UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Northwest Region
7600 Sand Point Way N.E., Bldg. 1
Seattle, WA 98115

Refer to:
2003/00261

June 10, 2003

Gloria Brown
Forest Supervisor
Siuslaw National Forest
4077 SW Research Way
Corvallis, OR 97339

Re: Endangered Species Act Section 7 Formal consultation and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation, 2003-2006 Knotweed Eradication Project, Lincoln County, Oregon

Dear Ms. Brown:

Enclosed is 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 Lincoln County Soil and Water Conservation District Knotweed Eradication Project, 2003-2006. In this Opinion, NOAA Fisheries concludes that the proposed action is not likely to jeopardize the continued existence of listed Oregon Coast coho salmon (*Oncorhynchus kisutch*). As required by section 7 of the ESA, NOAA Fisheries has included reasonable and prudent measures with nondiscretionary terms and conditions that are necessary to minimize incidental take associated with this action.

This document also serves as consultation on essential fish habitat (EFH) pursuant to section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations at 50 CFR Part 600. In this consultation, NOAA Fisheries concludes that the proposed action will adversely affect designated EFH for Pacific salmon, coastal pelagic species, and west coast groundfish. NOAA Fisheries has included conservation recommendations to avoid, minimize, or otherwise offset effects to designated EFH produced by this project.

If you have questions regarding this consultation, please contact Rob Markle of my staff in the Oregon Habitat Branch at 503.230.5419.

Sincerely,

for Michael R Crouse

D. Robert Lohn
Regional Administrator

Endangered Species Act - Section 7 Consultation
Biological Opinion

&

Magnuson-Stevens Fishery Conservation and Management Act
Essential Fish Habitat Consultation

Knotweed Eradication Project, 2003-2006
Siletz/Yaquina (HUC #17100204) and Alsea Subbasins (HUC #17100205)
Lincoln County, Oregon

Agencies: Siuslaw National Forest

Consultation Conducted By: NOAA's National Marine Fisheries Service, Northwest Region

Date Issued: June 10, 2003

Issued by: for Michael R Crouse
D. Robert Lohn
Regional Administrator

Refer to: **2003/00261**

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Parts per million

1 ppm = 1,000 ppb (parts per billion)
1 ppm = 1,000 mu g L^{-1} (micrograms per liter)
1 ppm = 1 mg L^{-1} (milligrams per liter)

1. INTRODUCTION

1.1 Consultation History

On March 14, 2003, NOAA's National Marine Fisheries Service (NOAA Fisheries) received a request from the Siuslaw National Forest, U.S. Forest Service (FS) for formal consultation pursuant to section 7 of the Endangered Species Act (ESA) and consultation pursuant to section 305(b) of the Magnuson-Stevens Fishery Management and Conservation Act (MSA) for a knotweed eradication project proposed by the Lincoln County Soil and Water Conservation District (SWCD) for the calendar years 2003 through 2006. The FS will provide Federal funds for the proposed action through Title II of the Secure Schools and Community Self-Determination Act of 2000, also known as the Payments to Counties program or PayCo. A biological assessment (BA) dated February 21, 2003, accompanied the letter.

The FS prepared the BA. NOAA Fisheries staff provided technical assistance as part of the Level 1 ESA consultation streamlining team (Level 1 Team) of the Oregon Coast Province in accordance with the February 26, 1997 (revised June 1999), consultation streamlining guidelines (NOAA Fisheries *et al*. 1999). In the BA, the FS used procedures established in NOAA Fisheries (1996) to determine the effects of the proposed action.

The FS determined that the proposed action may effect and was "likely to adversely affect" (LAA) Oregon Coast (OC) coho salmon (*Oncorhynchus kisutch*). This proposed action is the subject of this biological opinion (Opinion). In addition, the BA provided an evaluation of the effects the proposed action would have on habitat designated as essential fish habitat (EFH) under the MSA.

1.2 Proposed Action

The proposed action is implementation of the Lincoln County Soil and Water Conservation District's knotweed eradication project for the years 2003-2006. The purpose of the project is to eradicate from Lincoln County three species of knotweed: Giant knotweed (*Polygonum sachalinense*), Japanese knotweed (*P. cuspidatum*) and Himalaya knotweed (*P. polystchyum*). Knotweed is native to Asia and is also known as fleeceflower. Oregon has designated knotweed as a class "B" noxious weed (ODA 2003), recommending "limited to intensive control at the state or county level as determined on a case-by-case basis." The SWCD proposes to use herbicides to prevent the ubiquitous establishment and the associated loss of native riparian vegetation within Lincoln County to knotweed. Knotweed distribution in the county is relatively restricted at this time. Failure to address the issue in a timely manner will result in an escalation of the problem.

Chemical treatment for knotweed is the most effective control method for established stands due to the plant's extensive root system, which can readily propagate new growth (Dawson and Holland 1999). The use of the herbicides glyphosate and triclopyr have proven effective at controlling knotweed (Beerling 1990, Soll *et al*. 2001). Beerling (1990) cautioned that herbicide use was a short-term control measure and not a method of eradication. Dawson and Holland (1999) recommended: (1) Immediately controlling new knotweed colonies before they become well established; (2) containing plant material and treating on site; (3) treating upstream sites and proceed downstream; (4) developing a long-term management policy that includes surveying; and (5) never considering partial or incomplete control measures.

The BA describes the action, the environmental baseline in the action area, and the potential effects of the action on OC coho salmon. The project description provided in the BA submitted by the FS is included in this document by reference and is summarized below.

The SWCD proposes to use the herbicides glyphosate and triclopyr to eradicate knotweed in the county on non-Federal lands. Project sites include lowland and riparian sites throughout the lower Salmon, Siletz, Yaquina, Alsea and Yachats River watersheds and along some smaller coastal stream watersheds such as Beaver and Schooner Creeks (*i.e.*, Lincoln County portions of Siletz/Yaquina and Alsea subbasins). The Siletz/Yaquina subbasin contains 408,265 acres of non-Federal lands (84%), and the Alsea subbasin (excluding Cummins/Tenmile/Mercer Frontal 5th field watershed) contains 143,948 acres of non-Federal lands (39%) (Appendix A). Watersheds and estimated treatment sites over the course of the proposed project are listed below:

- <u>Salmon River</u>. Lower portions of this watershed contain scattered small patches of knotweed. The estimated total infestation is 1.5 acres.

- <u>Siletz River</u>. This watershed appears less affected than many others. Knotweed stands exist in the Rock Creek drainage, and along the mainstem from Logsden to Siletz, and in Kernville. A few strands are present in lower Drift Creek pastureland. The estimated total knotweed infestation is 2.5 acres.

- <u>Yaquina River</u>. This watershed has the heaviest knotweed infestations, particularly from Eddyville to Chitwood and in and around Toledo. Stands are also present along the Yaquina Bay road. The estimated total knotweed infestation is 6.5 acres.

- <u>Beaver Creek</u>. Only two knotweed stands are known, one on lower Elkhorn Creek and one on lower south fork Beaver Creek. The estimated total knotweed infestation is less than one acre.

- <u>Alsea River</u>. This watershed may be the least infested in Lincoln County. A few stands are present from Tidewater to Waldport. The estimated total knotweed infestation is 3.5 acres.

- <u>Yachats River</u>. Knotweed is scattered from the forks to the mouth of the river, and is most common in the lower four miles. The estimated total knotweed infestation is 3.5 acres.

