity. It is possible that as the Daybreak and expansion ponds are filled with relatively finer-grained materials, hyporheic flow may be refracted away from the ponds and towards the river, causing insignificant localized changes to groundwater and hyporheic upwelling locations and timing.

The new excavated ponds potentially could also affect the water temperature in the downgradient hyporheic water, or the hyporheic area considered downstream of the site as a result of increasing the surface area of the ponds from approximately 64 acres to 102 acres. Additionally, late-summer water temperatures in the ponds could increase due to increased residence time in the ponds and thereby increased hyporheic water temperature. However, although the final reclaimed ponds will have a larger surface area compared to existing conditions, the surface water area relative to their total volume will be reduced as a result of the reconfiguration of the existing ponds and the increased depth of the new ponds. Pond water temperatures below a depth of 10 to 15 feet are expected to remain at 12°C or less. It is anticipated that 50% or more of the new pond volume will remain at the cooler ambient groundwater temperatures, even during the summer months.

Data from hyporheic wells at the Daybreak site indicate that as water travels from the river or ponds into the hyporheos, the water temperature is moderated and the fluctuations are dampened. This moderating effect occurs as water flows through the ground to the river for a distance before discharging to the river. Therefore, it is expected that the new ponds will have no net effect on hyporheic water temperature discharged to the East Fork Lewis River.

Interception of subsurface flow could affect biogeochemical processes and the distribution of interstitial invertebrates downgradient from the new ponds. However, since flow paths described in the HCP indicate that most of the subsurface flow from the new ponds will flow into the existing ponds, any changes in subsurface biogeochemical or faunal characteristics from the new ponds will likely be the same as those under existing conditions and have insignificant effects on the East Fork Lewis River.

Effects on Steelhead. Expanded mining and reclamation under the HCP will not substantially impact groundwater contributions to the East Fork Lewis River. However, the transfer of 330 afy currently used for irrigation to the State Trust for instream flow enhancement could slightly increase flows and the amount and quality of rearing habitat and have a slightly positive effect on adult upstream migrating and juvenile rearing steelhead. The increased flows will not affect steelhead spawning and incubation since the increased flows will occur in the summer and early fall, outside the summer- and winter-run steelhead spawning window of March through late May or early June.

Effects on Chinook Salmon. Expanded mining and reclamation under the HCP will not substantially impact groundwater contributions to the East Fork Lewis River. However, the transfer of 330 afy currently used for irrigation to the State Trust for instream flow enhancement could slightly increase flows and the amount and quality of rearing habitat and have a slightly positive effect on adult upstream migration, spawning, incubation and rearing of juvenile chinook salmon.

Effects on Coho Salmon. Expanded mining and reclamation under the HCP will not substantially impact groundwater contributions to the East Fork Lewis River. However, the transfer of 330 afy currently used for irrigation to the State Trust for instream flow enhancement could slightly increase flows and the amount and quality of rearing habitat and have a slightly positive effect on adult upstream migration and rearing of juvenile coho salmon. The increased flows will not affect coho spawning and incubation since the increased flows will occur in the summer and early fall, prior to spawning.

Effects on Chum Salmon. Expanded mining and reclamation under the HCP will not substantially impact groundwater contributions to the East Fork Lewis River. However, the transfer of 330 afy currently used for irrigation to the State Trust for instream flow enhancement could slightly increase flows and have a slightly positive effect on adult upstream chum salmon potentially migrating upstream in the early fall. The increased flows will not affect chum spawning and incubation since the increased flows will occur prior to spawning. Juvenile chum will not be in the river during the summer and early fall when flows will be increased, and therefore there will be no effect on juvenile chum.

2.1.5.3 Surface Water

2.1.5.3.1 Temperature. The East Fork Lewis River is a naturally wide, low elevation alluvial channel and thus particularly vulnerable to temperature impacts. It is currently on the state 303(d) list as water quality impaired due to elevated water temperatures. Summer water temperatures sometimes exceed 22°C at Daybreak Park, just upstream of the HCP area. The HCP has a slight potential to affect surface and groundwater temperature as a result of the presence of the existing ponds, creation of new ponds, and the implementation of various conservation measures.

Normal water temperatures in salmonid streams vary daily, seasonally, annually, and spatially. Most stocks of anadromous salmonids have evolved with the temperature patterns of the streams they use for migration, spawning, and rearing and deviations from the normal pattern could adversely affect their survival (Bjornn and Reiser 1991). Humans have altered temperature patterns by changing riparian zone vegetation, diverting water, building reservoirs, and removing sediment/gravel from streams and floodplains. In streams, changes in water temperatures may affect fish indirectly as well as directly.

Many populations of native salmonids respond to natural temperature patterns in streams by moving upstream or downstream when water temperatures become unsuitable. Fish may use a section of stream during one season of the year, but move to other sections at other seasons because temperatures become unsuitable. Salmonids may not always be able to avoid unsuitable temperatures, however, especially if the temperatures change rapidly and are not part of the normal pattern in which the fish evolved (*Ibid.*).

Salmonids are coldwater fish with well studied temperature requirements (Spence *et al.* 1996). Salmon and steelhead prefer habitats with water temperatures less than about 15°C. Upper lethal temperature limits generally range in the vicinity of about 23° to 25°C, although many salmonid species can survive short-term exposures to temperatures as high as 27° to 28°C (NMFS 2003b). Although fish may survive at temperatures near the extremes of the suitable range, growth is reduced at low temperatures (all metabolic processes are slowed), and at high temperatures (most or all food must be used for maintenance) (Bjornn and Reiser 1991).

Each native fish stock appears to have a unique time and temperature for spawning that likely maximizes the survival of their offspring. Temperatures before and during spawning must allow the spawners to survive and deposit their eggs, but temperatures during incubation of the embryos (which regulates timing of juvenile emergence from the redd) may be the primary evolutionary factor that has determined the time of spawning (*Ibid.*).

Water temperature during incubation generally affects the rate of embryo and alevin development and the capacity of water for DO, and (beyond certain limits) survival of the young fish. There are upper and lower temperature limits for successful incubation of salmonid eggs. In general, the higher the temperature (within the acceptable range), the faster the rate of development and the shorter the incubation time and time to emergence (*Ibid.*).

Intragravel water temperatures are generally influenced by temperatures of the surface water, the thermal mass of the substrate, and the interchange rate of surface and intragravel water. There are seasonal as well as diurnal differences: intragravel water temperatures often are lower than surface water temperatures during summer, and higher during winter. When salmonids spawn in areas close to groundwater inflows, embryos experience reduced extremes in water temperatures than they would otherwise (*Ibid.*). Use of areas with groundwater flow may have survival advantages if the water quality (*e.g.*, suitable temperatures) in upwelling areas is more suitable than in areas without groundwater.

Additional physiological and behavioral changes of salmonids generally related to water temperature include: delays in upstream migration because natal streams are too warm, disease outbreaks in migrating and spawning fish, altered timing of migration, and accelerated or retarded maturation (*Ibid.*).

Water temperatures at the surface of the existing ponds and in the East Fork Lewis River are generally similar. Surface water temperatures at the Pond 5 outlet are 1°C to 1.6°C higher than temperatures in Dean Creek (measured just upstream of the Pond 5 outlet). No temperature data are available for Dean Creek downstream of the Pond 5 station, but temperatures are expected to be higher there, as downstream of Pond 5 the creek enters a series of low-velocity beaver ponds that decrease the flow velocity and increase the area of surface water exposed to solar radiation. Continuous temperature monitors installed in the East Fork Lewis River upstream and downstream of the confluence with Dean Creek in 1998 revealed no substantial differences in temperature.

Flows in Dean Creek generally become subsurface during the summer, and water quality conditions in the ponds and in the beaver complex on lower Dean Creek may be inadequate to support salmonids. Without modifications to the outflow configuration, increased discharge of water that is warmer than Dean Creek at the outlet could increase the potential for adverse impacts resulting from high temperatures.

The existing ponds become thermally stratified in the summer, with temperatures that may exceed 20°C in the upper 10 to 15 feet. Temperatures in the hypolimnion, or lower layer, are cooler and are adequate for salmonids, but DO measurements are generally low. Temperature conditions in the new ponds are expected to be similar to those observed in the deeper existing ponds.

The new ponds will be 10 to 25 feet deeper than the existing ponds and have a much larger volume of cooler bottom water during the late summer months. Implementation of the closed-loop clarifier system (CM-01) will eliminate the mixing in Ponds 1 and 2. Storedahl's creation of valley-bottom forest (CM-06) surrounding all the ponds may eventually increase shade and reduce wind-generated mixing in the ponds. The net effect of the conservation measures should be a larger volume of cold bottom water and a more readily available supply of late summer cold-water for implementation of the water management plan (CM-04).

Under the water management plan (CM-04), release of water from Pond 5 to Dean Creek will be controlled by restricting outflows to a single location at the northwest corner of Pond 5 and installing a control valve. Water temperatures of the pond outflow and in Dean Creek will be monitored weekly during April through September. No water will be released from the ponds to Dean Creek when outflow temperatures exceed ambient temperatures at the Dean Creek Pond 5 station. The gravity-fed pond outlet structure will allow colder, bottom water to be released to Dean Creek, which could benefit salmonids in lower Dean Creek. During the warm summer months, a pump-intake in Pond 3 or 5 will release colder bottom water to the upper reach of Dean Creek. Reestablishment of native riparian vegetation (CM-13) will provide some additional shade to the East Fork Lewis River and will substantially increase shade to Dean Creek, further moderating water temperatures there.

2.1.5.3.2 Turbidity.

2.1.5.3.2.1 *General Turbidity Effects*. Suspended sediments from aggregate processing and/or an avulsion could adversely affect salmonid fishes in the East Fork Lewis River. The size of the sediment particles and flow velocities typically affect the duration of sediment suspension in the water column. Larger particles (greater than 2 millimeters), such as sand and gravel, settle rapidly, but silt and very fine sediment may be suspended for several hours to days. Suspended sediments can adversely affect salmonid migratory and social behavior and foraging opportunities (Bisson and Bilby 1982; Sigler *et al.* 1984; Berg and Northcote 1985).

Turbidity is defined as a measurement of relative clarity due to an increase in dissolved, or suspended, undissolved particles (measured as total suspended solids, or TSS). Although there is no well-defined relationship between turbidity and suspended sediment, a five NTU increase in turbidity may be associated with an increase in suspended sediment concentration of approximately 5 - 25 mg/L (Bell 1991). At moderate levels, turbidity can reduce primary and secondary productivity and, at high levels, has the potential to interfere with feeding and to injure and kill adult and juvenile fish (Spence *et al.* 1996, Bjornn and Reiser 1991). An increase in sensitive biochemical stress indicators and an increase in gill flaring may occur when salmonids are exposed to highly turbid water (gill flaring allows the fish to create sudden changes in buccal cavity pressure, which acts similar to a cough). Salmonid fishes may move laterally and downstream to avoid turbid plumes (Sigler *et al.* 1984, Lloyd 1987, Servizi and Martens 1991). Juvenile salmonid fishes tend to avoid streams that are chronically turbid, such as glacial streams or those disturbed by human activities, except when the fish must traverse these streams along migration routes (Lloyd 1987). A potential positive effect of increased turbidity is providing refuge and cover from predation. Fish that remain in turbid waters experience a reduction in predation from piscivorous fish and birds (Gregory and Levings 1998). In habitats with intense predation pressure, this provides a beneficial trade-off of enhanced survival in exchange for physical effects such as reduced growth.

Exposure duration is a critical determinant of the occurrence and magnitude of physical or behavioral effects (Newcombe and Jensen 1996). Salmonid fishes have evolved in systems that periodically experience short-term pulses (days to weeks) of high suspended sediment loads, often associated with floods, and are adapted to such exposures. Adult and larger juvenile salmonid fishes appear to be little affected by the high concentrations of suspended sediments that occur during storm and snowmelt runoff episodes (Bjornn and Reiser 1991). However, chronic exposure can cause physiological stress that can increase maintenance energy and reduce feeding and growth (Redding et al. 1987, Lloyd 1987, Servizi and Martens 1991).

Increases in TSS can adversely affect filter-feeding macroinvertebrates and fish feeding. At concentrations of 53 to 92 parts per million (ppm) (24 hours exposure) macroinvertebrate populations were reduced (Gammon 1970). Concentrations of 250 ppm (1 hour) caused a 95% reduction in feeding rates in juvenile coho salmon (Noggle 1978). Concentrations of 1200 ppm (96 hours) killed juvenile coho salmon (*Ibid.*). Concentrations of 53.5 ppm (12 hours) caused physiological stress and changes in behavior in coho salmon (Berg 1983).

2.1.5.3.2.2 *Turbidity Effects Specific to the HCP Area*. The most common method of reducing turbidity from construction, mining, or increased surface water runoff, is the use of long detention and settling times that allow suspended sediments to settle out of the water column. This has been the historical method used to control turbidity generated by aggregate processing at the Daybreak site (Storedahl 2003). Prior to the development of the HCP, gravel processing at the Daybreak Mine relied on passive settling of fine sediments as water flowed from Pond 1 to Pond 2 and eventually to Pond 5 to control turbidity. When the ability of the ponds to passively settle turbidity was no longer effective, operations were curtailed until turbidity levels decreased. Implementation of an improved water treatment system between May 1999 and May 2001, that actively flocculated fine sediments, resulted in an increased settling efficiency of solids in the water and reduced levels of turbidity in Ponds 3 and 5, and in the outflow from Pond 5. In May 2001, Storedahl suspended wet processing and discharge of process water to the Daybreak ponds. Since then, aggregate on the site has been processed without washing. Recent (Fall 2001) turbidity measurements in Pond 5, Dean Creek, and at the confluence of Dean Creek and East Fork Lewis River indicate that during storm runoff, the turbidity of the pond discharge is significantly lower than that of Dean Creek itself. The proposed improved water treatment systems are a conservation measure in the HCP, designed to reduce turbidity levels to less than 25 NTUs. Regardless of the processing system implemented under the HCP, Storedahl must observe the NPDES mandated level (50 NTU) until development of the Daybreak site is complete.

Surface water outflows from Pond 5 vary throughout the year, with higher flows during the winter. Winter outflows are expected to increase slightly following completion of the Daybreak Mine expansion. Existing summer pond discharges are small (approximately 0.3 cfs), but may be substantial relative to the low or non-existent flows observed in Dean Creek at the same time. During the winter, Pond 5 outflows of 5 cfs account for nearly 13% of the estimated winter baseflows (approximately 40 cfs) in Dean Creek. Thus, if turbid pond outflows were to occur, they could influence the turbidity of Dean Creek during all seasons.

During late summer, flows in Dean Creek are generally less than 1 cfs, and thus contribute less than one percent of the surface flow in the East Fork Lewis River. Visual observations made by the applicant prior to implementation of the current flocculation water treatment system indicate that flow from Dean Creek completely mixes with flow in the East Fork Lewis River over a distance of less than 50 feet (Storedahl 2003). During high frequency, low flow events, most of the turbidity will settle in the reed canary grass of lower Dean Creek, before reaching the East Fork Lewis River. Thus potential turbidity impacts to the East Fork Lewis River associated with the existing ponds and wet processing under the current NPDES permit are believed to be minimal. Turbidity impacts with the current water treatment system are even fewer. Fine sediment inputs to the lower river are believed to be dominated by material eroded from of the high bluffs just upstream of the Ridgefield site and near the Daybreak Bridge.

Sediment that remains in suspension through the ponds and lower reaches of Dean Creek is generally the finest fraction (particles smaller than 0.05 mm). Since flows in the East Fork Lewis River have a much greater transport capacity than Dean Creek, most of these fines likely remain suspended until they are carried into the tidal influence zone. However, sediments that settle out above the tidal influence zone and in the first 1.25 miles downstream of the mouth of Dean Creek could detrimentally affect salmonid spawning habitat.

Under the HCP, processing of imported sand and gravel materials with higher levels of fines than the on-site aggregate could increase turbidity. The high suspended solids content and the flow rate make the historical detention system less than optimal and sometimes ineffective in meeting effluent limitations. In order to significantly improve pond water quality, an aggressive treatment system is proposed in the HCP .

With the HCP, Storedahl will continue to dry process or use the existing wet processing (additive-enhanced settling process) until a closed-loop system (CM-01), specifically designed and constructed for the materials processed at the site, can be tested and permitted. The development and installation of the closed-loop system will take from one to three years. During this time, Storedahl will monitor, during wet processing, the effectiveness and toxicity of the current system and the potential adverse effects on aquatic organisms. Please see section 2.1.5.3.3 for additional information on the closed-loop wash-water clarification system.