- Ocean Tributaries North of Yaquina River. Knotweed stands are present along Logan Creek in Roads End, near the Chinook Winds Casino, near Devil's Lake, and elsewhere in Lincoln City. Stands are present in several areas of Newport, including Agate Beach. The estimated total knotweed infestation is 3.5 acres (mostly uplands).

- Ocean Tributaries South of Yaquina River. A few knotweed stands are located along Highway 101 between Newport and Waldport. Several stands are located between Waldport and Yachats, and in Yachats. The estimated total knotweed infestation is three acres (mostly uplands).

The project was developed following review of a similar effort conducted by The Nature Conservancy along the Sandy River, Oregon (Soll *et al*. 2001). Manual control alone has proven labor intensive and ineffective at eradicating knotweed (BA; pages 4 - 5). A total of 25 acres of non-Federal land in Lincoln County would be treated over a four-year period, 2003 to 2006. Glyphosate and triclopyr quantities would dramatically decline following the 2003 and 2004 applications, respectively (Tables 1 and 2, Figure 1). Glyphosate, in the form of Rodeo® or AquaMaster®, would be used in the 100-year floodplain and areas outside of the floodplain where aquatic contamination may result (*e.g*., steep slopes or sandy soil areas adjacent to streams, or intermittent stream channels). Triclopyr, in the form of Garlon® 3A, would be applied to areas outside of the 100-year floodplain where this SWCD does not anticipate aquatic contamination will result.

Three surfactants are also proposed to enhance herbicide adhesion to target plants and increase effective absorption. The surfactant LI-700® is proposed for use with the glyphosate formulation, and R-11® for use with the triclopyr formulation.

The primary application method would be using a low pressure sprayer, either a backpack (four gallon capacity), or a hand-carried tank with a hand-held spray wand (1-2 gallon capacity). A licensed commercial applicator would conduct all herbicide applications. Rodeo®, AquaMaster®, and Garlon® 3A would be mixed to a 5% or less solution with 1% or less surfactant. The FS indicated the Rodeo® and AquaMaster® formulations contain 648 grams of glyphosate per liter ($g\ L^{-1}$) and the Garlon® 3A formulation contains 1,361 grams of triclopyr per gallon (or 360 $g\ L^{-1}$) (see BA, p. 10). Therefore, the proposed glyphosate application concentrations would range from 6,480 to 32,400 parts per million (ppm) for the spray method, and the proposed triclopyr application concentrations would range from 1,798 to 17,977 ppm, depending on the percent solution applied (Table 3).

The SWCD propose to use three treatment scenarios. Under the single-treatment scenario the SWCD would only apply herbicides during May and June. Under the two-treatment scenario the SWCD would use an additional application to re-sprouted knotweed plants in July or August. The three-treatment scenario (rarely used) would include an application in September or October. All applications would occur between May and October, and would cease at the onset of the rainy season in October. Application would occur to knotweed plants ≤4.9 feet (1.5 meters) tall. Larger plants would be hand or mechanically cut before treatment.

Foliar glyphosate treatments have exhibited 95% efficacy at controlling knotweed when applied twice during the growing season or applied once in the fall following cutting to ground level in early summer (Soll *et al*. 2001). Foliar Garlon® 3A treatments have exhibited 92% efficacy with single application in August (Soll *et al*. 2001), although the SWCD believes greater reductions in stem counts would result from repeated applications during a single growing season.

During the first year of application, the SWCD would undertake field trials using a variety of treatment applications to evaluate their performance. The alternate methods include glyphosate injection using procedures presented by Crockett *et al*. (2002) and the use of a "very low toxicity surfactant," Agri-Dex®, with Rodeo® or AquaMaster®. For the injection method, the proposed glyphosate application concentrations would be 648,000 milligrams per liter (or 648,000 ppm) (Table 3). While labor intensive, the injection method has demonstrated excellent efficacy with no regrowth observed 22 months after injection (Crockett *et al*. 2002). Results of the trials would be documented, and treatment performance would be evaluated based on a select set of criteria: Stem reduction and number of treatments required to obtain eradication objectives, volume of herbicide used per area, and costs compared to standard application methods.

Table 1. Glyphosate applications proposed by the Lincoln County Soil and Water Conservation District to eradication knotweed, 2003-2006.

	Treatment Area (acres)				Rodeo®/AquaMaster® Application (gallons)			
Location	2003	2004	2005	2006	2003	2004	2005	2006
Siletz River	1.0	1.0	0.1	≤0.1	1.4	1.4	0.1	>0.1
Salmon River	0.7	0.7	≤0.1	≤0.1	1.0	1.0	>0.1	>0.1
Yaquina River	3.0	2.4	0.5	≤0.1	4.2	3.4	0.7	>0.1
Beaver Creek	0.4	0.4	≤0.1	≤0.1	0.6	0.6	>0.1	>0.1
Alsea River	2.0	1.0	0.1	≤0.1	2.8	1.4	0.1	>0.1
Yachats River	2.0	1.1	0.1	≤0.1	2.8	1.5	0.1	>0.1
Ocean Tribs North	1.5	1.4	≤0.1	≤0.1	2.1	2.0	>0.1	>0.1
Ocean Tribs South	1.0	1.0	0.1	≤0.1	1.4	1.4	0.1	>0.2
Total	11.6	9	≤1.2	≤0.8	16.3	12.7	>1.4	>0.9

Table 2. Garlon® 3A applications proposed by the Lincoln County Soil and Water Conservation District to eradication knotweed, 2003-2006.

	Proposed Treatment Area (acres)				Proposed Garlon® 3A Application (gallons)			
Location	2003	2004	2005	2006	2003	2004	2005	2006
Siletz River	0.3	0.2	0	0	0.4	0.3	0	0
Salmon River	0.1	0	0	0	0.2	0	0	0
Yaquina River	0.5	0.1	0	0	0.8	0.2	0	0
Beaver Creek	0	0	0	0	0	0	0	0
Alsea River	0.3	0.1	0	0	0.5	0.2	0	0
Yachats River	0.2	0.1	0	0	0.3	0.2	0	0
Ocean Tribs North	0.5	0.1	≤0.1	0	0.8	0.2	>0.2	0
Ocean Tribs South	0.8	0.1	≤0.1	≤0.1	1.2	0.2	>0.2	>0.2
Total	2.7	0.7	≤0.2	≤0.1	4.2	1.3	>0.4	>0.2

Figure 1. Total estimated annual herbicide application area proposed by the Lincoln County Soil and Water Conservation District to eradication knotweed, 2003-2006.

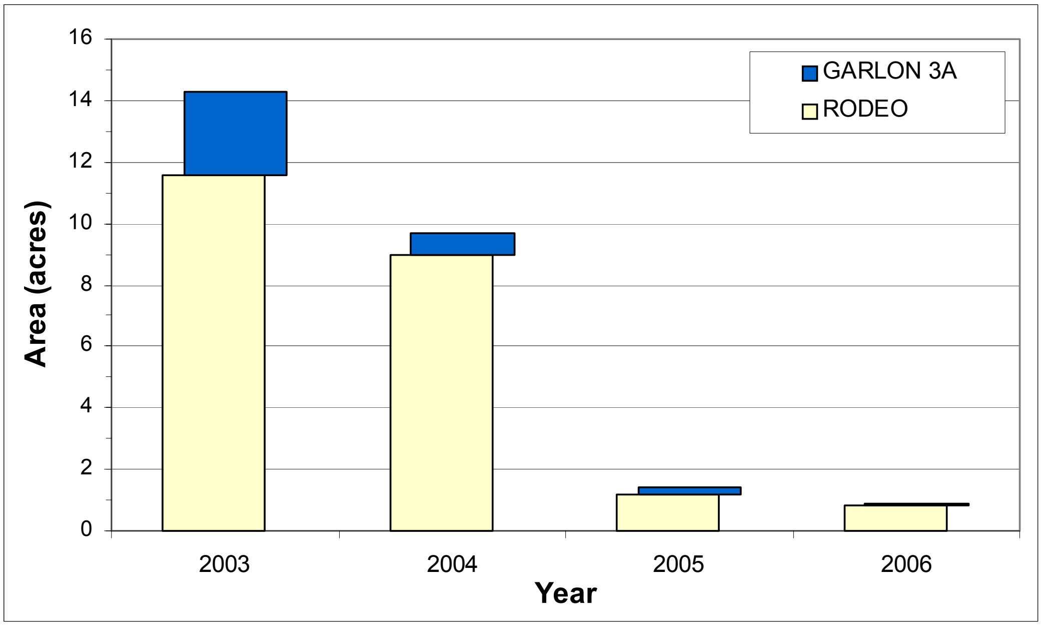


Table 3. Proposed herbicide application concentrations for the eradication of knotweed in Lincoln County, 2003-2006.

Formulation(1)	Glyphosate (ppm)	Triclopyr (ppm)
100%	648,000	not proposed
5%	32,400	17,977
4%	25,920	14,382
3%	19,440	10,786
2%	12,960	7,191
1%	6,480	3,595
0.5%	not proposed	1,798

(1) Rodeo®, AquaMaster®, or Garlon® 3A.

The FS included a list of project design features proposed by the SWCD in the BA (see p.7-8). These features include, in part:

Project Design Features:

1. Trained individuals under direction of a licensed applicator would apply herbicides using only low pressure spot spray or injection application methods and in accordance with label instructions.
2. Herbicide use would be limited to Rodeo® or AquaMaster® with LI-700® or Agri-Dex® on plants within the 100-year floodplain and when steep slopes, sandy soil or intermittent channels create the possibility of drift, drip or direct runoff into the floodplain or surface waters. Rodeo® or AquaMaster® would be diluted to 5% or less with 1% or less surfactant when applied to foliage. Injection application would use undiluted Rodeo® or AquaMaster® without surfactant.
3. Garlon® 3A with R-11® would not be used within the 100-year floodplain or on sites where steep slopes, sandy soils or intermittent stream channels permit direct runoff into the floodplain or surface water. Garlon® 3A would be diluted to 5% or less with 1% or less surfactant.
4. Spray activities would only occur during calm dry weather conditions to prevent drift and runoff; no spraying would occur during rain or high wind (*i.e.*, over 5 miles per hour), or if precipitation has been forecasted to occur within 24 hours of spraying.
5. All herbicide applications would occur from May through October, and would stop at the onset of the rainy season in October.
6. No herbicides would be applied to open water (surface water) or applied to plants in standing water.
7. Only the quantity of herbicides needed for a day's use would be transported to the project site.
8. Areas used for mixing herbicides would be located where an accidental spill would not run into surface waters or result in groundwater contamination. Impervious material would be placed beneath mixing areas in such a manner as to contain any spills associated with mixing or refilling.
9. A spill kit would be on site during all herbicide application.
10. Equipment cleaning, storage, and disposal of rinsates and containers would follow all applicable state and Federal laws.

2. ENDANGERED SPECIES ACT

2.1 Biological Opinion

NOAA Fisheries listed OC coho salmon as threatened under the ESA on August 10, 1998 (63 FR 42587), and issued protective regulations under section 4(d) of the ESA on July 10, 2000 (65 FR 42422). Critical habitat is currently not designated or proposed for this species.

The objective of this Opinion is to determine whether knotweed eradication project, 2003-2006, proposed by the Lincoln County SWCD is likely to jeopardize the continued existence of OC coho salmon.

2.1.1 Biological Information

Although there are currently limited data to assess population numbers or trends, all coho salmon stocks comprising the OC coho salmon ESU are depressed relative to past abundance. The status and relevant biological information concerning OC coho salmon are well described in the proposed and final rules from the Federal Register (60 FR 38011, July 25, 1995; and 63 FR 42587, August 10, 1998, respectively), and Weitkamp *et al.* (1995).

Abundance of wild coho salmon spawners in Oregon coastal streams declined during the period from about 1965 to roughly 1975, and has fluctuated at a low level since that time (Nickelson *et al*. 1992). Despite better-observed spawning escapements in 2001, population trends remain low (Table 4). Contemporary production of coho salmon may be less than 10% of the historic production (Nickelson *et al*. 1992). Average spawner abundance has been relatively constant since the late 1970s, but preharvest abundance has declined. Average recruits-per-spawner may also be declining. The OC coho salmon ESU, although not at immediate danger of extinction, may become endangered in the future if present trends continue (Weitkamp *et al*. 1995).

The bulk of production for the OC coho salmon ESU is skewed to its southern portion, where the coastal lake systems (*e.g.*, Tenmile, Tahkenitch, and Siltcoos basins) and the Coos and Coquille Rivers are more productive. Coho salmon populations in the Siletz/Yaquina and Alsea subbasins have been characterized as depressed (*e.g.*, spawning habitat underseeded, declining trends, or recent escapements below long-term average) and at moderate risk of extinction (Weitkamp *et al.* 1995, BLM 1996, FS 1997, Boateng & Associates 1999, BLM *et al.* 1999). However, while the *Lower Alsea Watershed Analysis* (BLM *et al.* 1999) characterized the Alsea River coho salmon population as severely depressed, Weitkamp *et al.* (1995) cited Nickelson *et al.* (1992) as finding the population healthy (*e.g.*, spawning habitat fully seeded and stable or increasing trends).

Coho salmon abundance in the project area is generally considered to be less than 10% of historic levels (BLM 1996, FS 1997, Boateng & Associates 1999, BLM *et al.* 1999). A recent estimate of average annual abundance of wild coho salmon spawners in watersheds included in the project is 6,434 fish (1990-2001) with a range of 2,123 spawners (1998) to 13,451 spawners (2001) (ODFW 2003) (Table 4). Though final estimates of 2002 returns are not available, preliminary information indicate continued increases in coho salmon spawners (ODFW 2003), as do forecasts for the 2003 return (Appendix C). Recent increases have been attributed to conservation efforts (*e.g.*, habitat restoration and harvest restrictions) and favorable ocean conditions, which are known to be cyclic.

Coho salmon returns to the Salmon River are dominated (91%) by fish of hatchery origin (Boateng & Associates 1999, p. 56). Juveniles may be found in the estuary from February through July (Boateng & Associates 1999, p. 57).