Upon completion of the closed-loop system design and approval process, aggregate will be processed without any substantial release of process water to the ponds, as the water will be recirculated within the treatment system. Use of the existing chemical-aided clarification system and the more intensive closed-loop system will minimize turbidity to levels one-half or even less (*i.e*., less than or equal to 25 NTU) than the current permitted NTU level (50 NTU).

Although the NPDES permit allows the release of water with turbidity near 50 NTU, Storedahl will maintain turbidity at the Pond 3 outlet to Pond 5 to below 25 NTU. Should turbidity levels exceed 25 NTU, Storedahl has proposed several possible management responses, including halting mining and/or wet processing operations.

To further understand the potential for adverse effects from the closed-loop wash water clarification system, bioassay monitoring, focusing on potential toxicity and bioaccumulation of the treatment additives that are bound to the solids, will be implemented. Should monitoring reveal an unacceptable pH level of the discharged water, or toxicity of the water and/or sediments, Storedahl has proposed several adaptive management responses, including: (1) using an alternative chemical flocculant; (2) modifying the rate and dosage of application; (3) reconfiguring the flow of water from Pond 1 to Pond 2 to Pond 3 to modify the settling time of the treated water, and; (4) halting wet processing and discontinuing wash water discharges until the ponds settle and/or corrective actions are implemented.

Implementation of the updated Storm Water and Erosion Control Plan (CM-02) will reduce surface erosion within the HCP area by requiring revegetation of bare soils, maintenance of asphalt or gravel surfaces on active roads, and decommissioning of abandoned haul roads. Runoff generated on the HCP area, or entering the site as overland flow from upslope areas, will be contained in the ponds to allow sediment to settle out.

Turbid water resulting from mining and reclamation activities will be prevented from reaching Dean Creek and the East Fork Lewis River through implementation of the Storm Water and Erosion Control Plan (CM-02). All sites being actively mined or disturbed by reclamation will be isolated so surface water does not flow from the site to the other ponds, or the activities will occur during May through September when surface water flow from Pond 5 is controlled or shut off.

Water quality in Dean Creek will also be protected and improved by reestablishing a 200-foot wide vegetated riparian zone (CM-07) and by revegetating and stabilizing eroding banks (CM-13 and CM-14). The combined effect of these measures will be to reduce turbidity and delivery of fine sediment from the HCP area to Dean Creek and the East Fork Lewis River.

Under CM-08 (Mining and Reclamation Design), Storedahl will add approximately 571,000 cubic yards or 685,000 tons of clean fill to the existing Daybreak ponds. Storedahl will generate 271,000 cubic yards of this material from topsoil and fine sediments processed on-site. The remaining 300,000 cubic yards will be clean imported fill. These relatively fine-sized sediments will be in addition to approximately 289,000 cubic yards of fine sediments already in place from historical gravel processing at the site. In the event of an avulsion, some fraction of these sediments could be entrained in the flow of the East Fork Lewis River. The volume of entrained material will be dependent on how the avulsion develops, the River's hydrology, and localized hydraulics.

Sediment does not move as a uniform mass, even when it is suspended in the water column. Rivers are hydraulically complex, with high velocity zones flanked by low velocity edges and back-eddies. Thus, a mass of fine sediment suddenly placed in the river will disperse into an elongated plume (Huber 1993). Some will settle out in back eddies and slack-water zones, to be re-mobilized during subsequent peak flows. Some sediments will enter the streambed via hyporheic pathways. After percolating through the streambed, reduced flow velocity and proximity to surfaces will induce settling, causing the interstitial pores to clog (Jobson and Carey 1989). Such sedimentation can only be reversed during later peak flows, which scour and then fill the gravel bed. Thus, recovery of the downstream 1.5 miles of spawning area from a pulse of sediments from the Daybreak site following an avulsion is likely to be on the order of two to four years (an estimated recurrence interval for streambed scouring events.)

The potential influence of fine-sized sediments in the Daybreak ponds on turbidity in the East Fork Lewis River will be similar to the impacts on turbidity of any overbank-flooding event along the East Fork Lewis River. The supply of fine sediments to the river comes from many sources within the watershed and floodplain. Fine-grained sediments are supplied to the river from processes such as hillslope erosion, rill and gully erosion, river bank erosion, mass wasting, and the failure of natural hydraulic controls such as beaver dams and log jams. The natural supply of fine sediments to the river varies from large-scale short-term introductions, to long-term chronic supplies. Deposition of fine sediments in the floodplain is a natural and on-going riparian function.

Consequently, sources of fine sediments in the floodplain are widespread and the potential impacts of fine-grained sediments placed in the Daybreak ponds on turbidity and gravel bed characteristics of the East Fork Lewis River are difficult to predict. However, it is important to note that these impacts, and their effects on covered salmonids, are likely to be much less severe than the massive channel destabilization, sediment mobilization and long recovery times predicted to occur as a result of an avulsion into gravel pits that have not been reclaimed by filling.

2.1.5.3.3 Inorganic Flocculants, Coagulants, and Polymers. Under CM-01, Storedahl proposes, after three years, to install and operate a closed-loop wash water clarification system to remove solids from the process water and re-circulate the water back into the closed-loop system. The closed-loop system will substantially reduce or eliminate discharge of process water into the existing ponds. The closed-loop system will benefit covered species through reductions to pond water turbidity and a reduction of water needed to process gravel. Storedahl commits to reducing, by at least half, the current Washington Department of Ecology permitted NTU level of 50. Storedahl's preliminary testing results indicate that a closed-loop water treatment system can achieve NTU levels of less than 10 NTUs (Storedahl 2003). Lower turbidity levels and smaller amounts of discharge water, in turn, mean less sediment that could potentially reach Dean Creek and the East Fork Lewis River during the active processing of gravel. Less discharge water also means that less water is need to process gravel, allowing Storedahl to donate a substantial potion of the property's water rights to instream flows, per CM-03. The remaining water rights used to operate the closed-loop system will be donated at the end of mining and processing activities.

Although the closed-loop system will reduce turbidity, eliminate the discharge of process water to the ponds, and minimize the use of water during gravel processing, a potential negative contribution of the closed-loop system is the introduction of chemical additives to process water. The final design of the closed-loop system will be developed in consultation with the Services, WDOE, and other appropriate permitting agencies, thus ensuring that chemicals known to be toxic to covered species will not be permitted. Although the specific type of closed-loop system that will be installed and operated during mining and processing activities on-site will not be known prior to the completion of this consultation, the system will contain the following components: (1) a pre-settling basin or tank that will remove coarser solids such as sand from the wash water; (2) a flocculant/coagulant injection system consisting of an additive storage tank or drum and metering pump and mixing tank; (3) a clarifier with a continuous solids removal system that will settle out flocculated materials; and (4) a belt press that will dewater the sediments and decrease moisture content. Water from the belt press will be re-circulated to the treatment system.

During previous gravel washing operations that used chemical additives, Storedahl monitored the process water discharge and the receiving waters (existing ponds) for aquatic toxicity following WDOE's Whole Effluent Toxicity Testing and Limits Guidance (WAC 173-205). Toxicity testing results from 15 tests indicated that the water treated with these additives was not toxic to rainbow trout fry (100% survival) or *Daphnia magna* (95% survival).

Under Monitoring and Evaluation Measure (MEM)-01 in the final HCP, wet processing and aquatic toxicity testing of the previous method of gravel processing will continue during the design and construction of the closed-loop system. Storedahl will continue to submit quarterly monitoring reports to WDOE and annual reports to the Services. During previous processing, approximately 98% of the additives bound with sediments and remained in Pond 1. All additives were presumed "spent" before reaching the discharge at Pond 5. Under the HCP, Storedahl will cap treated sediments in the existing ponds with several feet or more of clean fill, plus a minimum of 18 inches of topsoil, per CM-08, to reshape and narrow the footprint of Ponds 1, 2, and 3. The additives are not expected to enter groundwater because of the affinity for sediments.

Upon implementation of the closed-loop system, toxicity and bioaccumulation testing of sediments and additives will be initiated following EPA's (2000) *Methods for Measuring the Toxicity and Bioaccumulation of Sediment-associated Contaminants with Freshwater Invertebrates*. This testing procedure employs amphipods *(Hyalella azteca),* midges *(Chironomus tentans)*, and oligochaetes (*Lumbriculus variegates)* to measure toxicity above, on the surface, and within the sediments. Invertebrate samples collected from the existing ponds in January 2001, following more than a year of additive use in the current process water treatment system, contained a variety of invertebrates including amphipods and midges. Sampling for oligochaetes (worms) was not conducted at that time. Testing of cationic polyacrylamides (PAMS), which are generally more toxic than the anionic PAMs proposed for use in the closed-loop clarifier, has indicated no earthworm mortality, growth, reproduction, or other sublethal effects, which could be attributed to the PAMs (Sweet 2003). Nevertheless, should testing prove positive for toxicity, final HCP MEM-01 Clarification Process Monitoring includes management responses ranging from a change in additive(s) and/or dosage to the cessation of wet processing at the Daybreak Mine site. Storedahl will continue submitting quarterly whole sediment testing results to WDOE and annual summary reports to the Services.

Toxicity is partially dependent on exposure, and can be due to direct exposure to a substance at a critical concentration (lethal concentration or LC), or result from synergistic effects of a combination of substances. By incorporating toxicity testing in water quality and sediment monitoring, both the direct and synergistic effect(s) on invertebrates related to specific additive(s) and dosing rates can be directly measured. Prior to construction of the final closed-loop treatment system, Storedahl will move a scaled down pilot plant to the site to test the effectiveness of various configurations and additive(s) under a range of discharge conditions. This pilot testing will provide an opportunity to sample the product, *i.e.*, flocculated sediment, and perform toxicity testing before selecting which additive(s) and clarifier system will be assembled at the site. The closed-loop clarifier will be located outside the FEMA designated 100-year floodplain, but still within the 23-acre processing area. All chemicals will also be stored outside the 100-year floodplain.

A second potential exposure route is through an accidental catastrophic release of the additives used in the existing process water clarification system or the future closed-loop clarifier system. Storedahl will store additives at the site in a 5,100-gallon double-walled tank and/or within a metal building designed with a secondary containment component. The Storm Water Erosion Control Plan and Storm Water Pollution Prevention Plan (Technical Appendix D of the HCP) includes spill prevention measures in Section 5.2.2, and emergency spill containment and reporting measures in Section 5.3. However, assuming a worst case scenario, such as the release of all the additives contained in the 5,100 gallon double-walled tank, the concentration of the additive(s) in the existing or reconfigured ponds post-reclamation can be estimated. Note that these additives are designed to be highly soluble in water. As an example, if NALCO 7888 is stored in the tank, a release of 5,100 gallons of NALCO 7888 would likely result in a portion being adsorbed to the soil in the vicinity and the balance running into Daybreak Pond 1, where it would mix with water and some suspended sediments and the overflow would enter Daybreak Ponds 2, 3 and 5, with additional mixing occurring prior to discharging into Dean Creek. These ponds have a combined volume of 535 acre-feet. Complete mixing of the NALCO 7888 would result in a concentration of approximately 37 mg/l in the pond water. The reported LC50 for NALCO 7888 for rainbow trout is 475 mg/l, an order of magnitude higher than the resulting pond concentration. A similar calculation for the reconfigured ponds (under CM-08) with a final volume of 306 acre-feet, results in a concentration of approximately 64 mg/l, still well below the LC50. Storedahl expects that containment and cleanup response would result in even lower concentrations in the ponds than calculated in the above example. Covered species in the immediate vicinity of a spill are more likely to be adversely affected by an accidental spill of chemical additives, but it is anticipated that the chemical will be quickly diluted to sub-lethal concentrations as additive mixes with large volumes of water in Daybreak Ponds 1, 2, 3, and 5. Coho and steelhead that may have entered the existing ponds during flooding events on Dean Creek are the only species likely to be present in the existing ponds during normal day-to-day processing operations, and therefore, are most likely to be impacted during a chemical spill. Chinook and chum salmon are not expected to enter the existing ponds, because they are not expected to utilize Dean Creek at any time during the life of the plan.

Flocculants, coagulants, and polymers released into the ponds during an accidental spill could potentially enter Dean Creek and the East Fork Lewis River where they could combine with sediments causing them to settle out more quickly than anticipated under normal stream processes. For example, winter discharges from Pond 5 into Dean Creek range from 2.9 to 5.1 cfs (HCP Table 6-2) while Dean Creek 2-year (bank full) discharge is approximately 164 cfs (HCP Technical Appendix C, Table 4-4). If a worst case spill occurs during winter high flow, as described above, the concentration of the additive in the pond water would either be further diluted by the flow of Dean Creek and/or attached to sediments suspended in the flow. With a flow of 2.9 to 5.1 cfs from the ponds, the concentration of additive(s) in Dean Creek would be 1 to 2 mg/l, less than 7% of the optimum needed to affect treatment of the process water. Also note, this concentration would be less than 1% of the LC50 for the additive. However, even low doses of additive in Dean Creek could result in increased rates of settling of fine sediment and organics in Dean Creek. Additives leaving the pond are expected to adsorb to the naturally high turbidity levels in Dean Creek winter runoff and settle in the streambed and/or be carried with overbank flow and deposited onto Dean Creek's floodplain. Higher rates of settling, in turn, could lead to higher rates of habitat degradation, including the loss of spawning substrate for species that rear in Dean Creek (coho) and the loss of interstitial spaces used by aquatic macro-invertebrates (prey species of coho, chinook, chum and steelhead). Note, during the summer months the surface discharge from Daybreak Pond 5 is 0.3 cfs or less (HCP Table 6-2). Under CM-04 Water management plan, this discharge is pumped from the bottoms of Ponds 3 and 5. Simply stopping the pumping to Dean Creek, and possibly redirecting it to riparian irrigation would eliminate the discharge of spilled additive(s) into Dean Creek. Containment facilities and spill response measures in the HCP would minimize the amount of chemicals that enter Daybreak Pond 1. Reducing the mixing of the chemicals with water in Daybreak Ponds 1, 2, 3, and 5 would further dilute the concentration of these chemicals prior entering Dean Creek via the controlled outlet. Additional dilution of the additive(s) leaving the ponds into Dean Creek, as well as the availability of turbid water in Dean Creek's natural flow to further adsorb the diluted additive, would likely result in the additive being 'spent' long before it reaches the East Fork Lewis River. A spill of chemical additives in Daybreak Pond 1 is not expected to have an effect on covered species in the East Fork Lewis River.

2.1.5.3.4 Dissolved Oxygen. Decreases in DO have generally been shown to adversely affect swimming performance in salmonid fishes (Bjornn and Reiser 1991). Oxygen also affects both the feeding and growth rates of salmonids. If the oxygen levels drops below 50% saturation, the food consumption, gain in weight and food conversion ratio all drop (Bell 1991). Dissolved oxygen levels in the East Fork Lewis River fluctuate daily, but recorded levels have not been lower than the Washington State class A criterion (8 mg/l) in monthly monitoring between 1976 and 1992 at the Daybreak Park station (Hutton 1995a, as cited in USFWS and NMFS 2003). The relatively high DO levels probably result from turbulent flowing water and carryover from higher DO levels upstream (*Ibid.*). Low DO levels do not appear to be a water quality issue in the East Fork Lewis River near the project site.

In Dean Creek, historical DO data suggest that in summer, DO levels downstream of the J. A. Moore Road Bridge decline to levels stressful to fish (less than 8.0 mg/l). However, the water remains well oxygenated above the bridge. This pattern is consistent with conditions in the upper reaches of the creek, where the stream is well shaded and has a higher gradient. More recent DO monitoring at the Pond 5 outfall, associated with the process water treatment field testing, recorded levels ranging from 9.0 to 9.1 mg/l.

Dissolved oxygen levels in the ponds are a function of several factors, including temperature, the degree of water column mixing, photosynthetic activity, inputs of low DO groundwater, and decomposition rates of organic material. The DO concentration typically decreases as temperature increases, due to the inverse relationship between solubility of oxygen in water and water temperature. When water bodies become stratified due to temperature, DO levels at depth can decline dramatically, as oxygen consumed in decomposition processes is not replaced by either photosynthesis or mixing with more oxygenated water.

Because oxygen is a by-product of photosynthesis, the photosynthesis rates of aquatic plants and algae also contribute to DO levels. Photosynthesis rates increase with light levels and with temperature (up to a point). Dissolved oxygen levels can fluctuate substantially over 24 hours due to high photosynthetic activity during the day and respiration at night.

Mixing of surface waters with air due to wave activity and turbulence contributes to higher DO levels near the surface. Low DO levels can result in stress or mortality to fish and other aquatic animals.