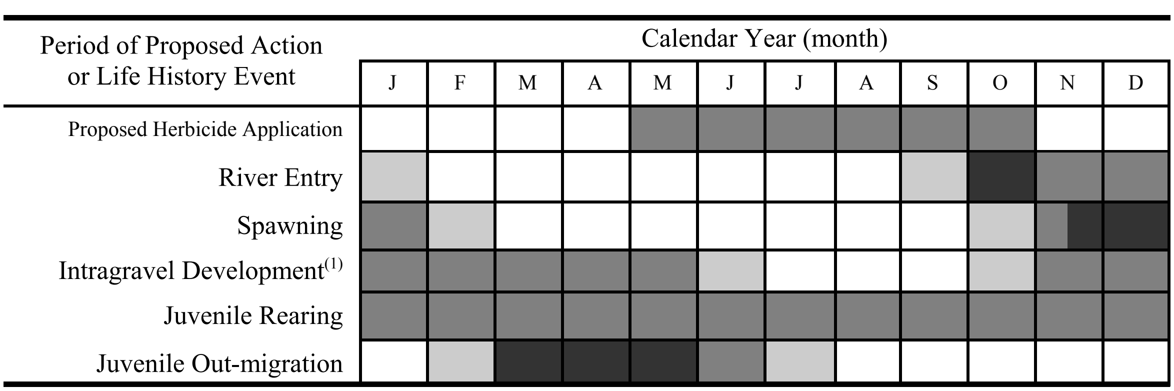
Timing of adult coho salmon river entry is largely influenced by river flow. Coho salmon normally wait for fall freshets before entering rivers. In the Siletz-Yaquina and Alsea subbasins, adults typically enter rivers between September and mid-January, with peak migration occurring in October (Weitkamp *et al*. 1995) (Table 5). Spawning occurs from October to February, with peak spawning occurring in late-November (*e.g*., Salmon, Siletz, Yaquina Rivers) or mid-December (*e.g*., Beaver Creek, Alsea and Yachats Rivers) (Weitkamp *et al*. 1995). The *Upper Siletz Watershed Analysis* (BLM 1996) indicates Siletz River run timing can be delineated into two distinct periods, one dominated by hatchery origin stock and the other by a wild stock. Fish of hatchery origin typically migrate upstream from October to late-November in the Siletz River, while wild coho salmon migrate upstream from early December to early February (BLM 1996, page 1xxx). Intragravel residency (egg to fry) varies greatly between river basins and reaches, and is largely dependent on substrate composition and water temperature (Sandercock 1991). No specific information is available on intragravel residence timing in project area watersheds. However, a study done in Oregon coastal streams found an average incubation period of 110 days, with emergence typically occurring two to three weeks following hatch (Sandercock 1991). This suggests a 4-5 month intragravel residency period. Seaward migration of juveniles occurs during the spring. Juvenile outmigration occurs from February through June, with peak migrations occurring from March through May (Weitkamp *et al*. 1995).

Table 4. Estimated spawning populations for naturally-produced coho salmon in the project area (Appendix B) (source: ODFW 2003).

	Estimated Wild Coho Population		
	Select Project Area Basins(1)		OC ESU
Year	Number of fish	Est. % of ESU	Number of fish
1990	2,699	16	16,510
1991	2,892	10	29,078
1992	11,230	29	38,604
1993	3,171	7	44,266
1994	6,360	17	37,477
1995	7,285	18	41,303
1996	9,314	16	59,453
1997	2,161	15	14,068
1998	2,123	11	19,816
1999	9,035	26	34,646
2000	7,482	14	54,085
2001	13,451	9	147,981
Average	6,434	14	44,774

(1) Data for Salmon River, Siletz River, Yaquina River, Devil's Lake, Beaver Creek, Alsea River, and Yachats River.

Table 5. Life history timing for OC coho salmon in the Siletz/Yaquina River (HUC 17100204) and Alsea River (HUC 17100205) subbasins (Weitkamp *et al*. 1995, Sandercock 1991). Dark shading indicates peak occurrence of life history event. Medium shading indicates increasing or declining occurrence of life history period or the herbicide application period, as appropriate. Light shading indicates onset or conclusion of life history period. Exceptions may exist that would allow individual fish to fall outside of the indicated periods.



(1) Based on spawning period (Weitkamp *et al*. 1995) and a 4-5 week intergravel development period (Sandercock 1991).

2.1.2 Evaluating Proposed Actions

The standards for determining jeopardy are set forth in section 7(a)(2) of the ESA as defined by 50 CFR 402 (the consultation regulations). NOAA Fisheries must determine whether the action is likely to jeopardize the listed species and/or whether the action is likely to destroy or adversely modify critical habitat. This analysis involves the initial steps of: (1) Defining the biological requirements of the listed species; and (2) evaluating the relevance of the environmental baseline to the species' current status.

Subsequently, NOAA Fisheries evaluates whether the action is likely to jeopardize the listed species by determining if the species can be expected to survive with an adequate potential for recovery. In making this determination, NOAA Fisheries must consider the estimated level of mortality attributable to: (1) Collective effects of the proposed or continuing action; (2) the environmental baseline; and (3) any cumulative effects. This evaluation must take into account measures for survival and recovery specific to the listed species' life stages that occur beyond the action area. If NOAA Fisheries finds that the action is likely to jeopardize the listed species, it must identify reasonable and prudent alternatives for the action.

For the proposed action, NOAA Fisheries' jeopardy analysis considers direct or indirect mortality of fish attributable to the action. Because critical habitat is not currently designated for OC coho salmon, NOAA Fisheries did not include a critical habitat analysis.

2.1.2.1 Biological Requirements

The first step in the methods NOAA Fisheries uses for applying the ESA section 7(a)(2) to listed salmon is to define the species' biological requirements that are most relevant to each consultation. 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.

The relevant biological requirements are those necessary for the listed species to survive and recover to 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 stock, enhance their capacity to adapt to various environmental conditions, and allow them to become self-sustaining in the natural environment. Essential habitat features for survival and recovery of coho salmon include: Substrate, water quality, water quantity, water temperature, water velocity, cover/shelter, food (juvenile only), riparian vegetation, space, and safe passage conditions.

For this consultation, the biological requirements are improved habitat characteristics that function to support successful adult and juvenile migration, adult holding, spawning, egg incubation, and rearing. In spite of increased returns in recent years, the status of OC coho salmon, based on their risk of extinction, has not significantly improved since the species was listed. This elevated extinction risk is largely reflective of the cyclic nature of oceanic conditions, freshwater habitat conditions that are degraded and not properly functioning, and hatchery practices that threaten the species' ability to survive the natural range of habitat variability.

2.1.2.2 Environmental Baseline

In step 2 of NOAA Fisheries' analysis, we evaluate the relevance of the environmental baseline in the action area to the species' current status. The environmental baseline is an analysis of the effects of past and ongoing human-caused and natural factors leading to the current status of the species or its habitat and ecosystem within the action area. The action area is defined by NOAA Fisheries regulations (50 CFR 402) as "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action." For the purposes of this consultation, the action area includes stream reaches in the Siletz/Yaquina River and Alsea River subbasins that could become contaminated by herbicides incidental to the proposed action, extending an undetermined distance downstream where concentrations would decline to below effects threshold.

The FS, in conjunction with the Bureau of Land Management (BLM) and using procedures in NOAA Fisheries (1996), has previously submitted information for the Siletz-Yaquina and Alsea subbasins that found the environmental baseline was functioning at risk or not properly functioning (Appendix D) (FS and BLM 2002). The characterized watersheds possess significant portions of Federally-owned forest lands. The remaining 5th field watersheds in the subbasins are likely in similar or worse condition due the extent of habitat degradation that has occurred in area estuaries and lowland floodplains (Risser 2000). The Oregon Progress Board (Risser 2000) specifically identifies the introduction of exotic species as a distinct threat to the Coast Range Ecoregion.

The BA indicates most proposed project sites in Lincoln County have been highly degraded by the establishment and dominance of knotweed stands and past land use (*i.e.*, lowland pasture development, road building, timber harvest or residential development). Project areas contain few natural habitat components and little native vegetation. When present, overstory vegetation generally consists of red alder. Knotweed has the ability to spread quickly and out-compete native vegetation communities, reducing plant diversity in the riparian zones. Frequently, understory vegetation is absent within knotweed stands due this domineering growth characteristic. By reducing diversity of the plant community there is also the potential for reducing the diversity of the animal community that depends on that vegetation, which would include terrestrial and aquatic insects that are consumed by coho salmon and other aquatic species that reside in adjacent streams and rivers. Knotweed also has the potential to limit future large wood recruitment to the stream by restricting the establishment of seedlings in riparian zones. The suppression of stream-side tree development reduces future cover for juvenile fish and the formation of complex pools that would result from wood recruitment. Knotweed also stabilizes gravel bars in and along the streams that may increase bank erosion due a reduction in the stream channel's cross-sectional area. Erosion generates suspended sediments, which may stress juvenile fish and reduce egg survival when fine sediments are deposited in spawning sites. Stressed fish are more susceptible to disease and predation.

Information about existing herbicide contamination in Lincoln County streams is limited. However, since Oregon forest practice rules do not preclude measurable concentrations of pesticides reaching streams, and stormwater runoff has commonly been found to contain pesticides applied to areas with urban, agricultural and forestry land uses (Spence *et al*.1996, ODF 2000; Ewing 2000), NOAA Fisheries assumes some localized herbicide contamination of streams in the action area exists.

Numerous streams in the Siletz/Yaquina and Alsea subbasins appear on the 303(d) List of Water Quality Limited Water Bodies of the Oregon Department of Environmental Quality (ODEQ) for temperature, bacteria, habitat modification, pH, chlorophyll A, fecal coliform, dissolved oxygen, or sedimentation (ODEQ 2002).

Based on the best information available on the current status of OC coho salmon, and NOAA Fisheries' assumptions given the information available regarding population status, population trends, and the poor environmental baseline conditions within the action area, the environmental baseline does not currently meet all of the biological requirements for OC coho salmon. Actions that promote or do not retard attainment of properly functioning aquatic conditions, when added to the environmental baseline, are necessary to meet the needs of the species (*i.e*., survival and recovery of listed fish).

2.1.3 Analysis of Effects

2.1.3.1 Effects of Proposed Action

In step 3 of NOAA Fisheries' analysis, we identify and evaluate the potential effects of the proposed action on the listed species with consideration of the existing environmental baseline in the action area, including whether the proposed action contributes to or maintains a degraded baseline condition.

2.1.3.1.1 General Effects

Because of their proximity and connections to streams, ecological conditions and processes in riparian areas strongly influence aquatic habitats. Riparian areas function to provide shade, cover, and channel structural elements; supply and process nutrients; support food webs; supply substrate materials; stabilize streambanks; filter upland sediments; and provide linkages to side channels, floodplains, and groundwater (Sullivan *et al*. 1987, Gregory *et al*. 1991, FEMAT 1993, Spence *et al*. 1996).
Most riparian area functions affecting streams and anadromous fish (including bank stability, shade, litterfall, large wood recruitment) occur within a distance equal to the height of a site-potential tree from the edge of the streambank (FEMAT 1993, p. V-27; Spence *et al*. 1996, p.

216-220) for streams without a floodplain, and decline rapidly beyond that distance. Where there is a floodplain, riparian area functions may extend for a distance equal to the height of a site-potential tree from the edge of the floodplain, since during a flood the entire floodplain can function as the stream channel (Rhodes *et al*. 1994). For the proposed project area, a site-potential tree height has been determined to be 200 to 260 feet, depending on location. Activities that adversely affect riparian area habitat conditions frequently translate into adverse affects on coho salmon in adjacent waterways.

The effects of chemical herbicide use frequently extend beyond the intended target species. Herbicide composition (including inert ingredients, carrier agents, and surfactants), chemical character, environmental conditions, and application techniques are among the factors that determine how herbicides affect non-target species and their ecosystems. Scientific studies have documented lethal effects, and to a lesser degree sub-lethal effects, of herbicide ingredients on many species. Results of these studies are typically laboratory-derived and may vary greatly. Toxicity under conditions in the field may vary more than in the laboratory (Henry *et al*. 1994), with pre-existing conditions ameliorating effects in some instances and amplifying effects in others. Recent evidence from Puget Sound streams demonstrates that coho salmon may be vulnerable to chemicals in runoff during the first month of fall rains, which both attracts salmon spawners into the streams and delivers concentrated residual chemicals from roads, roofs, and fields (Nat Scholz, NOAA Fisheries Northwest Fisheries Science Center, personal communication with Rob Markle, NOAA Fisheries Habitat Conservation Division, describing research in progress, April 14, 2003). Sub-lethal effects of herbicides on fish may include reduced growth, decreased reproductive success, altered behavior, and reduced resistance to stress (Spence *et al*. 1996).

Aquatic biota may be directly exposed to herbicides that are applied directly to stream channels; however, risks of contamination can be reduced if adequate no-spray buffers are maintained (Heady and Child 1994). The risk is further reduced by use of hand application techniques (as opposed to aerial application) and adherence to conservation measures that minimize the risk of drift or exposure resulting from spill events. However, as Spence *et al*. (1996) state, "toxic levels of chemicals may reach streams from storm runoff and wind drift even when best management practices are employed."

Indirect exposure may result from surface and subsurface transport. Potential responses of habitat to exposure include reduction in riparian vegetation, increase in solar radiation reaching the stream, elevation of stream temperatures, and reduced prey base. The loss of riparian vegetation may also decrease the amount of organic litter and large wood delivered to streams. Furthermore, bank instability may result from the loss of vegetation root structure, increasing sedimentation and reducing cover for fish.

In addition to toxic effects of active ingredients, the toxicity of inert ingredients are poorly understood. Similarly, the LC_{50} values likely are poor predictors of minimum concentrations needed to cause *take* of listed species under the ESA. By definition, LC_{50} values indicate the concentration at which half of an experimental population of the subject species dies as a result of exposure. Therefore, any concentrations that approach the LC_{50} values are likely to cause *take*. While sub-lethal effects also can constitute *take* under the ESA, the concentrations that result in such effects remain difficult to discern.

2.1.3.1.2 Effects of Rodeo® or AquaMaster® Application

Rodeo® (Dow Agrosciences) and AquaMaster® (Monsanto) have comparable formulations, comprised of glyphosate (53.8%) and water (46.2%) as the carrier agent. Toxicity information presented herein for the Rodeo® formulation also applies to the AquaMaster® formulation.

Glyphosate is a non-selective, broad-spectrum herbicide. Absorbed by leaves and translocated throughout the plant, glyphosate disrupts the photosynthetic process by preventing the synthesis of amino acids required for the construction of proteins. The herbicide affects a wide variety of plants, including grasses and many broadleaf species, and has the potential to eliminate desirable as well as undesirable vegetation. Plant selectivity can be achieved by using injection or wiping application methods. Application is only effective to plants that are not immersed and efficacy may be reduced if plants are inundated after application (*e.g*., rising tidal or flood waters). Shoots of cordgrass (*Spartina* sp.) in Willapa Bay, Washington, treated with Rodeo® (5%) and LI-700® (2%) contained greater concentrations of glyphosate at sites higher in the intertidal zone suggesting greater plant uptake of the herbicide (Kilbride and Paveglio 2001). Application of glyphosate to water may reduce pH (Anton *et al*. 1994).

Glyphosate is strongly adsorbed by soil and does not retain herbicidal properties following contact with soil. Some information indicates the presence of phosphate ions may impair or reverse glyphosate adsorption (Norris *et al*. 1991). The half-life of glyphosate in soil can range from three to 249 days (FS 2000). In general, glyphosate degradation is dependent on soil texture and organic content (FS 2000). Degradation is rapid in soils of low organic content, and slower in soils with high organic content (Tu *et al*. 2001). “Strong adsorption to soil particles slows microbial degradation, allowing glyphosate to persist in soils and aquatic environments” (Tu *et al*. 2001). Adsorption increases with increasing clay and organic content (FS 2000, Tu *et al*. 2001). Glyphosate degradation would be expected to be relatively slow in most project sites due to the loamy soils found throughout Lincoln County, and particularly in tidal marshes where fine-particle soils dominate.