In all five of the existing Daybreak ponds, DO levels were generally above 10 mg/l in March 1998 (USFWS and NMFS 2003). In the deeper ponds (Ponds 3 and 5), DO levels at lower depths had declined markedly by early June. By mid-August in the deeper ponds, DO levels were very low (near 0 mg/L below 8 feet of water depth in Pond 5). Naturally low DO in groundwater entering the ponds (EMCON 1998, as cited in USFWS and NMFS 2003), combined with reduced light penetration in the turbid pond water and stratification during the summer, accounts for the extremely low DO levels in the deeper ponds.

In contrast, the shallower ponds (Ponds 1, 2, and 4) had DO levels above 8.0 mg/l across their depth profiles through the summer, except near the bottoms of the ponds. The continuous mixing due to the recycling of process water in these ponds and possibly higher photosynthetic activity due to a higher abundance of submerged aquatic macrophytes undoubtedly influences the higher DO levels in these ponds. Low DO in water near the pond bottoms was probably due to high decomposition rates in benthic sediments.

Although the effects of the project on water quality in fish habitats are unlikely to adversely affect the covered species, the HCP includes several conservation measures to improve water quality conditions in the on-site ponds, Dean Creek, and the East Fork Lewis River. Specific measures to improve and protect water quality in Dean Creek habitats that could be used by coho salmon include a new gravel processing method, a revised stormwater and erosion control plan, a stormwater pollution prevention plan, reconfiguration of the surface water inlets and outlets from Pond 5 to Dean Creek, and revegetated riparian areas. Improved water quality in Dean Creek will benefit upstream migrating adult coho and rearing juvenile coho. Reduced turbidity could also benefit coho spawning and incubation in Dean Creek.

2.1.5.3.5 Surface Water Quantity. Expanded mining and reclamation activities have the potential to slightly alter the quantity of water flowing to Dean Creek and the East Fork Lewis River. Potential effects include: Increased rates of evapotranspiration and resultant reduced water quantity flowing to Dean Creek and the East Fork Lewis River, and alteration of groundwater elevations and groundwater/hyporheic flow paths. Table 5 contains estimates of changes in water flow through the ponds as new ponds are created and reclaimed.

Table 5. Estimates of changes in water flow through the ponds as new ponds are created and reclaimed.

		Existing Conditions		**Project Completion**	
	Flow Component	**Winter (cfs)**	**Summer (cfs)**	**Winter (cfs)**	**Summer (cfs)**
Inflows					
	Groundwater (all ponds)	3.2	1.2	3.2	1.2
	Surface Inflows (Dean Creek)	0 to 20.1	0.0	0.0	0.0
	Incident Precipitation	0.5	0.2	0.8	0.4
	Totals	3.7 to 23.8	1.4	4.0	1.6
Outflows					
	Groundwater	0.9	0.9	1.1	0.9
	Surface Outflow	2.9 to 5.1	0 to 0.3	2.9 to 5.1	0.3
	Evaporation	0.0	0.4	0.0	0.6
	Totals	3.8 to 6.0	1.3 to 1.6	4.0 to 6.2	1.8

Approximately 547 acre-feet per year (afy) of water is lost from the Daybreak site annually as a result of evapotranspiration under existing conditions. Under the HCP, irrigated pasture lands will be converted to open water, wetlands, and mixed valley-bottom forest. The analysis in the HCP indicates that 570 afy of water will be lost per year under future conditions. This four percent net increase of evaporative loss is not substantial, and with the transfer of Storedahl's 330 afy water right (CM-03), there will be a net increase in the amount of groundwater discharged to Dean Creek and the East Fork Lewis River, potentially benefitting multiple life stages of covered species.

<u>Effects on Steelhead</u>. Implementation of the water management plan (CM-04) could increase surface outflows from the ponds during the late summer and fall. Increased flows will be most notable in Dean Creek, where total discharge in the late summer is generally less than 1 cfs and stream sections go subsurface during the summer. However, flow increases are expected to be less than 0.5 cfs, thus, there will be no effect on the upstream migration, spawning, or incubation of

steelhead in the East Fork Lewis River. The increased flows will increase the amount of habitat available to juvenile steelhead, but with minimal benefits since Dean Creek is not their preferred habitat.

High water temperatures are most likely to detrimentally affect adult steelhead migrating upstream or holding in the mainstem during the summer low-flow period. Temperatures in the East Fork Lewis River during the spawning period are generally suitable (less than 10°C) for steelhead spawning, although temperatures in the river may exceed 10°C during the latter part of the their spawning and incubation season. Implementation of the HCP is expected to maintain or reduce water temperatures in Dean Creek adjacent to the HCP area, and have no measurable effect on water temperatures in the East Fork Lewis River. Seventeen hundred feet downstream of the Daybreak reach, Dean Creek flows through a large beaver complex with low velocities and a large area of shallow water exposed to solar radiation. Therefore, any temperature reductions resulting from the HCP will likely be localized, and will have little measurable effect on water temperatures in the East Fork Lewis River unless or until restoration activities (outside the scope of the HCP) are completed on the lower reach of Dean Creek.

Detrimental effects from high temperatures are most likely to impact juvenile steelhead stranded in the ponds during the late summer. Water quality within several of the existing ponds meets the water quality criteria required for steelhead rearing during the winter, but could pose a thermal risk to fish that remain throughout the summer months. Reconfiguration of the Pond 5 outlet will restrict juvenile steelhead, during most flows, from entering the ponds and becoming exposed to high temperatures. Implementation of the HCP could decrease temperatures in Dean Creek, although it is not expected to change temperatures in the East Fork Lewis River. For this reason, any slight temperature alterations that occur as a result of this HCP will not affect upstream migration, spawning, or incubation of steelhead in the East Fork Lewis River.

Dissolved oxygen levels measured in both Dean Creek and the East Fork Lewis River downstream of the Daybreak site generally exceed 10 mg/l during the steelhead spawning and rearing period and are not currently considered a limiting factor in the East Fork Lewis River. Implementation of the HCP may slightly increase the summer low-flow DO concentrations in Dean Creek as a result of increased DO in the Pond 5 outflow and pumped discharge to Dean Creek. However, because of the downstream beaver pond complex, low velocities and naturally high temperatures are likely to naturally result in reduced DO. Since increasing the DO of the pond outflow is not expected to influence DO levels in the East Fork Lewis River, increases in DO that occur as a result of the HCP will not affect upstream migration, spawning, incubation or rearing of steelhead in the East Fork Lewis River.

Under the HCP, turbidity is expected to be substantially reduced from recent conditions, to less than 25 NTUs. Turbidity is minimal under current, non-processing operations. Therefore, the reduction in turbidity expected to occur under the HCP is expected to have no effect on steelhead migrating upstream or holding, or juvenile rearing in the East Fork Lewis River. The reduction in the amount of fine sediment delivered to the river is likely to have a negligible effect on steelhead spawning downstream of the Daybreak site, considering all the natural contributions from other sediment sources. However, an avulsion through the Daybreak site before completion of reclamation activities could result in a large pulse of sediments settling on downstream spawning gravels, for at least a couple of years (see section 2.1.5.3.3 of this Opinion for more detail on the impacts to downstream steelhead habitat from an avulsion).

Effects on Chinook Salmon. Adult chinook salmon will be unlikely to utilize habitat in Dean Creek. Proposed flow increases (CM-03 and CM-04), temperature and turbidity reductions, and increases in DO concentrations in Dean Creek are of insufficient magnitude to measurably affect conditions in the East Fork Lewis River. Therefore, the HCP is not expected to have an effect on adult migration, spawning, incubation, or rearing of juvenile chinook salmon in the East Fork Lewis River. If chinook use habitat in Dean Creek for summer or winter rearing, water quality improvements achieved as a result of the HCP will have a slight positive effect on juvenile chinook rearing habitat.

The 1.25-mile segment of potential mainstem spawning habitat in the East Fork Lewis River from the Daybreak ponds to the tidal influence zone could be affected by sediment generated from Storedahl's operations, although spawning conditions in this reach are also influenced by sediments eroding from the high bluffs above the Ridgefield Pits and the Daybreak Bridge. This reach represents eight percent of the approximately 15 miles of available chinook spawning habitat, although the preferred spawning habitat for fall chinook is a 4.2 mile section from Daybreak Park (RM 10.2) to Lewisville Park (RM 14.4). Use of a clarification system has significantly reduced turbidity of the pond outflows and will therefore continue to reduce sediment inputs as a result of operations at the Daybreak site. Further, implementation of a closed-loop clarification system should substantially reduce or eliminate turbidity contributions from the processing operations. The net result will be a reduction in the amount of fine sediment delivered to the East Fork Lewis River, which could have a positive effect on chinook salmon spawning downstream of the Daybreak site, provided contributions from other sediment sources do not overwhelm minor reductions from the Daybreak site.

Effects on Coho Salmon. Implementation of the water management plan (CM-04) could increase surface outflows from the ponds during the late summer, fall and winter. Increased flows will be most notable in Dean Creek, where total discharge in the late summer is generally less than 1 cfs and stream sections go subsurface during the summer. Increased flows during the fall and winter could facilitate migration through the beaver ponds and increase attraction of adult coho to spawning habitat in Dean Creek. In addition, increasing summer low flows by 0.1 to 0.5 cfs could increase the amount and quality of summer rearing in Dean Creek. The increased flows are expected to have a positive effect on upstream migrating coho. However, the increased flows will only affect the lower portion of Dean Creek, which is downstream of the reach that provides suitable coho spawning habitat. Therefore, the increased flows will not increase the quantity of available spawning habitat in Dean Creek, and thus will have no effect on coho spawning and incubation.

Detrimental impacts from high water temperatures in the ponds are most likely to affect juvenile rearing coho during the summer low flow period. Water quality within several of the existing ponds meets the water quality criteria required for coho rearing during the winter, but could pose a thermal risk to fish that remain throughout the summer. Reconfiguring the Pond 5 outlet will limit juvenile coho from entering the ponds, except during flood flows greater than a 17-year return period. Depending on the timing of flood flows, juvenile coho could be stranded and later exposed to high temperatures in the summer. Habitat conditions in the existing ponds are considered unsuitable for extended juvenile rearing, and therefore, coho are not expected to survive in the ponds for prolonged periods of time. It is important to note, however, that reconfiguring the Pond 5 outlet will reduce the probability of coho from entering and being stranded in the ponds, compared to existing conditions. Also, implementation of the HCP is expected to maintain or reduce water temperatures in Dean Creek, although it is not expected to affect temperatures in the East Fork Lewis River. The overall net effect of these measures on juvenile coho rearing is expected to be neutral.

High water temperatures may also affect adult coho migrating upstream or holding in the mainstem during the summer low flow period. High temperatures can generally cause adult fish to delay entering spawning streams. Although implementation of the HCP will maintain or reduce water temperatures in Dean Creek, the large beaver complex downstream of the Pond 5 outlet will cause a large area of water exposed to solar radiation, and therefore no effect on water temperatures at the mouth of the stream. However, if flows in Dean Creek downstream of the Daybreak site are sufficient to attract adult coho, implementation of the water management plan to facilitate temperature reductions in the outflow coupled with increased riparian shade could have a positive effect on upstream migrating coho. Since temperatures in the East Fork Lewis River and Dean Creek during the fall and winter are generally suitable for coho spawning, the reduction in water temperatures expected from implementation of the HCP will not affect coho spawning and incubation.

Dissolved oxygen is not considered a limiting factor in the East Fork Lewis River. Implementation of the HCP may slightly increase the DO concentration in Dean Creek as a result of increased DO in the Pond 5 discharge. Increasing the DO of the pond discharge will have a positive effect on coho migrating upstream in Dean Creek, but will have no affect on juvenile coho rearing in the East Fork Lewis River because the increased levels of DO are not expected to persist in the river. Since DO concentrations in the East Fork Lewis River and Dean Creek during the fall and winter are generally suitable for coho spawning, the slight increase in DO concentrations expected from implementation of the HCP will not affect coho spawning or incubation.

Turbidity is expected to be substantially reduced under the HCP. Since high turbidity may cause adult fish to avoid spawning areas, reduced turbidity in lower Dean Creek may attract upstream migrating coho, resulting in a positive effect on coho spawning. However, the amount of potential spawning in lower Dean Creek is limited by the influence of beaver activity, which creates ponded conditions. Therefore, reduced turbidity and input of fine sediments will have no effect on coho spawning in Dean Creek. Juvenile coho rearing in Dean Creek will benefit from the reduced turbidity. Discharge from Dean Creek contributes only a fraction of the East Fork Lewis River flows, and therefore juvenile coho rearing in the mainstem are not expected to benefit from reduced turbidity.

If the Ridgefield study indicates that coho over-winter rearing habitat is limited, and the water quality monitoring confirms that the Daybreak ponds could provide suitable habitat, one or more of the ponds could be developed as off-channel rearing habitat under the proposed adaptive management program. This action would benefit all salmonids, but particularly coho.

The 1.25-mile segment of potential mainstem spawning habitat in the East Fork Lewis River from the Daybreak ponds to the tidal influence zone could be affected by sediment generated from Storedahl's operations, although spawning conditions in this reach are also influenced by sediments eroding from the high bluffs above the Ridgefield Pits and the Daybreak Bridge. This reach represents three percent of the approximately 41 miles of available coho spawning habitat, although coho prefer quiet areas with low flows, such as backwater pools and side channels. Use of a clarification system has significantly reduced turbidity of the pond outflows and will therefore continue to reduce sediment inputs as a result of operations at the Daybreak site. Further, implementation of a closed-loop clarification system should substantially reduce or eliminate turbidity contributions from the processing operations. The net result will be a reduction in the amount of fine sediment delivered to the East Fork Lewis River, which could have a positive effect on coho salmon spawning downstream of the Daybreak site, provided contributions from other sediment sources do not overwhelm minor reductions from the Daybreak site.

Effects on Chum Salmon. Detrimental impacts from high water temperatures are most likely to affect adult chum migrating upstream or holding in the mainstem during the early fall when flows are low. High temperatures may cause adult fish to delay entering spawning streams. Implementation of the HCP is expected to maintain or slightly reduce water temperatures in Dean Creek adjacent to the Daybreak site. However, downstream of the Pond 5 outlet, Dean Creek flows through a large beaver complex with low velocities and a large area of water exposed to solar radiation. Therefore, temperature reductions in Dean Creek resulting from the HCP will likely be localized, and would most likely not affect temperatures at the mouth of the stream.

Dissolved oxygen is not currently considered a limiting factor in the East Fork Lewis River. High temperatures and low DO generally occur only during the summer in the East Fork Lewis River. Water quality in the mainstem East Fork Lewis River is suitable for chum rearing during the time the young fish would be present.

Turbidity is expected to be significantly reduced under the HCP. Discharge from Dean Creek contributes only a fraction of the East Fork flows, and delivery of fine sediments is dominated by erosion of two high bluffs upstream of the Ridgefield Pits and the Daybreak Bridge. Therefore, juvenile chum present in the mainstem are not expected to be affected by reduced turbidity.

2.1.5.4 Avulsion Potential on Riverine Habitat

The potential for the East Fork Lewis River to avulse into the existing Daybreak ponds is part of the existing, baseline condition. Future aggregate mining operations at the Daybreak site will be conducted outside of the FEMA-designated 100-year floodplain of both the East Fork Lewis River and Dean Creek and will have no direct physical impact on channel morphology or riverine habitat. In much of the area, the existing and new ponds are further protected from flood flows by county and private roads. Also, the new ponds will occupy only a limited portion of any potential avulsion pathway through the expansion area. Thus, expansion of mining activities at the Daybreak site is not likely to increase the risk of future avulsion. However, channel migration studies and empirical evidence provided by the 1996 avulsion through the Ridgefield Pits suggest that future avulsion and capture of the new and existing ponds at the Daybreak site must be considered possible. On the other hand, the new ponds will become incorporated into the East Fork Lewis River only if the river avulses through local housing, utility corridors, and roads, or through the existing ponds and from there into the new ponds. We believe that an avulsion through the new ponds is less likely to occur during the 25-year-term of the ITP than an avulsion through the existing ponds. Defining a specific flood event that will cause an avulsion is difficult because an avulsion depends on the specific conditions involved. An avulsion could occur due to either the progressive erosion of a barrier separating two flow paths, or a rapid overtopping and breaching of the barrier. The avulsion into the Ridgefield Pits was related to both events.

An avulsion of the river into a floodplain gravel pit has both short-term and long-term impacts. Short-term impacts are those changes to the morphology of the river that take place during and shortly after the avulsion. Specifically, fine sediments from the existing pits may accumulate in the downstream spawning reach of the East Fork Lewis. Long-term impacts are those that continue to affect the morphology of the river well into the future. Additionally, these impacts can be described by their location in relation to the avulsion site: upstream, local, or downstream.