The main break-down products of glyphosate are aminomethylphosphonic acid (AMPA) or glycine, which are further broken down by soil microorganisms (Norris *et al*. 1991). One hundred nineteen days after treatment with Rodeo® at 4.7 L ha^{-1}, glyphosate concentrations in the estuarine mudflats of Willapa Bay, Washington, declined 51% to 72%, while AMPA did not degrade during that period (Simenstad *et al*. 1996). No short- or long-term effects to the benthic community were detected.

Glyphosate dissolves easily in water (Norris *et al*. 1991). However, because glyphosate is strongly adsorbed by soil particles, it is not easily released back into water moving through soil. In the project area, glyphosate has the greatest potential to enter flowing water due to direct deposition from drift or accidental spill during application. Indirect contamination may result from over-ground runoff that transports contaminated soil particles to waterways during spring and fall rains, or from inundation of treatment sites in tidal flats and floodplains. Glyphosate entering the water may quickly be bound to sediment and suspended particulates (Solomon and Thompson 2003), although some studies indicate it may remain in freshwater a "long time" (Anton *et al*. 1994). Tests show that the half-life for glyphosate in water ranges from 35 to 63 days. In British Columbia, following application of glyphosate using a no-spray buffer, very low concentrations of glyphosate and the breakdown product AMPA were sometimes observed in water and sediments of streams after the first heavy rain following application (FS 2000). These findings were consistent with a study were glyphosate was applied to agricultural watersheds at a rate comparable to the proposed action (~6-12 kg ha^{-1}, Appendix E) that found the highest concentrations in runoff one to 10 days, and detection up to 4 months, after application (Norris *et al*. 1991). The same study found the maximum amount of herbicide transported by runoff was 1.85% of the applied amount, and that in each of the three study years, "the first runoff event after treatment accounted for 99% of the total herbicide runoff..." (Norris *et al*. 1991). In over-water applications, higher peak concentrations were always observed in water following heavy rain events up to three weeks after application, and sediment peaks where observed later and persisted in stream sediments for more than one year (FS 2000).

Habitat Effects

By design, use of glyphosate would reduce stream bank and floodplain vegetation, including any treated native vegetation. This may result in short-term increases of direct solar radiation reaching adjacent streams and contribute to elevated water temperatures. Due to the scattered distribution of the treatment areas, NOAA Fisheries does not expect measurable increases in water temperature from the proposed action. In the long term, the re-establishment of natural vegetation should restore shade and reduce water temperature. The reduction of vegetation on gravel bars should allow re-establishment of the natural mobility of these geomorphological features, allowing natural transport of bedload sediment to resume. The removal of knotweed from gravel bars should provide a source of spawning gravel and increase the stream channel cross-sectional area, which may reduce off-site bank erosion and suspended sediment. The potential increase in suspended sediment generated by increased gravel bar mobility is likely to be a fraction of that currently produced by the restricted flow capacity of existing stream channels in infested areas.

Turbidity, including that due to suspended sediment, can at moderate levels reduce primary and secondary productivity, and at high levels can injure or kill adult and juvenile fish, and may also interfere with feeding (Bjornn and Reiser 1991, Spence *et al.* 1996). Coho salmon are visual cue feeders that prefer to acquire prey suspended in the water column or on the surface (Sandercock 1991). Therefore, sustained periods of high turbidity may reduce prey acquisition and adversely affect growth. Other behavioral effects on fish, such as gill flaring and feeding changes, have been observed in response to pulses of suspended sediment (Berg and Northcote 1985). Redeposited fine sediments also can reduce primary and secondary productivity (Spence *et al.* 1996), and can reduce incubation success (Bell 1991) and rearing space available for juvenile salmonids (Bjornn and Reiser 1991). Behavioral avoidance of turbid waters may be one of the most important effects of elevated suspended sediments (Scannell 1988, Birtwell *et al*. 1984, DeVore *et al*. 1980). Salmonids have been observed to move laterally and downstream to avoid turbid plumes (Servizi and Martens 1991; Scannell 1988; Lloyd 1987; McLeay *et al*. 1984 & 1987; Sigler *et al*. 1984).

<u>Biological Effects</u>

Glyphosate is "moderately to very slightly toxic" to fish (Table 6) (Mensink and Janssen 1994). The Material Safety Data Sheet for Rodeo® indicates the acute LC_{50} for rainbow trout of the 53.8% glyphosate formulation is 60 ppm (Dow 2000). This reflects the toxicity of application methods that do not dilute the formulation (*e.g*., injection, wiping), and does not consider typical spray application solutions that dilute the formulation or add surfactants. The salmonid 96-hour LC_{50} for Rodeo® is 1,100 ppm (Mitchell *et al*. 1987).

Glyphosate sub-lethal effect concentrations for salmonids have not been well studied. Following exposure (14-day) to sub-lethal glyphosate concentrations, a study using carp found histopathological changes in gills and liver structure, and liver, heart, kidney and serum enzyme activity (Neskovic *et al*. 1996). The threshold gill and liver histopathological responses were observed at concentrations equal to 0.8% (5 ppm) and 1.6% (10 ppm), respectively, of the 96-hour LC_{50} for that species (620 ppm). The gill histopathological response was thought to be reparable if the fish were relocated to uncontaminated water; however, the liver fibrosis could be indicative of serious liver damage. Statistically significant changes in enzyme activity were observed at 0.4% of the 96-hour LC_{50}, the lowest exposure concentration, in liver (alkaline phosphatase, $P<0.01$; and glutamic-pyruvic transaminase, $P<0.05$) and kidneys (glutamic-oxaloacetic transaminase, $P<0.05$; and glutamic-pyruvic transaminase, $P<0.05$). Responses to chemical exposure vary by species, but equivalent exposure concentrations (0.4%, 0.8%, and 1.6% of the 96-hour LC_{50}) for salmonids would be 4.4 ppm, 8.8 ppm, and 17.6 ppm.

Glyphosate exposure (Roundup® formulation) tests with rainbow trout found sac-fry the most sensitive life stage followed by emergent fry (Norris *et al*. 1991). Eyed eggs were the most resistant life stage. At a given life stage, there is some suggestion that toxicity does not significantly ($P<0.05$) differ based on specimen size (Mitchell *et al*. 1987). Osmoregulatory function in coho salmon smolts exposed to low concentrations (~50% LC_{50} value) of Roundup® was not affected (Mensink and Janssen 1994, section 9.1.2.3). Although exposure via ingestion has been demonstrated (Henry *et al*. 1994), studies on carp suggest glyphosate has a low potential for bioconcentration (FS 2000).

Glyphosate formulations are "moderately to very slightly toxic to aquatic invertebrates (Mensink and Janssen 1994, section 9.1.2.2). The 96-hour LC_{50} values range from 218 to 1,216 ppm (Henry *et al*. 1994) (Table 6). Exposure may occur by ingestion of contaminated particulates, and increased suspended solids may increase toxicity. Additions of clay increased toxicity to *Daphnia* sp. (Mensink and Janssen 1994). Conversely, toxicity to *Daphnia sp.* was decreased by aeration (Mensink and Janssen 1994). Therefore, glyphosate in well-oxygenated, turbulent streams (*e.g*., headwater streams) with few suspended solids may be less toxic to aquatic invertebrates than it is in slow moving rivers with high levels of suspended solids (*e.g*., lower river or tidal reaches). Aeration did not affect toxicity to rainbow trout (Mensink and Janssen 1994, section 9.1..2.3). Mayfly nymphs did not avoid low concentrations (0.2 to 2 ppm) of the Roundup® formulation; however, the nymphs avoided concentrations equal to the 96-hour LC_{50} value (Mensink and Jenssen 1994). Aquatic macroinvertebrate density declined by 42% for a 1.5-year period following treatment with Roundup® (Spence *et al.* 1996).

Glyphosate toxicity is affected by environmental factors (*e.g*., water hardness, temperature, or pH) (Mitchell *et al*. 1987, Norris *et al*. 1991, Anton *et al*. 1994, Henry *et al*. 1994, Mensink and Janssen 1994, SERA 1997). Toxicity increases at lower pH levels (acidic) and higher temperatures (Henry *et al*. 1994; Mensink and Janssen 1994, section 9.1.2.3; SERA 1997). With regard to pH, surfactants may have the opposite characteristic, exhibiting increased toxicity in alkaline waters (SERA 1997, FS 2000). The 96-hour LC_{50} value for the Roundup®formulation, which includes a surfactant, ranges from 6 to 30 ppm for various aquatic species in acidic waters, and approaches one ppm in alkaline waters (*e.g.*, estuaries) (FS 2000). The greater toxicity in alkaline waters suggests the surfactant in the Roundup®formulation contributes significantly to its toxicity.

The aquatic toxicity of surfactants recommended for use with Rodeo® varies greatly and may exceed that of Rodeo® under certain exposure scenarios, although the toxicity of the proposed surfactants (*i.e.*, LI-700® and Agri-Dex®) are relatively low (Table 6). Surfactants would constitute 1% or less of the applied herbicidal solution. LI-700® (Loveland Industries, Inc.) consists of phosphatidylcholine, propionic acid, and alkylpoloxyethlene ether (80%). The remaining 20% is identified only as "constituents ineffective as adjuvant" (SERA 1997). Agri-Dex® (Helena Chemical) is a mixture of polyoxyethylated polyol fatty acid ester, polyol fatty acid ester, and paraffin-base petroleum oil (SERA 1997). The additive effect of the surfactant on the toxicity of the applied solution is poorly understood. SERA (1997) reported, "data appear to be inadequate for a quantitative assessment of ecological effects of the surfactants," LI-700® and Agri-Dex®. Glyphosate has been found to have an antagonistic effect on the toxic action of a surfactant (Mensink and Janssen 1994). The actual toxicity of the applied solution is likely between that identified for a 5% Rodeo® solution and the surfactant alone (Mitchell *et al*. 1987). Henry *et al*. (1994) found Rodeo® and the adjuvants X-77 Spreader® and Chem-Trol® were additive in toxicity to amphipods.

Table 6. The aquatic toxicity of glyphosate, Rodeo® or an equivalent formulation, and the proposed surfactants. LC_{50} = concentration lethal to 50% sample population. EC_{50} = concentration at which 50% of the sample population exhibits an effect. NOEC = concentration at which no observable effects are noted among the sample population.

	Glyphosate	Rodeo® or equiv.	Agri-Dex®	LI-700®
Salmonid 96-hr NOEC	823 ppm(1)	1,500 ppm(1)		<100 ppm (6)
Salmonid 24-hr LC_{50}		60 ppm(4)		140 ppm (6)
Salmonid 48-hr LC_{50}				130 ppm (6)
Salmonid 96-hr LC_{50}	580 ppm(2)	1,100 ppm(2)	>1,000 ppm(5)	130 ppm (6)
Invertebrate 48-hr NOEC				100 ppm (6)
Invertebrate 48-hr EC_{50}	55 ppm(3)	5,600 ppm(3)		
Invertebrate 24-hr LC_{50}				450 ppm (6)
Invertebrate 48-hr LC_{50}	117 - 930 ppm(3)	218 -1,216 ppm(3)	>1,000 ppm(5)	170 ppm (6)
Invertebrate 96-hr LC_{50}		720- 1,177 ppm(3)		190 ppm (7)

(1) Anton et al.
(2) Mitchell *et al*. 1987.
(3) Henry *et al*. 1994.
(4) Dow 2000.
(5) Agri-Dex Technical Data Sheet (http://helenachemical-west.com/data/TDS/Agri.pdf).
(6) Loveland Industries, Inc. 2000.
(7) FS 2000.

The glyphosate formulations (Rodeo® or AquaMaster®) proposed for use under this action were selected for their low toxicity relative to other available formulations. By comparison, the LC_{50} of Roundup® (glyphosate + EntryII® surfactant) to fish is five to 26 ppm and the LC_{50} of R-11® (a common surfactant used with glyphosate) to fish is 3.8 ppm (SERA 1997).

Vectors of Exposure

The proposed action includes application of a glyphosate herbicide to dry areas within 100-year floodplains and to areas where the more mobile triclopyr formulation could enter floodplains or surface waters. Application to these areas would result in some level of glyphosate and surfactant contamination of the water. The vectors of possible exposure include drift, runoff, inundation, and spill. Direct contamination would likely include drift of chemicals during spraying adjacent to surface waters. At a lower occurrence probability, direct contamination may result from an accidental spill. Indirect contamination may result from tidal inundation of treated tidelands, flooding of treated gravel bars, or stormwater runoff. Stormwater-related indirect sources are more likely to occur during spring when soils are saturated and measurable precipitation is still relatively frequent. Depositional areas are unlikely to represent a large risk to coho salmon, although contaminated sediments in suspension may provide an exposure source. The ingestion of glyphosate-contaminated sediment has been demonstrated in aquatic invertebrates (Mensink and Janssen), and it stands to reason that fish may also experience increased toxicity via this source or through contaminated prey.

The proposed application concentrations (6,480-648,000 ppm) exceed known effect threshold concentrations (Table 6) and therefore direct contamination may affect fish or invertebrates near the entry point. The effect largely will be dependent on the volume and extent of contamination and the ability or inclination of the organism to avoid exposure. The temporal and spatial extent of exposure would depend on the mixing zone needed to reduce contamination levels below the effect threshold concentration.

Mixing zone size would vary greatly and depend on contamination volume (*e.g*., drift or spill), receiving volume (*e.g*., one cfs or 30 cfs), point of entry (*e.g*., drift deposition or gravel bar inundation), and amount of turbulence, which is related to habitat type (*e.g*., step-pool, slack water side channel), but is expected to be limited due to the turbulent character of headwater stream reaches and the volume of receiving waters in lowland reaches. Hydrologically complex waterways with meanders, pools, riffles, and eddies that accelerate mixing and dilution are more likely to disperse contaminants than simplified waterways with consistent channel velocities that allow contaminants to maintain a more consolidated profile (Lee 1995, Heard *et al*. 2001). Mixing distances are shorter in smaller streams, and mixing is slower when the discharge point is near the streambank (Heard *et al*. 2001). A recent study of transverse mixing distances in small streams (1.4 to 3.5 ft^3 s^{-1}) in eastern Iowa found heterogeneity in tracer concentrations 16.4 feet to more than 328 feet downstream of mid-channel release points (Heard *et al*. 2001). Unfortunately, short of empirically determining mixing distances for specific stream reaches, prediction of mixing lengths quantitatively is not yet feasible (Heard *et al*. 2001).