2.1.5.4.1 Upstream Impacts. Short-term impacts upstream of an avulsion into a gravel mining pond may generally include head cutting (which erodes the bed and increases the channel slope), channel armoring, and/or an increase in the channel armor size (bed coarsening). When a pond is breached and the elevation of the river or the active overflow pathway is higher than the elevation of the pond, a localized drop in the streambed and water surface profile occurs. This drop or knickpoint represents a zone of high energy dissipation and thus high erosive force. This erosion will then propagate (head cut) upstream until it encounters a resistant object such as bedrock, larger substrate material, a man-made structure or buried large woody debris, or until the knickpoint spreads out longitudinally, allowing development of a stable slope and armor layer. Even if the initial drop in water surface profile is diffuse (spread out), any shortening or “short circuiting” of the channel length due to the avulsion will cause steeper slopes, and thus higher energy gradient and sediment transport rates. This causes channel incision (reach-scale bed erosion) which will propagate upstream until streambed surface coarsening and flattening of the initially-steepened profile reduce the sediment transport rate and re-establish an equilibrium between the streambed and the sediment transport.

Long-term upstream impacts may generally include continued head cutting; bed coarsening; channel incision; bank failure due to increased toe erosion, bank heights and slopes in excess of the maximum stable heights and angles of repose; instability of structures such as levees and bridges; and reduced sediment deposition due to the increased channel slope. During subsequent high flow events, the channel bed may continue to adjust to altered hydraulics, including higher energy dissipation and greater flow confinement. Higher flow events may thus cause additional disruption of the armor layer, increased degradation and coarsening of the bed. The down cutting of the bed could cause knickpoints to form at confluences, allowing channel bed degradation and bank instability to propagate into tributaries. All of these processes would be evident as changes in channel cross-section. As the river erodes the banks, an increase in the amount of material input to the stream will occur for the same amount of lateral erosion. This will help fill in the gravel pits downstream, initiating their recovery phase. Increased bank erosion also widens the incised channel, causing it to shallow and eventually reduce its sediment transport capacity to the point where deposition can begin to occur. This begins a phase of aggradation, fed by sediments from upstream bank erosion and continued local lateral migration as the channel reestablishes a more stable meander pattern and profile, and hydrologic floodplain. At the same time, as angles decline and vegetation reestablishes a rooting zone and surface cover, toe slope and bank erosion will decline to sustainable levels and over-steepened banks will begin to take a more stable form.

Incision of the river could result in impacts to riparian vegetation because of a lowering of the water table and decreased frequency of overbank flood events. In addition, floodplain function, such as organic matter input to the stream, flooding of side channels, and nutrient exchange between water and floodplain sediments, would be reduced if channel incision over a substantial reach were to occur as a result of avulsion.

When the East Fork Lewis River avulsed into the Ridgefield Pits in 1996, the river changed course and began flowing through a series of six mined and reclaimed gravel ponds. At the entrance to the ponds, the channel bottom degraded by approximately five feet. Later observations by Norman *et al.* (1998) estimated 10 feet of degradation at the entrance. This decrease in bed elevation resulted in the channel bottom head cutting upstream. Although the extent of the knickpoint migration is unknown, qualitative field observations suggest that head cutting has extended up to at least the Daybreak Bridge. No geologic controls, or knickpoints, have been identified. It is possible that the original knickpoint has been longitudinally dispersed over a distance long enough to stabilize it through normal surface armoring processes. No structures have been destabilized and no tributaries are perched as a result of the Ridgefield Pit. The historical slide area along the high bank on the south side of the river upstream of the Ridgefield site, however, continues to actively erode. The bluff erosion is likely caused by a combination of deep-seated mass movement, exacerbated by stormwater runoff at the top of the bluff, along with natural river meandering and channel incision caused by the avulsion into the Ridgefield Pits. Unfortunately, no systematic studies of the evolution of the East Fork Lewis River's cross section, profile or substrate characteristics have been initiated.

2.1.5.4.2 Local Impacts. An avulsion into a floodplain gravel pond has many potential localized impacts. The specific impacts depend on the characteristics of the river and pond at the avulsion site. Typically, short-term impacts in the immediate vicinity of an avulsion can include an immediate change in hydraulic conditions from a high-velocity shallow river to a low-velocity, deep and wide lake-like reach. A delta will typically develop at the entrance to the ponds, which is formed from bank material that formerly divided the pond from the river, from material removed from the upstream channel by head cutting, and from capture of the river's normal sediment load. Typically, the former pond will act as a deposition zone for sediment, capturing a large portion of the sediment load that might otherwise interact with the streambed or floodplain or be transported through the reach.

Additionally, a section of river channel may be abandoned as the river changes course and flows through the former pond. The abandoned channel may go dry, stranding fish, during average flows if the elevation differential between the avulsion point and the exit from the newly formed pool is large enough. The downstream portion of the abandoned channel may develop into a backwater slough during moderate or low flows or the area can continue to flow with intercepted groundwater or hyporheic water. During higher flows, the river may use the abandoned channel as a secondary conveyance. This channel may act as a deposition zone for finer material such as sands and silts that are carried as suspended load during high flows.

In the long-term, the former pond will continue to flow as a wide and deep channel with very low velocities until substantial filling with sediment has occurred. As the delta continues to form and grow at the entrance to the pits, the channel locally takes the form of a braided reach with shifting, unstable bars and distributary channels. Velocities will increase and depth will decrease at the entrance to the pool, while further downstream, the velocities will continue to be slow in the wide and deep channel.

Additional impacts of an avulsion into gravel ponds may include impacts to water quality and ground water levels. A breach at Pond 1 would cause a drop of a couple of feet in the pond surface elevation and an increased groundwater gradient into the pond. During summer low flow periods, the wide channel that formed in the former gravel pond may cause an increase in surface water temperature. The magnitude of the temperature increase will depend on the surface area of the channel, exposure to solar radiation, residence time, and discharge. Portions of the newly formed pools may provide deeper and cooler water than some of the shallower reaches of the river.

An avulsion could also disrupt water quantity and water quality conservation measures implemented as part of this HCP. If an avulsion resulted in the East Fork Lewis River entering Pond 5, then a new outlet from Pond 5 would likely be created, making the controlled outlet to Dean Creek ineffective. An avulsion might require a change in the pumped release system into Dean Creek as part of the adaptive management strategy of the HCP.

The localized impacts of the East Fork Lewis River avulsion into the Ridgefield Pits in 1996 included an increase in channel depth, increased channel width, reduced river velocities, formation of deltic sediment deposit, and the movement of approximately 3,200 feet of channel into a new location. The new channel is of approximately equal length and is comprised of primarily deep pools with slow moving water. The mined and reclaimed gravel ponds had a maximum depth of approximately 30 feet before the avulsion. The channel width changed from a maximum of approximately 200 feet to a maximum of approximately 800 feet. In the embayments and backwaters of the former ponds, river velocities are low. In August 1999, temperatures increased moving downstream through the pools, from 18.9° C in Pit 2 to 20.6°C in Pit 6. During a 2-year event, the average velocity in the main thread of flow through the former ponds is estimated to be approximately 2.5 feet per second, while velocities at cross sections upstream of the former ponds average approximately 4 to 7 feet per second. Recent field observations suggest that the abandoned channel, created when the avulsion occurred, has started to fill with medium sands during subsequent high flow events, and substantial wetland/riparian vegetation has begun to colonize the pond margins within a couple of years post-avulsion. Observations also indicate that the delta at the entrance to the pools has increased in size, resulting in the creation of approximately 900 linear feet of riffle habitat through the historical Pits 1 and 2. The remaining pools are 3 to 10 feet deep, with bottoms composed of fine sediments. Between RM 7 and RM 9, aquatic habitat in the river channel is dominated by rearing habitat of uncertain quality due to the area that flows through the Ridgefield Pits. It is estimated that within this two-mile reach of river, there is 149,890 square yards of rearing area and 68,690 square yards of spawning area.

2.1.5.4.3 Downstream Impacts. An immediate short-term impact, as well as an ongoing long-term impact of an avulsion would be reduced sediment supply to the downstream channel until the ponds fill with sediment. As the pool formed by the former gravel pond traps sediment, the supply of sediment to the downstream channel is curtailed. Until the pond fills and sediment transport re-equilibrates, bed degradation, bed coarsening, and increased bank erosion along the downstream channel may occur. With a reduced supply of sediment to the downstream reaches, the river will locally increase its sediment transport capacity. The increased transport capacity will erode the channel bed and/or banks. In addition, channel incision leads to greater flow confinement, concentrating more hydraulic energy and erosive poser within the channel banks during floods. The erosion will transport finer sediments downstream and leave behind the coarser material, causing the bed material to coarsen. As a result of the avulsion in 1996, large cobbles, indicative of bed coarsening, dominate the substrate in the East Fork Lewis River for approximately 50 feet downstream of the Ridgefield Pits, although abundant smaller-sized gravels downstream of this area provide suitable substrate for spawning salmon. In a reach that is sediment starved, bank erosion may be so great as to result in channel widening or migration. Although measurements of pre- and post avulsion downstream channel widths and elevations are not available, concerns have been expressed that channel incision and accelerated channel bank erosion are occurring downstream of the Ridgefield Pits as a consequence of the 1996 avulsion. Bank erosion downstream of the mouth of Dean Creek is believed to have another cause, namely few bank-rooted trees, since agriculture fields have been cleared to the river's edge and riprap has been placed in several areas.

An avulsion into a Daybreak gravel pond may also cause a short-term (*i.e.*, two to four years) increase in the supply of fine sediment to downstream reaches. During gravel processing operations, fine sediments will be washed from the sands and aggregate and then deposited in the ponds. During reclamation, additional fines will be added to the ponds to create shallow water and wetland habitats. Turbulence induced by the river flowing through the avulsed pond(s) can entrain material previously deposited in the pond. There is professional disagreement over the magnitude of impacts from an avulsion through the Daybreak site. The applicant suggests that 120,300 tons of fine sand-sized and large particles would be quickly carried downstream, settling briefly (*i.e.*, 1.1 days) on the 1.25 miles of spawning habitat, due to the high sediment conveyance capacity of the river and the fine textured nature of the material involved (Grindeland 2004b). The Services, on the other hand, believe that sediment does not move as a uniform mass, even when it is suspended in the water column. Rivers are hydraulically complex, with high velocity zones flanked by low velocity edges and back-eddies. Thus, a mass of fine sediment suddenly placed in the river will disperse into an elongated plume (Huber 1993). Some will settle out in back eddies and slack-water zones, to be re-mobilized during subsequent peak flows. Some sediments will enter the streambed via hyporheic pathways. After percolating through the streambed, reduced flow velocity and proximity to surfaces will induce settling, causing the interstitial pores to clog (Jobson and Carey 1989). Such sedimentation can only be reversed during later peak flows, which scour and then fill the gravel bed. Thus, recovery of the downstream 1.5 miles of spawning area from a pulse of sediments from the Daybreak site following an avulsion is likely to be on the order of two to four years (an estimated recurrence interval for streambed scouring events.)

It is important to note that the applicant, in consultation with the Services, decided to place the fine sediments in the existing and new ponds as a conservation measure (CM-08) designed to minimize the predicted headcut that would develop from an avulsion into excavated gravel pits. We believe that impacts from a pulse of fine sediments settling temporarily on downstream spawning areas are likely to be much less severe than the massive channel destabilization and sediment mobilization caused by an avulsion into the Daybreak ponds.

Another potential impact to reaches located downstream of any future avulsed pond is reduced flood levels. The increased width and depth associated with the avulsed pond creates additional channel storage. The amount of reduction in flood levels provided by the changed geometry is related to the volume of additional storage and the magnitude and duration of the flood event. Based on detailed analysis in the HCP, the reduction in flood peaks as a result of the new ponds is predicted to be relatively small (less than one percent from baseline), and therefore negligible.

2.1.5.5 Conservation Measures on Riverine Habitat.

Neither HCP activities nor mining activities influence the likelihood of an avulsion into the ponds. Avulsion is a likely natural occurrence that, when it occurs, would bring mining activities into contact with functioning habitat. Therefore, the HCP activities include conservation measures developed to both reduce the likelihood of avulsion and to reduce the effects of avulsion when it occurs. These measures include filling and reshaping the existing Daybreak ponds, monitoring river conditions, and a variety of biotechnical and structural river control measures. The conservation measures were designed to resist a potential avulsion during the term of the HCP, to mitigate for the effects of a potential avulsion of the East Fork Lewis River into the reclaimed existing ponds in the future, and to reduce the recovery time and adverse effects that such a potential avulsion would have on the habitat of the East Fork Lewis River and the status of the covered species. The geomorphic recovery time for sustainable channel migration and complexity and bank erosion rates following a potential avulsion will be reduced by the amount of time it would otherwise take for the river to fill the pond with sediment transported from upstream (estimated to be from 5 to 200 years, depending on the magnitude of average sustainable sediment loads over the long-term).

The conservation measures in the HCP also include monitoring studies, a contingency plan, and endowment funds to respond to a potential avulsion. Reclamation of the existing ponds under the HCP will reduce the potential severity of upstream headcutting, reduce the disruption of downstream sediment transport, and result in 101,640 fewer square yards of open water habitat in the existing Daybreak Ponds in the event of an avulsion. Conservation measures to address avulsion impacts (Chapter 4 of the HCP) include:

- CM-05: Conservation and Habitat Enhancement Endowment. Upon completion of the 25-year-term of the ITP, a one million dollar endowment will be available to monitor, manage, and respond to a potential avulsion.

- CM-06: Native Valley-Bottom Forest Revegetation. Restoration of a floodplain forest will increase roughness, decrease the energy of flood flows, provide shade and reduce water temperature.

- CM-08: Mining and Reclamation Designs. Narrowing and shallowing the existing ponds will reduce the likelihood of an avulsion by increasing the buffer width between the river and the existing ponds and between the existing ponds and the new ponds. These narrowed ponds will accommodate an avulsion by directing the water through a more natural flow path back to the river. Orienting the new ponds roughly parallel to the river and creating shallow wetlands in the existing and new ponds will create habitat that is more similar to natural side channels or oxbow lakes. Reducing the depth of the Phase 1C, 1D, and 2 excavations will reduce the head differential and potential headcutting from an avulsion. In the event of an avulsion, the reclamation will reduce the severity of upstream headcutting, reduce the disruption of downstream sediment transport, and result in 101,640 fewer square yards of open water habitat. This will also reduce the area of open water that would be subjected to increased warming.

- CM-09: Avulsion Contingency Plan. Bank stability will be assessed annually and actions taken to prevent probable avulsions. If an avulsion occurs, assessments, funds, and actions will be directed towards restoration.

- CM-10: Study of Ridgefield Pits and East Fork Lewis River. Information gained from assessing this past avulsion will be used to monitor, assess, and protect the Daybreak site.

- CM-12: Conservation Easement and Fee-Simple Transfer: Upon completion of all reclamation activities, the entire Daybreak site will be transferred, with a conservation easement, in fee to one or more public or non-profit organizations along with the one million dollar endowment.

Because avulsions are triggered by low-frequency events such as log jams, landslides, large floods, or upstream changes in river position, it is not possible to predict when, or if, an avulsion will definitely occur. However, the relative risk of one location along the river versus another can be qualitatively evaluated to determine the potential locations of future avulsions. An evaluation of the avulsion potential in the vicinity of the Daybreak site was conducted based on available information and historical trends (Technical Appendix C in the HCP). This analysis suggested if an avulsion were to occur, the most likely location would be into the existing Daybreak Pond 1. Of several avulsion paths identified, an avulsion into Pond 1 would result in the largest potential adverse impacts as compared to existing conditions, because of the relatively large amount of channel area that would be affected. An avulsion through this path would switch the river out of its current channel through the Ridgefield Pits, and instead channel the river through the four largest existing Daybreak ponds. Spawning (riffle) and rearing (pool) habitat conditions would change (Table 6), and rearing habitat area would double in size between RM 7 and RM 9. The amount of spawning habitat, however, is projected to decrease by only 22% (from 68,690 square yards to 53,670 square yards of riffle habitat as approximately 1,582 linear feet of current riffle habitat is converted to pool habitat).

An avulsion into Pond 1 could result in an upstream headcut, and attendant channel destabilization, of up to 4,500 feet (6,667 square yards) of spawning habitat. If salmonid redds are present in this reach, it could result in harm or mortality to those eggs and alevins. These effects from headcutting could occur under the existing, baseline conditions. Under the HCP, however, filling the existing ponds to an elevation approximating the thalweg in the East Fork Lewis River would reduce the likelihood and magnitude of an upstream-migrating headcut and downstream channel incision, and the potential for adverse impacts to covered species relative to existing, baseline conditions, should an avulsion into the existing Daybreak ponds occur (Table 6).

Under the HCP, CM-08 would result in the infilling of the ponds with approximately 571,000 cubic yards of materials. If an avulsion occurred before these activities were complete and rooted vegetation was established, then some of these materials could be washed into the East Fork Lewis River, and could cause increased adverse effects above the baseline and take of covered species. An avulsion of the East Fork Lewis River into the Daybreak ponds could result in short-term (*i.e*, several years) deposition of up to 120,300 tons of sand-sized and larger particles (an unknown fraction of which would be from HCP infill materials) within the 1.25 miles of spawning habitat in the East Fork Lewis River downstream of Dean Creek, potentially smothering an unknown number of redds, if they are present. Depending on the timing of the avulsion, this could adversely affect chinook, coho and chum salmon and steelhead redds and cause take of eggs and alevins.

Sediment capture in the avulsed ponds could cause a reduced supply of bed material to the downstream reach, increasing channel instability and habitat degradation downstream from the avulsed ponds, and potentially negatively affecting spawning, rearing, and migration of chinook, coho and chum salmon and steelhead. These degradation effects could continue for many decades under the existing, baseline conditions, should an avulsion occur. Following implementation of the HCP's conservation measures, the recovery estimate for the avulsed ponds is reduced by as much as 5 to 200 years; hence the HCP will reduce the potential for long-term adverse effects caused by reduced sediment supplies to downstream spawning areas.

Table 6. Estimated amounts of existing and projected (in the event of an avulsion) spawning and rearing habitat in the East Fork Lewis River near the Daybreak site.

Channel Location	River Mile	Spawning (Square Yard)	Rearing (Square Yard)
Existing	RM 6 - RM 7	52,719	2,729
	RM 7 - RM 9	68,690	149,890
	RM 9 - RM 10	46,000	2,092
total		**167,409**	**154,711**
Avulsion Path 1	RM 6 - RM 7	52,719	2,729
	RM 7 - RM 9	53,670	337,750
	RM 9 - RM 10	46,000	2,092
total		**193,090**	**220,615**
Avulsion Path 2	RM 6 - RM 7	52,719	2,729
	RM 7 - RM 9	90,818	220,198
	RM 9 - RM 10	46,000	2,092
total		**189,537**	**225,019**
Avulsion Path 3	RM 6 - RM 7	52,719	2,729
	RM 7 - RM 9	94,371	215,794
	RM 9 - RM 10	46,000	2,092
total		**193,090**	**220,615**

These estimates reflect the immediate condition of habitat that is likely following an avulsion in Pond 1. However, two uncertainties exist with these calculations. First, prior to a potential avulsion along this path, the habitat quantity and quality will be different than it is currently. Specifically, an avulsion will only occur after the channel has migrated over years or decades. The amount and quality of habitat within the river between the current condition and the avulsed condition is unknown. Second, because Pond 1 will be shallower following reclamation, it is likely that gravel will quickly deposit within Pond 1 following an avulsion, similar to what was observed in the upper portion of the avulsed Ridgefield Pit reach. This deposition of gravels over the finer sediments in Pond 1 could result in the creation of shallow riffle (spawning) habitat in the Pond 1 reach within five or more years following an avulsion. In addition, because Pond 1 will be shallower following reclamation, the potential for upstream incision will be reduced.

An avulsion could also occur in Pond 4 or Pond 5 (*i.e.*, Avulsion Paths 2 and 3 described in Technical Appendix C and summarized in Table 6). If the East Fork Lewis River avulsed into one of these ponds, the flow would likely exit through the western berm of Pond 5 and the main channel would not capture Ponds 1, 2, or 3. This would result in a reduced area of pool (rearing) habitat in the reach between RM 7 and RM 9, compared to an avulsion into Pond 1. The net effect would be an increase of 32 to 37% in pool habitat compared to existing conditions. Impacts to upstream and downstream habitat would be similar to those caused by an avulsion through Avulsion Path 1.

Some life stages, such as upstream migrating adult fish, may benefit from pond capture and the increase in pool holding habitat, while other species or life stages may be adversely affected by an alteration in the amount and location of habitat types. The Ridgefield Pits Study (CM-10) will be used to identify the nature and magnitude of impacts of pond capture by species and lifestages. Restoration plans and adaptive management decisions will then be designed to focus on improving or optimizing habitat conditions for those species and lifestages or certain suites of species. The overall effect of the HCP will be to reduce the risk of future avulsion through the Daybreak site, while increasing the likelihood that the ponds will provide juvenile rearing and adult holding habitat in the event of an avulsion.

Avulsion prevention measures (CM-09) will minimize the effects on lost opportunity for the creation of side and flood channels resulting from natural channel migration processes. First, preventive solutions will only be implemented if there is a real threat of avulsion prior to completion of reclamation and revegetation of the existing ponds. This could avoid the potential of lost opportunity altogether, and would reduce the time period of lost opportunity should engineering solutions be necessary. Second, engineering solutions that would be applied are largely “soft” techniques that slow or redirect channel migration but do not eliminate it. If needed during the 25-year-term of the HCP, hardening of banks adjacent to the existing Daybreak ponds or roads to prevent an avulsion would represent lost opportunity for habitat creation.

Downstream adverse impacts of the avulsion prevention solutions will likely be limited to reduction in fine sediment supply and/or short-term (*i.e.*, several years) deposition of fine sediments used for pond reclamation onto spawning gravels. Reductions in fine sediment supply (beyond baseline conditions) would occur after implementation of streambank hardening along the Storedahl Pit Road. If the river is prevented from eroding into the land on which the road is located, the sediment released from the eroding bank will no longer be available for transport. This represents a very small fraction of the total sediment supply to downstream reaches, but could lead to increased erosion of downstream streambanks and increased armoring of streambanks by riparian property owners.

Preventing the East Fork Lewis River from migrating and potentially avulsing into the Daybreak site could also result in slightly reduced amounts of LWD being recruited into the river. However, implementation of the HCP will slightly increase the amount of forested land along the river and thus the potential for LWD recruitment.

Implementation of the HCP will also improve habitat in part of Dean Creek. Dean Creek currently lacks shade and habitat complexity due to the absence of riparian vegetation and recruitable LWD. The banks are severely eroded in places due to the lack of vegetation and livestock trampling, and in some reaches flows are subsurface during the summer. Restoration of riparian forests, bank stabilization using bioengineering, and placement of in-channel LWD will enhance habitat quality in Dean Creek by reducing temperatures and increasing channel complexity. Stabilized banks and increased scour around obstructions will create deeper pools and may help maintain surface flows and possible refugia through summer when flows are low.

Effects on Steelhead. Increasing the buffer width (CM-08) and reforesting the area between the East Fork Lewis River and the Daybreak ponds (CM-06) will reduce the likelihood of an avulsion through the Daybreak site. Monitoring and implementation of the avulsion contingency plan (CM-09) will reduce the likelihood and the consequences of an avulsion during the term of the ITP. Observations of the Ridgefield site suggest that the result of avulsion would be formation of a series of pools and an increase in the complexity of the channel and shoreline. However, this complexity is of an unnatural morphology and unstable nature (*i.e.*, rapidly evolving). Deep, thermally stratified pools provide refuge habitat for adult and juvenile steelhead when stream temperatures elsewhere in the river reach incipient lethal levels. They also provide slackwater edge habitat for recently emerged steelhead fry and refuge for winter juvenile rearing. Prior to the 1996 avulsion, only three pools deeper than six feet were identified between RM 7.0 and RM 10.2 during a survey in 1991 (EnviroScience 1996a). Therefore, an increase in the available deep, coldwater refugia from an avulsion through the Daybreak site could have a positive effect on upstream migrating and juvenile rearing steelhead. Or, it could reduce habitat availability and connectivity by exacerbating average summertime reach temperatures. CM-08 (narrowing and shallowing of existing ponds), however, is designed to reduce the likelihood that an avulsion would create a string of deep, artificial pools. Since pool depths at the Ridgefield site in 1999, three years after the avulsion, were generally less than 10 feet, any positive thermal effects for upstream migrating steelhead would be short-lived. Migrating adult steelhead could be stranded, with adverse effects, in avulsed ponds after high flow events if the ponds become isolated due to sediment deposition and receding water levels. However, observations of the Ridgefield Pits indicate that following winter high flows, the off-channel pools remain connected to the river, most likely due to substantial hyporheic flow. Thus the possibility of stranding remains low. If migrating adults become stranded, reproduction is negatively affected.

Conversely, an avulsion into the Daybreak site would release non-native fish to the East Fork Lewis River, slightly increase downstream travel time, and increase the area of deep, low-velocity habitat favored by predators, all of which could negatively affect juvenile steelhead. In addition, juvenile steelhead could be stranded in avulsed ponds immediately after high flow events, if the ponds become isolated by sediment deposition and receding water levels. If juveniles strand, survival is negatively affected.

Enhanced native valley-bottom forest revegetation (CM-06) is expected to slightly increase the amount of food available to juvenile steelhead in Dean Creek and the East Fork Lewis River downstream of the confluence with Dean Creek. Storedahl's restoration of stream banks and placement of LWD in Dean Creek, in concert with restoration of the riparian zone (CM-07) is expected to result in an overall improvement of stream habitat and a positive effect on the survival of juvenile steelhead in Dean Creek.

There are currently an estimated 54 miles of suitable steelhead spawning habitat in the East Fork Lewis River watershed. Since an avulsion is most likely to occur during fall and winter high flows, and since steelhead spawn in the spring, direct impacts to steelhead spawning and incubation by dewatering of redds in the abandoned channel and scour of redds up or downstream of the site are unlikely. An avulsion into the Daybreak site could affect steelhead spawning over the long-term by replacing spawning habitat in the channel, that would have existed prior to an avulsion, with deep, slow pool habitat. If the river avulsed into Pond 1, it could decrease by 22% the available spawning habitat that currently exists in the river between RM 7 and RM 9. While the amount of spawning habitat that could be impacted between RM 7 and RM 9 (1,582 linear feet) amounts to less than one percent of the available steelhead spawning area (54 miles) in the East Fork Lewis River, the loss could persist for decades, although it would diminish over time as gravel is deposited in the pools and the channel continues to meander.

Sediments released downstream during an avulsion could also impact 1.25 miles of riffle habitat immediately upstream of the tidal zone, or 2% of the available steelhead spawning area in the East Fork Lewis River. Because the area that could be impacted represents a small fraction of the total available steelhead spawning habitat, and because the typical timing of an avulsion would be prior to the spawning period, a potential avulsion is expected to have only minor negative impacts on steelhead spawning and incubation.

<u>Effects on Chinook Salmon</u>. As described above, if an avulsion occurred, the result would likely be the formation of a series of deep pools that could provide refuge habitat for adult chinook salmon when stream temperatures elsewhere in the river reach lethal levels. Because the river is currently on the Washington State 303(d) list due to temperature concerns, an increase in the number of deep, coldwater refugia could have a positive effect on upstream migrating chinook. However, the positive effects would be short-lived due to natural filling of the avulsed ponds. Furthermore, the creation of a wide, low-velocity reach could reduce habitat availability and connectivity by exacerbating average summertime reach temperatures, which are already very high. On the other hand, CM-08 (reclamation design) is designed to reduce the likelihood that an avulsion would create a string of deep, artificial pools.

There are currently 15 miles of potentially suitable chinook spawning habitat in the East Fork Lewis River between Lucia Falls and the limit of tidal influence at Mason Creek. Most fall chinook spawn in the 4.2 mile section from Daybreak Park (RM 10.2) to Lewisville Park (RM 14.4). Since chinook spawn in the late summer and fall, eggs are in the gravel during the fall and winter high flow period, when an avulsion is most likely to occur. Chinook spawning and incubation in the project reach could therefore be directly impacted by scour and dewatering of redds if an avulsion into the Daybreak site occurs. An avulsion into the Daybreak site could affect chinook spawning over the long-term by replacing spawning habitat in the channel that would have existed prior to an avulsion with deep, slow pool habitat (Table 6). If the river avulsed into

Pond 1, it could result in a decrease of 22% of the available spawning (riffle) habitat that currently exists in the river between RM 7 and RM 9. The amount of spawning habitat that could be impacted between RM 7 and RM 9 (1,582 linear feet) amounts to two percent of the available chinook spawning area (15 miles) in the East Fork Lewis River. These effects could persist for decades, although during this time there would be a gradual increase in spawning habitat as gravel is deposited in the pools and the channel continues to meander. Sediments released downstream during a potential avulsion could also impact 1.25 miles of riffle habitat immediately upstream of the tidal zone, or eight percent of the available chinook spawning area in the East Fork Lewis River. Reductions in fine sediment supply caused by Storedahl's pro-active streambank protection could lead to increased erosion of downstream streambanks and increased armoring of streambanks by riparian property owners. Thus, while implementation of the HCP is expected to reduce the likelihood of future avulsions through the Daybreak site, if an avulsion does capture the Daybreak ponds, it could negatively affect available chinook spawning habitat, as well as survival of eggs or alevins in the redds at the time of the avulsion, for a period of time.

The potential net effect of an avulsion through the Daybreak ponds on juvenile chinook salmon is unknown, but perhaps slightly positive. However, observations indicate that relatively high numbers of juvenile chinook are found in the abundant low-velocity, shallow edge habitat within the avulsed Ridgefield Pit reach during the spring (R2 Resource Consultants, unpublished data, as cited in Storedahl 2003). Conversion of the predominantly riffle-type habitat of the existing natural channel to a series of deep, slow pools that contain structure and extensive wetlands will create conditions that share some features with channels that avulse into natural off-channel habitats. Chinook salmon prefer pools for winter rearing and will use off-channel habitats, especially during high-flow conditions. Therefore, increasing this type of habitat is expected to have a positive effect on juvenile chinook salmon survival.

Conversely, downstream migrating smolts generally move at rates that are a function of the local current velocity (Raymond 1979, Moser *et al.* 1991). Predatory fishes such as northern pikeminnow prefer slower moving waters. An avulsion into the Daybreak site would release non-native fish to the East Fork Lewis River, slightly increase downstream travel time, and increase the area of deep, low-velocity habitat favored by predators, all of which could negatively affect juvenile chinook salmon survival. In addition, juvenile chinook salmon could be stranded in avulsed ponds immediately after high flow events if the ponds become isolated by sediment deposition and receding water levels.

<u>Effects on Coho Salmon</u>. Expanded mining and gravel processing at the Daybreak site under the HCP will not directly affect physical habitat in the East Fork Lewis River or Dean Creek. However, if the channel should avulse through the Daybreak site, the result would likely be formation of a series of deep pools. An increase in the number of deep pools as a result of an avulsion could positively affect upstream migrating coho, although positive effects are expected to be less beneficial for adult coho than for chinook or steelhead, since coho tend to enter rivers later in the season and hold for shorter periods of time before spawning. Adult migrating coho could be stranded in avulsed ponds after high flow events if the ponds become isolated by sediment

deposition and receding water levels. However, the off-channel ponds of the Ridgefield Pits remain connected to the river, most likely due to hyporheic flow.

The East Fork Lewis watershed currently has 41 miles of coho spawning habitat. Since a potential avulsion into the Daybreak site would most likely occur during fall and winter high flows, and coho are fall spawners, coho spawning and incubation could therefore be directly impacted by scour and dewatering of redds. An avulsion into the Daybreak site could also affect coho spawning over the long-term by replacing spawning habitat in the channel, that would have existed prior to an avulsion, with deep, slow pool habitat (Table 6). If an avulsion were to occur into Pond 1, it could decrease by 22% the available spawning (riffle) habitat that currently exists in the river between RM 7 and RM 9. The amount of spawning habitat that could be impacted between RM 7 and RM 9 (1,582 linear feet) amounts to less than one percent of the available coho spawning area (41 miles) in the East Fork Lewis River watershed. However, this lost habitat consists of mainstem channel, which is not preferred coho spawning habitat, in comparison to preferred tributary habitat. The loss could persist for decades, although it would diminish over time as gravel is deposited in the pools and the channel continues to meander. Sediments released downstream during a potential avulsion could also impact 1.25 miles of riffle habitat immediately upstream of the tidal zone, or three percent of the available coho spawning area in the East Fork Lewis River watershed. Thus, while implementation of the HCP is expected to reduce the likelihood and consequences of future avulsions through the Daybreak site, and because the area that could be impacted represents a small and suboptimal fraction of the total available coho spawning habitat, an avulsion into the Daybreak site is not expected to significantly affect coho spawning and incubation except for those redds dewatered at the time of the avulsion.

The potential net effect of an avulsion through the Daybreak ponds on juvenile coho salmon is unknown but projected to be slightly beneficial. However, observations indicate that relatively high numbers of juvenile coho are found in the abundant low-velocity, shallow edge habitat within the avulsed Ridgefield Pit reach (R2 Resource Consultants, unpublished data, as cited in Storedahl 2003). Conversion of the predominantly riffle-type habitat of the existing natural channel to a series of deep, slow pools that contain structure and extensive wetlands will create conditions that share some features with channels that avulse into natural off-channel habitats. Winter rearing coho prefer pools and embayments, such as those formed by an avulsion into the ponds. Therefore, increasing this type of habitat is expected to have a positive effect on juvenile coho survival.

Conversely, downstream migrating smolts generally move at rates that are a function of the local current velocity (Raymond 1979, Moser *et al.* 1991). Predatory fishes such as northern pikeminnow prefer slower moving waters. An avulsion into the Daybreak site would release non-native fish to the East Fork Lewis River, slightly increase downstream travel time, and increase the area of deep, low-velocity habitat favored by predators, all of which could negatively affect juvenile coho survival. In addition, juvenile coho could be stranded in avulsed ponds immediately after high flow events if the ponds become isolated by sediment deposition and receding water levels.

Effects on Chum Salmon. Expanded mining and gravel processing at the Daybreak site under the HCP will not directly affect physical habitat in the East Fork Lewis River or Dean Creek. However, if the channel should avulse through the Daybreak site, the result would likely be formation of a series of deep pools fed by river flow and groundwater. An increase in the number of deep pools as a result of an avulsion would increase the amount of salmonid holding habitat and could have a positive effect on upstream migrating chum. However, since chum spend little time holding in mainstem rivers, a potential avulsion through the Daybreak site would be unlikely to affect adult migrating chum.

There are currently 41 miles of suitable chum spawning habitat in the East Fork Lewis watershed. The preferred spawning habitat historically used by chum is presumed to be the mainstem and side channels between RM 6 and RM 10. Natural avulsions benefit chum by maintaining a network of side channels and abandoned channels fed by groundwater during the fall and winter. However, because a potential avulsion into the Daybreak site would most likely occur during fall and winter high flows, and chum are fall spawners, chum spawning and incubation could therefore be directly impacted by upstream scour. Dewatering of redds in the abandoned channel could also occur. An avulsion into the Daybreak site could affect chum spawning over the long-term by replacing spawning habitat in the channel, that would have existed prior to an avulsion, with deep, slow pool habitat (Table 6). An avulsion could also cause a temporary (two to four years) loss of spawning habitat as fine sediments used to fill the Daybreak ponds flush through the downstream spawning reach. An avulsion into Pond 1 could cause a decrease of 22% of the available spawning (riffle) habitat that currently exists in the river between RM 7 and RM 9, or 33% of the preferred chum spawning area in the mainstem between RM 6 and RM 10. Because implementation of the HCP will reduce the likelihood and consequences of an avulsion, and because the current utilization of the stretch of the river between RM 6 and RM 10 by chum is low, if any, the potential net effect of an avulsion through the Daybreak ponds on spawning and incubating chum salmon is unknown. If impacts to chum spawning are identified through post-avulsion monitoring, chum spawning habitat could be replaced by developing groundwater fed spawning channels in the abandoned mainstem and/or rehabilitation of lower Dean Creek.

The potential net effect of an avulsion through the Daybreak ponds on juvenile chum salmon is unknown. Conversion of the predominantly riffle-type habitat of the existing natural channel to a series of deep, slow pools that contain structure and extensive wetlands will create conditions that share some features with channels that avulse into natural off-channel habitats. Juvenile chum prefer pools and embayments, such as those formed by an avulsion into the ponds, but overall they spend little time in the riverine environment. Therefore, increasing this type of habitat is not expected to affect juvenile chum.

Conversely, downstream migrating smolts generally move at rates that are a function of the local current velocity (Raymond 1979; Moser *et al.* 1991, both cited in Storedahl 2003). An avulsion through the Daybreak site could slightly increase the travel time of downstream migrating fish, slightly increase the time smolts are exposed to predators, and dramatically increase the area of deep, low velocity habitat favored by predators, all of which would negatively affect juvenile chum survival. In addition, juvenile chum could be stranded in avulsed ponds immediately after high flow events if the ponds become isolated by sediment deposition and receding water levels.

2.1.5.6 Predation and Competition

The existing ponds contain native and non-native fish and amphibian species that could prey on juvenile salmonids. Native predators of juvenile fish known to be present in the ponds include northern pikeminnow and sculpin. Non-native predators include largemouth bass, black crappie, yellow perch, and bullfrogs. It is unknown if or how many of these non-native species also occur in the beaver pond complex near the mouth of Dean Creek, or are present in the East Fork Lewis River. Mining, processing, and reclamation activities at the Daybreak site will add approximately 96 acres of pond and wetland habitat, and could therefore increase the total number of potential predators supported at the site.

If the East Fork Lewis River were to avulse, the most likely location would be into the existing Daybreak ponds. An avulsion into the existing ponds could result in an increase in the amount of predation on juvenile salmonids from both native and non-native fish. In addition, an avulsion could result in the release of predatory fish into the East Fork Lewis River from the ponds and it could also expose juvenile salmonids in the avulsed reach to increased predation. However, the risk of predation on juvenile salmonids in avulsed pits from non-native fish would be relatively low because juvenile salmonids are migrating when water temperatures are still relatively cool and bass are in their winter feeding dormancy.

Currently, flooding of the East Fork Lewis River potentially exposes the covered species to predation from fish in Pond 5, because the river backs up into Pond 5 during relatively low-flow flood events (approximately a five-year flood event). Although the extent of this baseline predation is unknown, the western berm of Pond 5 has low spots where surface water from Pond 5 can exit, depending on the pond surface elevation and dam building by beavers. During approximately a two-year flood event or greater, water in the East Fork Lewis River spreads out over the floodplain and overtops the outlets of Pond 5. This natural flooding can result in predation on salmonids that move with the flood water out of the high velocity areas and into the lower velocity backwater, including Pond 5, which contain native and non-native predators.

The primary goal of reconfiguring the existing ponds to be narrower and shallower through conservation measure CM-08 (Mining and Reclamation Designs) is to reduce the potential adverse effects of an avulsion into these ponds. A second benefit of this conservation measure is to reduce the total amount of the existing pond habitat. The amount of habitat suitable for predators will be reduced in the existing Daybreak ponds as a consequence of narrowing the ponds. Non-native predators in the ponds, such as largemouth bass, are essentially lake-dwelling species. Reducing the amount of pond habitat will reduce the carrying capacity of the Daybreak site to support these species. This should eventually result in slightly fewer non-native predators in the existing ponds.

The implementation of CM-09 (Avulsion Contingency Plan) will also result in a reduced likelihood of the East Fork Lewis River avulsing into the existing or new ponds. Reducing the risk of an avulsion into the unreclaimed ponds will reduce the likelihood of the East Fork Lewis River capturing additional slow-velocity, wide pool habitat that is potential habitat for predaceous fish. The net effect of implementing CM-08 and CM-09 will be to reduce the risk of potential predation by reducing the likelihood and consequences of an avulsion and by reducing the amount of habitat available to predators in the event an avulsion does occur in the future.

Conservation measure CM-04 (Water Management Plan) will also reduce the amount of predation on the covered species by reducing the frequency that flood waters of the East Fork Lewis River backflood into Pond 5. Implementation of CM-04 will result in reconfiguring and increasing the elevation of the western berm so that surface water releases are controlled at a single outlet. A secondary benefit of this conservation measure is that the East Fork Lewis River will be able to overtop and backwater into Pond 5 only during a 17-year or greater flood event. Over a 25-year time period, the net effect will be more than an 80% reduction in the potential frequency of events conducive to predation by fish in the ponds on the covered salmonids in the river.

Storedahl's implementation of CM-16 (Control of Non-Natives) will also reduce the numbers of largemouth bass in the Daybreak ponds through targeted harvest. Removing largemouth bass by angling, seining, and other fish trapping methods will reduce the number of largemouth bass and therefore reduce the potential amount of predation on the covered species. But because fish populations and movements are difficult to control, selective harvest is expected to reduce largemouth bass numbers for only a couple of years following intensive harvest events. These intensive harvest events will occur three times during the term of the ITP and under the direction of warmwater fish biologists in WDFW. To prevent the reintroduction and recolonization of largemouth bass into the existing ponds, and especially into Pond 5, Storedahl will install rock barriers to restrict the movement of fish between the existing ponds and the created ponds. Since local anglers frequent the ponds, Storedahl will post educational signs warning the public about the dangers of transferring or releasing non-native fish species into or between the ponds and into the East Fork Lewis River and Dean Creek. The net effect of selective harvesting (CM-16) will be a short-term reduction in the number of largemouth bass in the Daybreak ponds.

Although the frequency of salmonids entering the Daybreak ponds during flood events will be minimized by restructuring the berm along Pond 5 and therefore the risk of predation will be reduced, fish that do enter the ponds may be able to feed in high quality rearing habitat resulting from the creation of emergent and forested wetland habitat around each pond. It is unknown how an enhanced competitive advantage for juvenile salmonids rearing in off-channel areas compares with a potentially increased risk of predation within the same habitat.

Effects on Steelhead. Implementing the HCP will not alter the fish species assemblage in the East Fork Lewis River of Dean Creek. While the existing ponds contain native and non-native fish species that may colonize the created ponds, none of the species present are expected to prey upon or compete with adult steelhead for spawning sites, although several of the species are known to prey on salmonid eggs. Restricting access to Pond 5 by restructuring the berm will restrict juvenile steelhead during most flows from entering the ponds. Reducing the available pond habitat by narrowing the existing ponds and targeted harvest of largemouth bass in the Daybreak ponds will reduce the number of predators. Therefore, implementation of the HCP will not affect predation on, or competition with, spawning, incubating, or rearing juveniles, or holding or migrating adult steelhead.

Effects on Chinook Salmon. Although the existing ponds contain a variety of native and non-native fish species, none of them are expected to prey upon or compete with adult chinook during upstream migration. Restricting Pond 5 outflows to a single site and reconfiguring the western berm to prevent backflooding from the East Fork Lewis River during floods with a magnitude less than a 17-year event will restrict chinook salmon from entering the ponds during most flows. Reducing the available habitat by narrowing the existing ponds and targeted harvest of largemouth bass in the Daybreak ponds will reduce the number of fish predators. Therefore, implementation of the HCP will not affect predation on, or competition with, spawning, incubating, or rearing juveniles, or holding or migrating adult chinook salmon.

Effects on Coho Salmon. Although the existing ponds contain a variety of native and non-native fish species, none of them are expected to prey upon or compete with adult coho during upstream migration or for spawning sites, although several of the species are known to prey on salmonid eggs. Restricting Pond 5 outflows to a single site and reconfiguring the western berm to prevent backflooding from the East Fork Lewis River during floods with a magnitude less than a 17-year event will restrict coho salmon from entering the ponds during most flows. Therefore, implementation of the HCP will not affect predation on, or competition with, spawning, incubating, or rearing juveniles, or holding or migrating coho salmon.

Effects on Chum Salmon. While the existing ponds contain a variety of native and non-native fish species, none of them are expected to prey upon or compete with adult chum during upstream, although several of the species are known to prey on salmonid eggs. Restricting Pond 5 outflows to a single site and reconfiguring the western berm to prevent backflooding from the East Fork Lewis River during floods with a magnitude less than a 17-year event will restrict chum salmon from entering the ponds during most flows. Reducing the available habitat by narrowing the existing ponds and targeted harvest of largemouth bass in the Daybreak ponds will reduce the number of predators. Therefore, implementation of the HCP will not affect predation on, or competition with, spawning, incubating, or rearing juveniles, or migrating adult chum salmon.

2.1.6 Cumulative Effects

Cumulative effects include the effects of future state, tribal, local or private actions not involving Federal activities that are reasonably certain to occur within the action area of the Federal action subject to this consultation. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act. The reasonably foreseeable future was considered in terms of the 25-year-term of the HCP.

State, Tribal and local government actions will likely be in the form of legislation, administrative rules or policy initiatives. Government and private actions may include changes in land and water uses, including ownership and intensity, any of which could affect listed species or their habitat. Government actions are subject to political, legislative and fiscal uncertainties. These realities, added to the geographic scope of the action area which encompasses numerous government entities exercising various authorities and the many private land holdings, make any analysis of cumulative effects difficult and somewhat speculative. This section identifies representative actions that, based on currently available information, are reasonably likely to occur. It also identifies some goals, objectives and proposed plans by government entities.

2.1.6.1 Representative State Actions

Washington State administers the allocation of water resources within its borders. The state is reasonably likely to allow further water appropriations. State and local governments are cooperating with each other to increase environmental protections, including better habitat restoration. NOAA Fisheries also cooperates with the state water resource management agencies in assessing water resource needs in the basin, and in developing flow requirements that will benefit listed fish. During years of low water, however, there could be insufficient flow to meet the needs of the fish. These cooperative government efforts could be discontinued or even reduced, so their positive cumulative effects on listed fish is unpredictable.

The state of Washington has various strategies and programs designed to improve the habitat of listed species and assist in recovery planning, including the Salmon Recovery Planning Act, a framework for developing watershed restoration projects. The state is developing a water quality improvement scheme through the development of Total Maximum Daily Loads (TMDLs). The promulgation of TMDLs to benefit water quality will not be subject to section 7 consultation, thus is included here as a cumulative effect. Most transportation and construction projects require a number of permits, which include State Environmental Policy Act (SEPA) review.

Economic diversification has contributed to population growth and movement in the state, a trend likely to continue for the next few decades. Such population trends will place greater demands in the action area for electricity, water and buildable land; will affect water quality directly and indirectly; and will increase the need for transportation, communication and other infrastructure development. Growth in new businesses is creating urbanization pressures with increased demands for buildable land, electricity, water supplies, waste disposal sites, transportation, and other infrastructure. The impacts associated with economic and population demands will affect habitat features, such as water quality and quantity, which are important to the survival and recovery of the listed species. The overall effect is likely to be negative, unless carefully planned for and mitigated.

Washington enacted a Growth Management Act to help communities plan for growth and address growth impacts on the natural environment. For example, most Growth Management Act counties, including Clark County and municipalities within Clark County, have enacted critical area ordinances that impose restrictions for controlling peak storm water events. If the programs continue they may help reduce some of the potential adverse effects identified above.

2.1.6.2 Local Actions

Local governments are faced with similar but more direct pressures from population growth and movement. There are demands for intensified development in rural areas as well as increased demands for water, municipal infrastructure and other resources. The reaction of local governments to such pressures is difficult to assess without certainty in policy and funding. In the past local governments in the action area generally accommodated additional growth in ways that adversely affected fish habitat. Also there has been little consistency among local governments in dealing with land use and environmental issues so that any positive effects from local government actions on listed species and their habitat are likely to be scattered throughout the action area.

Some local governments, including Clark County, are considering ordinances to address aquatic and fish habitat health impacts from different land uses. Clark County is developing a comprehensive program, which, if submitted, may qualify for a limit under NOAA Fisheries' ESA section 4(d) rule which is designed to conserve listed species. Local governments also may participate in regional watershed health programs, although political will and funding will determine participation and therefore the effect of such actions on listed species. Overall, without comprehensive and cohesive beneficial programs and the sustained application of such programs, it is likely that local actions will not have measurable positive effects on listed species and their habitat, but may even contribute to further degradation.

Increased rural development in the East Fork Lewis River watershed will undoubtedly continue, but with some finite limit imposed by existing local development regulations. However, the increased development will not encroach on the areas of the East Fork Lewis River floodplain and riparian areas that have been preserved under the greenbelt program. Continued acquisitions and additions to the East Fork Lewis River greenbelt are expected, albeit at an unknown level.

2.1.6.3 Tribal Actions

Treaty Indian tribes are co-managers of the fishery resource and promulgate their own harvest regulations and influence the regulations that affect others. Tribal governments are likely to continue to participate in cooperative efforts involving watershed and basin planning designed to improve fish habitat. The previous comments related to growth impacts apply also to Tribal government actions. Tribal governments will need to apply comprehensive and beneficial natural resource programs to areas under their jurisdiction to produce measurable positive effects for listed species and their habitat.

2.1.6.4 Private Actions

The effects of private actions are the most uncertain. Private landowners may convert current use of their lands, or they may intensify or diminish current uses. Individual landowners may voluntarily initiate actions to improve environmental conditions, or they may abandon or resist any improvement efforts. Their actions may be compelled by new laws, or may result from growth and economic pressures. Changes in ownership patterns will have unknown impacts. Whether any of these private actions will occur is highly unpredictable, and the effects even more so. However, based on recent efforts in the lower East Fork Lewis River watershed, private actions to improve environmental conditions are reasonably likely to occur.

2.1.6.5 Summary

Non-Federal actions are likely to continue affecting covered species. The cumulative effects in the action area are difficult to analyze considering the geographic landscape, and the political variation in the action area, the uncertainties associated with government and private actions, and the changing economies of the region. Whether these effects will increase or decrease is a matter of speculation; however, based on the trends identified in this section, the adverse cumulative effects are likely to increase. Although state, tribal, and local governments have developed plans and initiatives to benefit listed fish, they must be applied and sustained in a comprehensive way before NOAA Fisheries can consider them "reasonably foreseeable" in its analysis of cumulative effects.

2.1.7 Integration and Synthesis of Effects

Storedahl's mine expansion and habitat enhancement project is expected to cause a mix of adverse and beneficial effects to listed and unlisted fish species. Under the existing, baseline conditions, the Daybreak/Ridgefield reach of the East Fork Lewis River is highly dynamic and susceptible to an avulsion, and its corollary, recovery. An avulsion through the existing Daybreak ponds would cause habitat modifications and consequently impaired behavioral patterns that injure or cause mortality to covered species and would result in stranding of covered species. Following an avulsion, the ability of the covered species to use the area for spawning, foraging, or as a source of cover, or refuge, would be diminished for several years or decades by: (1) the extent to which an avulsion alters the amount of spawning (riffle) and rearing (pool) habitat; (2) the extent of a headcut and upstream channel alteration resulting from an avulsion; (3) the extent to which downstream spawning habitat is affected by released fine sediment; (4) the extent of increased surface water (pool) influence on water temperature; (5) the extent that increased slow water (pool) habitat increases exposure to predation on migrating smolts; and (6) the number of fishes stranded in wetlands and ponds following an avulsion.

Under the HCP, infilling and reconfiguring the ponds, together with monitoring and preventive actions, will decrease the likelihood of an avulsion into the ponds and reduce the extent of adverse effects of an avulsion, relative to existing, baseline conditions. In the long term, reclamation of the existing ponds will make the ponds more avulsion resistant, and reduce the time needed for geomorphic recovery from an avulsion. Proposed pond reclamation under CM-08 (mining and reclamation designs) will reduce the possibility and/or extent of a head cut, and consequently the potential impact on covered species and habitat. Monitoring of the movement of the river towards the ponds will allow timely implementation of measures to prevent an avulsion. Reclamation activities will also reduce habitat for non-native predatory fishes, and would increase wetland acreage, all of which will benefit the covered species. However, since an avulsion is, by definition, “a significant and abrupt change in channel alignment resulting in a new stream or river course,” an avulsion occurring before stabilization and establishment of vegetation in and around the existing ponds, the extent of head cutting and the amount of sediment carried downstream from the existing ponds could equal or exceed that expected under the existing, baseline conditions. The dynamic nature of geomorphic recovery in the nearby Ridgefield Pits and the relatively unpredictable timing of an avulsion make the evaluation of effects under future conditions difficult.

NOAA Fisheries anticipates that the mining activities covered under the proposed HCP/ITP would contribute to or result in some take of listed or unlisted fish. Using the best available science, the Ecosystem Diagnosis and Treatment (EDT) model was used to estimate the decline in returns to the spawning grounds of adult winter and summer steelhead and chum and fall chinook salmon under degraded conditions (Sweet, March 15, 2004). The EDT is an information-based decision support tool used for ecosystem management by the Lower Columbia Fish Recovery Board and others throughout the Pacific Northwest.

Although project-specific impacts (*e.g.*, an avulsion, deposition of fine sediments, reduced channel stability, and changes to groundwater flow and quality) were not specifically modeled, the EDT model does provide an estimate of relative adult population abundance under severe degradation through the incorporation of hypothetical degradation values for each river reach in the model, including the 1.25 mile reach between Dean Creek and Mason Creek (Reach 5) and the reach between Manley Creek, just downstream of the Daybreak Bridge, and Dean Creek (Reach 6). Assuming an avulsion results in severe degradation to Reach 5, the EDT model predicted the following relative (compared to existing conditions) declines in annual population abundances: fall chinook at 14.9%, winter steelhead at 1.5%, summer steelhead at 0.1%, and chum at 6%. Applying these relative declines to the recent average returns of adults results in the loss of 35 adult fall chinook salmon, one adult winter steelhead, one adult summer steelhead, and seven adult chum salmon (assuming that 75% of the reported Lewis River chum salmon population (estimated at 150 fish) is in the East Fork Lewis River). An avulsion would negatively affect coho salmon, but at unknown numbers.

The EDT model also estimated annual relative declines in population abundance under degraded conditions (*e.g*., channel instability) in Reach 6 (Manley Creek to Dean Creek): fall chinook salmon at 4.2%, winter steelhead at 0.3%, summer steelhead at 0.1%, and chum at 3%. Translating these relative declines to the recent average returns of adults would result in the annual loss of 10 adult fall chinook salmon, one adult winter steelhead, one adult summer steelhead, and 4 adult chum salmon. Channel instability could also negatively affect coho salmon, but at unknown numbers.

The actual decline in numbers of adults in Reaches 5 and 6 would differ depending on the escapement in any give year. Even in the absence of an avulsion, habitat degradation in these reaches occurs under existing baseline conditions. The HCP measures are designed to reduce the likelihood of such an event, and to reduce the extent of effects when such an event occurs.

Take, as predicted by the EDT model, is not expected to jeopardize the continued existence of threatened Lower Columbia River chinook salmon, Columbia River chum salmon, or Lower Columbia River steelhead. This determination also applies to covered, currently unlisted, Lower Columbia River/Southwest Washington coho salmon.

2.1.8 Determination of Post-relinquishment Mitigation

The terms and processes for determining any additional mitigation owed by Storedahl for relinquishment, revocation or suspension of the ITP are described in sections 6.2 and 6.3 of the Implementation Agreement. The primary feature of the post-relinquishment agreement is that mitigation requirements are determined by the Services based on: (a) the covered activities that may be requested to be continued, if any; (b) the impact(s) of activities being relinquished; and (c) the type and amount of mitigation that would have been required if Storedahl had carried out the full term of the HCP.

2.1.9 Conclusion

This ITP will allow Storedahl to expand the Daybreak gravel mine while avoiding, minimizing, and mitigating the effects of these operations on floodplain, riparian, and in-stream habitats for listed and certain unlisted fish. The proposed conservation measures will also improve and protect habitat by implementing many on-site and off-site ecological enhancements, including: resisting a potential avulsion into the Daybreak ponds; accommodating a potential future avulsion through reclamation designs; and minimizing the adverse effects of a potential avulsion by reducing the recovery time. Upon completion of all reclamation, the Daybreak property will be transferred with a conservation easement and endowment to a public or non-profit organizations. The processes for adaptive management provide a mechanism for adjusting future activities based on the results from proposed monitoring and evaluation.

This analysis has examined the covered activities described in the HCP, the jurisdictional fish species that may be affected, the processes by which there may be effects, and the consequences thereof on the overall productivity of salmonids and their habitats across the plan area. NOAA Fisheries has examined general information in the species' Status Reviews (Table 2), specific information in the Services' FEIS, and the Storedahl HCP and finds these and other sources of information to be sufficient with which to conduct this analysis.

After analyzing direct, indirect, cumulative, interrelated, and interdependent effects; and based on the best available scientific information, NOAA Fisheries concludes that issuance of the proposed ITP is not likely to jeopardize the continued existence of threatened Lower Columbia River chinook salmon, Columbia River chum salmon, and Lower Columbia River steelhead, or the candidate Lower Columbia River/Southwest Washington coho salmon that occur in the plan area.

2.1.10 Reinitiation of Consultation

As provided in 50 CFR 402.16, reinitiation of formal consultation is required if: (1) The amount or extent of taking specified in the Incidental Take Statement is exceeded, or is expected to be exceeded; (2) new information reveals effects of the action may affect listed species in a way not previously considered; (3) the action is modified in a way that causes an effect on listed species that was not previously considered; (4) a new species is listed or critical habitat is designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease, pending conclusion of the reinitiated consultation.

2.2 Incidental Take Statement

The ESA at section 9 (16 U.S.C. 1538) prohibits take of endangered species. The prohibition of take is extended to threatened anadromous salmonids by section 4(d) rule (50 CFR 223.203). Take is defined by the statute as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct." (16 U.S.C. 1532(19)) Harm is defined by regulation as "an act which actually kills or injures fish or wildlife. Such an act may include significant habitat modification or degradation which actually kills or injures fish or wildlife by significantly impairing essential behavior patterns, including, breeding, spawning, rearing, migrating, feeding or sheltering." (50 CFR 222.102) Harass is defined as "an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding, or sheltering." (50 CFR 17.3) Incidental take is defined as "takings that result from, but are not the purpose of, carrying out an otherwise lawful activity conducted by the Federal agency or applicant." (50 CFR 402.02) The ESA at section 7(o)(2) removes the prohibition from any incidental taking that is in compliance with the terms and conditions specified in a section 7(b)(4) incidental take statement (16 U.S.C. 1536).

Take of threatened Lower Columbia River chinook and Columbia River chum, and Lower Columbia River steelhead has been prohibited by a final 4(d) rule that became effective on January 9, 2001 (July 10, 2000, 65 FR 42422). The Incidental Take Permit proposed to be issued by NOAA Fisheries provides authorization to take listed species under the terms of the HCP, IA, and the Permit itself.

The Storedahl HCP and its associated documents identify anticipated impacts on affected species likely to result from the proposed activities, and the measures that are necessary and appropriate to minimize those impacts. No take is expected to result from Storedahl's mining and processing activities. Instead, a primary driver for the decision to seek an ITP is the likelihood of an avulsion and/or flooding into the existing ponds, during the next 25 years. An avulsion would bring the East Fork Lewis River into contact with mining activities causing "harm," as defined above. Implementation of the HCP's conservation measures would minimize and mitigate both the likelihood and extent of effects on covered species of an avulsion. An avulsion would take chinook, chum, coho and steelhead in the following ways: (1) an avulsion would result in channel abandonment, with a loss of spawning and rearing habitat, and dewatering of salmonid redds; (2) an avulsion would result in an upstream headcut, and attendant channel destabilization, along with harm or mortality to eggs and alevins; (3) if an avulsion occurred before completion of pond reclamation activities, fine sediments would wash into the East Fork Lewis River, potentially smothering redds and taking eggs and alevins; (4) an avulsion would result in an increase in surface water area, with an increase in summertime water temperatures in the avulsed reach and the area immediately downstream of the open water, along with delayed upstream migration of adult salmonids and reduced cool water habitat available for holding adults; (5) an avulsion would increase the amount of favorable habitat in the river for predatory fishes, resulting in increased predation on juvenile salmonids as they migrate through captured pool habitat; and (6) an avulsion would result in stranding of covered species in the abandoned river channel, the wetlands associated with mining, reclamation and habitat enhancement, and within the avulsed ponds. The dynamic nature of geomorphic recovery and the relatively unpredictable timing of an avulsion make the estimation of take under future conditions difficult.

2.2.1 Amount or Extent of Anticipated Take

As stated in 2.1.2 above, the following species use the action area for migration, spawning, and rearing. As such they would be present in the action area during an avulsion and be exposed to the effects of the interaction between otherwise lawful mining activities and functioning habitat. Therefore, the incidental take of these species is reasonably certain to occur.

2.2.1.1 Lower Columbia River Chinook Salmon - Threatened

NOAA Fisheries anticipates that an undetermined number of LCR chinook salmon may be taken as a result of full implementation of the proposed action and associated level of protection over the permit term and possible extensions. The incidental take of this species is expected to be in the form of harm, harassment, kill, and injury, resulting from activities covered under the HCP. As analyzed in this opinion, NOAA Fisheries has determined that this extent of anticipated take is not likely to result in jeopardy to the species.

Harm is defined to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, spawning, rearing, migrating, feeding, or sheltering. Avulsion would harm salmonids through modification of geomorphic characteristics, sediment transport, hydraulics, hydrology, and water quality. These modifications could occur upstream, locally, and downstream of the Daybreak site. Even with conservation measures in place, an avulsion of the East Fork Lewis River into the existing Daybreak ponds could result in short-term (*i.e.*, several years) deposition of up to 120,300 tons of sand-sized and larger particles (an unknown fraction of which would be from the HCP infill materials) within the 1.25 miles of spawning (52,719 square yards) in the East Fork Lewis River downstream of Dean Creek; and long-term impacts due to increased water temperatures to adult holding and juvenile rearing habitat quality. In addition, salvage and emergency response efforts following an avulsion could result in harm to some fish.

Harassment means an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavior patterns which include breeding, spawning, rearing, migrating, feeding, or sheltering. Salvage and emergency response efforts following an avulsion could result in harassment to some adult and juvenile fish.

Kill may occur due to the smothering of an unknown number of redds following an avulsion. In addition, salvage, and emergency response efforts following an avulsion could kill some adult and juvenile fish. An increase in favorable habitat for predatory fishes could increase predation on juvenile chinook salmon.

Injury Salvage and emergency response efforts and an increased risk of predation following an avulsion could result in injury to some adult and juvenile fish.

2.2.1.2 Lower Columbia River Steelhead - Threatened

NOAA Fisheries anticipates that an undetermined number of LCR steelhead may be taken as a result of full implementation of the proposed action and associated level of protection over the permit term and possible extensions. The incidental take of this species is expected to be in the form of harm, harassment, kill, and injury, resulting from activities covered under the HCP. As analyzed in this opinion, NOAA Fisheries has determined that this extent of anticipated take is not likely to result in jeopardy to the species.

Harm may occur due to a potential avulsion and its modifications to geomorphic characteristics, sediment transport, hydraulics, hydrology, and water quality. These modifications could occur upstream, locally, and downstream of the Daybreak site. Even with conservation measures in place, an avulsion of the East Fork Lewis River into the existing Daybreak ponds could result in short-term (*i.e.*, several years) deposition of up to 120,300 tons of sand-sized and larger particles (an unknown fraction of which would be from the HCP infill materials) within the 1.25 miles of spawning (52,719 square yards) in the East Fork Lewis River downstream of Dean Creek; and long-term impacts due to increased water temperatures to adult holding and juvenile rearing habitat quality. In addition, salvage and emergency response efforts following an avulsion could result in harm to some fish.

Harassment means an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavior patterns which include breeding, spawning, rearing, migrating, feeding, or sheltering. Salvage and emergency response efforts following an avulsion could result in harassment to some adult and juvenile fish.

Kill may occur due to the smothering of an unknown number of redds following an avulsion. In addition, salvage, and emergency response efforts following an avulsion could kill some adult and juvenile fish. An increase in favorable habitat for predatory fishes could increase predation on juvenile steelhead.

Injury Salvage and emergency response efforts and an increased risk of predation following an avulsion could result in injury to some adult and juvenile fish.

2.2.1.3 Columbia River Chum Salmon - Threatened

NOAA Fisheries anticipates that an undetermined number of CR chum salmon may be taken as a result of full implementation of the proposed action and associated level of protection over the permit term and possible extensions. The incidental take of this species is expected to be in the form of harm, harassment, kill, and injury, resulting from activities covered under the HCP. As analyzed in this opinion, NOAA Fisheries has determined that this extent of anticipated take is not likely to result in jeopardy to the species.

Harm may occur due to a potential avulsion and its modifications to geomorphic characteristics, sediment transport, hydraulics, hydrology, and water quality. These modifications could occur upstream, locally, and downstream of the Daybreak site. Even with conservation measures in place, an avulsion of the East Fork Lewis River into the existing Daybreak ponds could result in short-term (*i.e.*, several years) deposition of up to 120,300 tons of sand-sized and larger particles (an unknown fraction of which would be from the HCP infill materials) within the 1.25 miles of spawning (52,719 square yards) in the East Fork Lewis River downstream of Dean Creek; and long-term impacts due to increased water temperatures to adult holding and juvenile rearing habitat quality. In addition, salvage and emergency response efforts following an avulsion could result in harm to some fish.

Harassment means an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavior patterns which include breeding, spawning, rearing, migrating, feeding, or sheltering. Salvage and emergency response efforts following an avulsion could result in harassment to some adult and juvenile fish.

Kill may occur due to the smothering of an unknown number of redds following an avulsion. In addition, salvage, and emergency response efforts following an avulsion could kill some adult and juvenile fish. An increase in favorable habitat for predatory fishes could increase predation on juvenile chum salmon.

Injury Salvage and emergency response efforts and an increased risk of predation following an avulsion could result in injury to some adult and juvenile fish.

2.2.1.4 Lower Columbia River/Southwest Washington Coho Salmon - Candidate

NOAA Fisheries anticipates that an undetermined number of LCR/SW coho salmon may be taken as a result of full implementation of the proposed action and associated level of protection over the permit term and possible extensions. The incidental take of this species is expected to be in the form of harm, harassment, kill, and injury, resulting from activities covered under the HCP. As analyzed in this opinion, NOAA Fisheries has determined that this extent of anticipated take is not likely to result in jeopardy to the species.

Harm may occur due to a potential avulsion and its modifications to geomorphic characteristics, sediment transport, hydraulics, hydrology, and water quality. These modifications could occur upstream, locally, and downstream of the Daybreak site. Even with conservation measures in place, an avulsion of the East Fork Lewis River into the existing Daybreak ponds could result in short-term (*i.e.*, several years) deposition of up to 120,300 tons of sand-sized and larger particles (an unknown fraction of which would be from the HCP infill materials) within the 1.25 miles of spawning (52,719 square yards) in the East Fork Lewis River downstream of Dean Creek; and long-term impacts due to increased water temperatures to adult holding and juvenile rearing habitat quality. In addition, salvage and emergency response efforts following an avulsion could result in harm to some fish.

Harassment means an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavior patterns which include breeding, spawning, rearing, migrating, feeding, or sheltering. Salvage and emergency response efforts following an avulsion could result in harassment to some adult and juvenile fish.

Kill may occur due to the smothering of an unknown number of redds following an avulsion. In addition, salvage, and emergency response efforts following an avulsion could kill some adult and juvenile fish. An increase in favorable habitat for predatory fishes could increase predation on juvenile coho salmon.

Injury Salvage and emergency response efforts and an increased risk of predation following an avulsion could result in injury to some adult and juvenile fish.

2.2.2 Reasonable and Prudent Measures and Terms and Conditions

All conservation measures described in the final HCP (Storedahl 2003), together with the associated Implementation Agreement and the section 10(a)(1)(B) permit issued with respect to the HCP, are hereby incorporated by reference as reasonable and prudent measures and terms and conditions within this Incidental Take Statement. Such terms and conditions are non-discretionary and must be undertaken for the exemptions under section 10(a)(1)(B) and section 7(o)(2) of the ESA to apply. If the permittee fails to adhere to these terms and conditions, the protective coverage of the section 10(a)(1)(B) permit and section 7(o)(2) may lapse. The amount or extent of incidental take anticipated under the proposed HCP, associated reporting requirements, and provisions for disposition of dead or injured animals are as described in the HCP and its accompanying section 10(a)(1)(B) permit.

3.0 SECTION 10 (a)(2)(B) FINDINGS

3.1 Permit Issuance Considerations

Although only three of the four anadromous salmonid species addressed in the HCP and under the jurisdiction of NOAA Fisheries are listed under the ESA at this time, this document is intended to provide Storedahl assurances that they will receive an Incidental Take Permit (ITP) if and when the unlisted species (coho) is subsequently listed under the ESA, subject to the "unforeseen circumstances" clause in the IA. In order to issue an ITP under the ESA section 10(a)(1)(b) and 50 CFR section 222.307, NOAA Fisheries must consider the following:

1. The status of the affected species or stocks. The status of anadromous salmonids potentially affected by the HCP has been considered above (section 2.12). The environmental baseline for anadromous fish and their habitats (section 2.1.3) was also considered.

2. The potential severity of direct, indirect and cumulative impacts on anadromous salmonids and their habitats as a result of the proposed activity. The impacts of the HCP were examined in detail in this analysis (section 2.1.7).

3. The availability of effective monitoring techniques. Monitoring of the implementation of the HCP and the effectiveness of the HCP prescriptions are a critical feature of this HCP. Monitoring reports will be completed and submitted to the Services according to the schedule described in Chapter 5 of the HCP. The frequency and period of monitoring varies by plan element with compliance monitoring of key items extending throughout the entire 25-year-term of the plan.

4. The use of the best available technology for minimizing and mitigating impacts. The prescriptions established in this HCP represent the most recent developments in science and technology in minimizing and mitigating impacts to riparian and aquatic habitats, from the closed-loop wash-water clarification process to mining and reclamation designs. Further, the adaptive management component of this HCP assures new science and technology will continue to be employed in the HCP as it is developed.

5. The views of the public, scientists and other interested parties knowledgeable of the species or stocks or other matters related to the application were received and reviewed by NOAA Fisheries. Over the past six years, the Applicant has hosted and facilitated more than 40 tours of the Plan Area and 50 meetings with federal, tribal, state and county representatives, as well as non-governmental groups, neighbors and stakeholders.

Storedahl first submitted a preliminary working or conceptual draft to the Services in March 1999. In September of 1999, Storedahl submitted the first working draft of the HCP to the Services, as well as the Washington Department of Fish and Wildlife, Washington Department of Natural Resources, Lower Columbia Fish Recovery Board, Conservation Commission, Clark County, and Friends of the East Fork. In addition, copies of this draft were placed in public libraries for citizen review and comment. A second working draft of the HCP was submitted to the Services in July of 2000. This draft was also mailed to other federal, state, and local governmental agencies, non-governmental groups, and the local press, among others, for review and comment prior to the development of the final draft HCP.

During the development of this draft the Services worked with Storedahl to develop an EIS and IA to accompany the HCP. The Services formally initiated an environmental review of the project through publication of a notice in the Federal Register on December 27, 1999 (64 FR 247). This notice stated that the Services were preparing an EIS for the proposed issuance of an ITP. The notice identified the applicant, covered species and area under the proposed permit. The notice also announced a 30-day public scoping period during which other agencies, tribes, and the public were invited to provide comments and suggestions regarding issues and alternatives to be considered. Storedahl submitted the final draft documents of the HCP, EIS, and IA with their formal application for an ITP in September 2002. On November 22, 2002 (67 FR 70408) the Services published notice of the availability of the Draft EIS and informed the public that Storedahl had submitted applications for incidental take permits and included the HCP and IA. This notice initiated a 61-day public comment period under NEPA. The comment period was extended for 31 days to February 21, 2003 (Dec. 13, 2002, 67 FR 76740), in response to requests from the public. This resulted in a comment period of 92 days.

A total of 45 comment letters were received by the Services pertaining to the DEIS and HCP: 12 from government agencies and elected officials, one from a tribal organization, 11 from public organizations, and 21 from individual citizens. Volume II, Response to Comments, of the FEIS contains copies of all of those letters and the Services' responses. Many of the comments and suggestions were incorporated into the FHCP and FEIS.

The Final Environmental Impact Statement was noticed in the Federal Register on November 28, 2003 for a 30 day review period (68 FR 66820). The comment period was subsequently extended 30 days for a total review period of 60 days (Jan. 9, 2004, 69 FR 1585). The Services received twenty-five comment letters regarding the FEIS and FHCP. Responses to the comments are contained in the appendices of the Services' Record of Decision (March 2004, on file at NOAA Fisheries' Washington State Habitat Office, Lacey, WA).

The public process had substantial influence on the final HCP and FEIS. A number of substantive changes were incorporated into the final HCP and EIS. Another factor the Services considered in making the decision was consistency with the Federal Trust responsibility to Native American Tribes. This Trust responsibility imposes a duty on Federal agencies to protect Trust assets for Tribes. Through the development and comment phases of drafts of the HCP, Storedahl held meetings and provided site tours with affected tribal governments, *i.e.*, the Cowlitz Tribe, and their technical staffs to inform, discuss, and represent their interests in these matters. The Services have concluded that the proposed HCP is consistent with this Trust responsibility.

3.2 Permit Issuance Findings

Having considered the above, NOAA Fisheries makes the following findings under section 10(a)(2)(b) of the ESA with regard to the adequacy of the HCP meeting the statutory and regulatory requirements for an Incidental Take Permit under section 10(a)(1)(B) of the ESA and 50 CFR section 222.307:

1. The taking of listed species will be incidental. NOAA Fisheries anticipates that the proposed action would likely result in incidental take of threatened LCR chinook, CR chum, LCR steelhead and currently unlisted LCR/SW coho. Activities that will occur in

the HCP area that may result in take may include "harm" through adverse changes in essential habitat features such as modifications to geomorphic characteristics, sediment transport, hydraulics, hydrology, and water quality as a result of a potential avulsion. In addition, salvage and emergency response efforts following an avulsion could result in harm to some fish. Also, take of both juvenile and adult salmonids may occur via the "harass, kill, or injury" definition as well, by salvage and emergency response efforts and an increased risk of predation following an avulsion. Some instances of incidental take will likely occur despite the conservation measures in the HCP. These types of take are speculative, not quantifiable, and would be limited by the uncertain probability of an avulsion.

2. Storedahl will, to the maximum extent practicable, minimize and mitigate the impacts of taking anadromous salmonids associated with watershed management and related activities. The HCP includes conservation measures to improve water quality, provide enhanced flows, establish riparian and floodplain vegetation, reestablish floodplain/stream interactions, establish a conservation easement and endowment, and control non-native predatory fishes. Measures in this HCP minimize and mitigate for any take that may occur, through reducing the risk of an avulsion by implementing mining and reclamation designs, and a contingency plan in the event that an avulsion occurs in the ponds. Also, Storedahl will monitor and conduct research to test assumptions and to determine the effectiveness of HCP prescriptions.

3. NOAA Fisheries has received the necessary assurance that the plan will be funded and implemented. The suite of mitigation, minimization, and adaptive management measures has assured funding commensurate with the effort and operational costs specific to each element. Signing of the IA by Storedahl assures that the HCP will be implemented. Also, the HCP and IA commit Storedahl to adequately fund implementation of the HCP.

4. Based upon the best available scientific information, the taking will not appreciably reduce the likelihood of the survival and recovery of the species in the wild. Conservation measures identified in the plan will reduce the potential for an avulsion of the East Fork Lewis River into the Daybreak site, mitigate for negative effects in the event than an avulsion occurs, and result in a benefit to anadromous salmonid species. The Act's legislative history establishes the intent of Congress that this issuance criteria be based on a finding of "not likely to jeopardize" under section 7(a)(2) (see 50 CFR section 402.02). This is the identical standard to section 10(a)(2)(B). The conclusions regarding jeopardy for the listed ESU and for all other unlisted anadromous salmonid are found in section 2.1.9 of this Opinion. In summary, NOAA Fisheries has considered the status of the species, the environmental baseline, the effects of the proposed action, including any indirect and cumulative effects, to conclude that issuance of the Incidental Take Permit to Storedahl for Lower Columbia River chinook, Columbia River chum, Lower Columbia River steelhead, and Lower Columbia/Southwest Washington coho salmon would likely not jeopardize the continued existence of any of the anadromous salmonids addressed in the HCP.

5. The Storedahl HCP has been developed to assure that other measures, as required by NOAA Fisheries have been met. The HCP and IA incorporate all elements determined by NOAA Fisheries to be necessary for approval of the HCP and issuance of the permit.

3.3 Conclusion

Based on these findings, it is determined that the Applicant's HCP meets the statutory and regulatory requirements for an Incidental Take Permit under section 10(a)(1)(B) of the ESA and 50 CFR section 222.307.

4.0 MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT

4.1 Background

The MSA, as amended by the Sustainable Fisheries Act of 1996 (Public Law 104-267), established procedures designed to identify, conserve, and enhance EFH for those species regulated under a Federal fisheries management plan. Pursuant to the MSA:

- Federal agencies must consult with NOAA Fisheries on all actions, or proposed actions, authorized, funded, or undertaken by the agency, that may adversely affect EFH (section 305(b)(2));
- NOAA Fisheries shall provide conservation recommendations for any Federal or State activity that may adversely affect EFH (section 305(b)(4)(A));
- Federal agencies shall within 30 days after receiving conservation recommendations from NOAA Fisheries provide a detailed response in writing to NOAA Fisheries regarding the conservation recommendations. The response shall include a description of measures proposed by the agency for avoiding, mitigating, or offsetting the impact of the activity on EFH. In the case of a response that is inconsistent with the conservation recommendations of NOAA Fisheries, the Federal agency shall explain its reasons for not following the recommendations (section 305(b)(4)(B)).

Essential fish habitat means those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity (MSA section 3). For the purpose of interpreting this definition of EFH: Waters include aquatic areas and their associated physical, chemical, and biological properties that are used by fish and may include aquatic areas historically used by fish where appropriate; substrate includes sediment, hard bottom, structures underlying the waters, and associated biological communities; necessary means the habitat required to support a sustainable fishery and the managed species' contribution to a healthy ecosystem; and "spawning, breeding, feeding, or growth to maturity" covers a species' full life cycle (50 CFR 600.110). Adverse effect means any impact which reduces quality and/or quantity of EFH, and may include direct (*e.g.*, contamination or physical disruption), indirect *(e.g.*, loss of prey or reduction in species fecundity), site-specific or habitat-wide impacts, including individual, cumulative, or synergistic consequences of actions (50 CFR 600.810).

Any reasonable attempt to encourage the conservation of EFH must take into account actions that occur outside EFH, such as upstream and upslope activities, that may have an adverse effect on EFH. Therefore, EFH consultation with NOAA Fisheries is required by Federal agencies regarding any activity that may adversely affect EFH, regardless of its location.

The objectives of this EFH consultation is to determine whether the proposed action may adversely affect designated EFH, and to recommend conservation measures to avoid, minimize, or otherwise offset potential adverse impacts to EFH resulting from the proposed action.

4.2 Identification of Essential Fish Habitat

Pursuant to the MSA, the Pacific Fisheries Management Council (PFMC) has designated EFH for three species of federally-managed Pacific salmon: chinook *(Oncorhynchus tshawytscha*); coho (*O. kisutch*); and Puget Sound pink salmon (*O. gorbuscha*) (PFMC 1999). Freshwater EFH for Pacific salmon includes all those streams, lakes, ponds, wetlands, and other water bodies currently, or historically accessible to salmon in Washington, Oregon, Idaho, and California, except areas upstream of certain impassable man-made barriers (as identified by the PFMC), and longstanding, naturally-impassable barriers (*i.e.*, natural waterfalls in existence for several hundred years). Detailed descriptions and identifications of EFH for salmon are found in Appendix A to Amendment 14 to the Pacific Coast Salmon Plan (PFMC 1999). Assessment of the impacts to these species' EFH from the proposed action is based, in part, on this information.

4.3 Proposed Actions

The proposed action and action area are detailed above in section II of this Opinion as the issuance of an Incidental Take Permit (ITP) under section 10 of the ESA for the implementation of a habitat conservation plan (HCP) and its associated Implementation Agreement by J. L. Storedahl & Sons, Inc., an aggregate mining company in rural Clark County, Washington, near the East Fork Lewis River. The action area includes habitats that have been designated as EFH for various life-history stages of chinook and coho salmon.

4.4 Effects of the Proposed Actions

As analyzed above in section 2.1.5, these activities may result in detrimental short- and long-term impacts to a variety of habitat parameters. The Storedahl HCP and its associated documents clearly identify anticipated impacts on affected species likely to result from the proposed activities and the measures that are necessary and appropriate to minimize those impacts. These potential effects are primarily related to an avulsion of the East Fork Lewis River into the existing Daybreak ponds and include the loss of spawning and rearing habitat from channel abandonment; head cutting and subsequent channel destabilization; deposition of sediments, or reduced supply of bed material, on downstream spawning habitat; increased summertime water temperatures; and increased favorable habitat for native and non-native predatory fishes.

4.5 Conclusion

NOAA Fisheries believes that the proposed action may adversely affect designated EFH for chinook and coho salmon.

4.6 Essential Fish Habitat Conservation Recommendations

The conservation measures Storedahl included in the HCP as part of the proposed activities are adequate to minimize the adverse impacts from these activities to designated EFH for Pacific salmon. NOAA Fisheries understands that Storedahl intends to implement these conservation measures to minimize potential adverse effects to the maximum extent practicable. Consequently, NOAA Fisheries has no additional conservation recommendations to make at this time.

4.7 Statutory Response Requirement

Pursuant to the MSA (section 305(b)(4)(B)) and 50 CFR 600.920(j), Federal agencies are required to provide a detailed written response to NOAA Fisheries' EFH conservation recommendations within 30 days of receipt of these recommendations. The response must include a description of measures proposed to avoid, mitigate, or offset the adverse impacts of the activity on EFH. In the case of a response that is inconsistent with the EFH conservation recommendations, the response must explain the reasons for not following the recommendations, including the scientific justification for any disagreements over the anticipated effects of the proposed action and the measures needed to avoid, minimize, mitigate, or offset such effects.

4.8 Supplemental Consultation

NOAA Fisheries must reinitiate EFH consultation with itself if the proposed action is substantially revised in a manner that may adversely affect EFH, or if new information becomes available that affects the basis for NOAA Fisheries' EFH conservation recommendations (50 CFR. 600.920(l)).

5.0 REFERENCES

Section 7(a)(2) of the ESA requires biological opinions to be based on the best scientific and commercial data available. This section identifies the data and references used in developing this Opinion.

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