A recent study that modeled a glyphosate/LI-700® application to three aquatic habitats (*i.e*., pond, stream, estuary) found exposure concentrations for application rates comparable to those proposed (6-12 kg ha^{-1}, Appendix E) did not exceed the LC_{50} concentration (Solomon and Thompson 2003), and agrees with field study data (Gardner and Grue 1996, p. 450). The amount of chemical applied and the time of delivery following application would influence the contamination level. Monitoring of repeated annual applications of Rodeo® and LI-700® to control cordgrass in tidal flats over a three-year period found increased concentration of glyphosate in sediments, but concentrations did not exceed known effects threshold concentrations (Kilbride and Paveglio 2001). Increases were attributed to glyphosate contained in residual cordgrass rhizomes, which did not readily metabolize or exude the chemical. NOAA Fisheries expects glyphosate to persist in the action area soils and substrates below effect threshold concentrations for one to five years, depending on the frequency and duration of treatments for a specific site.

Delivery of glyphosate solution to project area streams via runoff or inundation is likely. Predominately, delivery would be greatest during the first runoff event or tidal inundation period after treatment. Regarding runoff delivery, assuming 1.85% of the applied Rodeo® enters flowing water (agricultural delivery rate suggested in Norris *et al*. 1991), an estimated 27 to 191 grams of glyphosate might reach the watershed stream system in 2003 depending on the particular watershed (Table 7). For example, using Yaquina Watershed in 2003:

1.85% x 4.2 gal Rodeo® x 2452.7 grams glyphosate gal^{-1} Rodeo® = 191 grams glyphosate

Input locations would be distributed along several miles of stream and river, and exposure concentrations likely would be below lethal response thresholds. Estimated delivery would decline starting in 2005 due to the reduction in the amount of herbicide used in the watersheds (Table 7). Therefore, the greatest risk of surface water contamination and aquatic effects is from the 2003 and 2004 applications.

Rainbow trout fry avoided glyphosate (Vision®) at concentrations equal to 50% of the LC_{50} value (Morgan *et al*. 1991). Vision® is a glyphosate salt formulation containing either 10% or 15% surfactant (similar to Roundup®). The same study (Morgan *et al*. 1991) found juvenile rainbow trout did not avoid short-term exposure ($\leq$1 hour) to Vision® until the 96-hour LC_{50} value was exceeded. Therefore, juvenile coho salmon may not avoid exposure to lower glyphosate concentrations by relocating. Sub-lethal effects on fish have been documented at exposures for various contaminants, including glyphosate (Neskovic *et al*. 1996), at concentrations less than 1% of their LC_{50} value.

Glyphosate application would not occur during spawning or the majority of the incubation and emergence periods, and rarely would be applied when adults are present. The proposed action would apply the herbicide during periods when some of the most sensitive coho salmon life stages, sac-fry and emergent fry, are present (May and June). Although incubation and emergence declines rapidly during this period. Therefore, the progeny of late spawning coho salmon are most at risk of being affected. Rearing juveniles may be repeatedly exposed as persistent knotweed sites may be treated up to three times per season. Returning adult coho salmon and eggs may be indirectly exposed to glyphosate primarily due to runoff.

Sub-lethal effects are most likely to be exhibited as a result of exposure to glyphosate contaminated waters, predominately in the form of avoidance. Where extended exposure occurs due to impeded mobility (*e.g.,* sac-fry) or extensive contamination, sub-lethal effects on juvenile coho salmon may include relocation necessitated by short-term loss of prey organisms, histopathological changes in gills and liver structure, and physiological stress, which may lead to secondary effects. Barring a spill, NOAA Fisheries does not expect exposure concentrations to reach lethal concentrations. On the other hand, exposure at higher concentrations resulting from tidal inundation or in areas receiving rainfall sufficient to cause runoff within 24 hours of application cannot be wholly dismissed.

The FS completed “worst case scenario” analysis of a runoff event, and estimated “end of pipe” glyphosate and surfactant contamination concentrations several orders of magnitude below salmonid or invertebrate effect threshold concentrations. An analysis by the FS of a theoretical spill found only localized and short-term effects were likely to occur.

Table 7. An estimate of glyphosate delivered to watershed streams in the project area assuming a 1.85% delivery rate (Norris *et al*. 1991).

	Rodeo®/AquaMaster® Application (gal)				Est. Glyphosate Delivery to Area Streams (g)			
Location	2003	2004	2005	2006	2003	2004	2005	2006
Siletz River	1.4	1.4	0.1	0.1	63.5	63.5	4.5	4.5
Salmon River	1	1	0.1	0.1	45.4	45.4	4.5	4.5
Yaquina River	4.2	3.4	0.7	0.1	190.6	154.3	31.8	4.5
Beaver Creek	0.6	0.6	0.1	0.1	27.2	27.2	4.5	4.5
Alsea River	2.8	1.4	0.1	0.1	127	63.5	4.5	4.5
Yachats River	2.8	1.5	0.1	0.1	127	68.1	4.5	4.5
Ocean Tribs North	2.1	2	0.1	0.1	95.3	90.7	4.5	4.5
Ocean Tribs South	1.4	1.4	0.1	0.2	63.5	63.5	4.5	9.1
Total	16.3	12.7	1.4	0.9	740	576	64	41

Any contaminates in flowing water are likely to move downstream and decline rapidly as mixing occurs and glyphosate binds to particulates (Solomon and Thompson 2003), although elevated concentrations may persist in near-bank areas, eddies, and side channels with slower velocities. The preponderance of evidence in the relevant scientific literature indicates that the use of glyphosate near the water poses a minimal risk of long-term adverse affects on salmonids or their prey base (Morgan *et al*. 1991, Norris *et al*. 1991, Anton *et al*. 1994, Gardner and Grue 1996, Simenstad *et al*. 1996, FS 2000, Kilbride and Paveglio 2001). Any affects to freshwater or estuarine invertebrates would likely be of limited temporal and spatial extent as well. Therefore, any contamination would likely represent short-term, non-lethal exposure for coho salmon that would not significantly reduce the prey base. To some extent this finding is based on the assumption that existing background chemical contamination is minimal and not of such character as to cause a synergistic or threshold effect to occur.

Use of the injection method, proposed as a field trial, would avoid direct contamination from drift or indirect contamination from runoff since the herbicide would remain contained either in the applicator or the plant itself and no soil contamination would result. Furthermore, no surfactant would be necessary. However, the injection method might increase the risk of spill since concentrated Rodeo® would be used and more time on-site would be required. Due to their limited mobility, sac-fry and emergent fry would be at the greatest risk of extended exposure to lethal effect concentrations of glyphosate. In most situations, the effects would be limited to sub-lethal responses similar to those described previously for the spray application.

2.1.3.1.3 Effects of Garlon® 3A Application

Garlon® 3A (Dow AgroSciences) is a formulation made up of triclopyr triethylamine (TEA) salt (44.4%) and inert ingredients (55.6%). The majority of the inert ingredients (98.2%) have not been identified by the manufacturer. Those inert ingredients that have been identified (water, emulsifiers, surfactants, and ethanol) comprise approximately 1% of the formulation. However, the Garlon® 3A formulation, including the unidentified ingredients, has been tested for toxicity.

Triclopyr mimics a natural plant growth hormone, auxin, causing uncontrolled and disorganized growth in susceptible plant species. Triclopyr does not affect grasses at recommended application rates (FS 2001). Triclopyr is absorbed by plant surfaces (*e.g.*, green bark, leaves, roots, and cut stem surfaces), and moves throughout the plant accumulating in the meristem.

As with glyphosate, use of triclopyr would reduce vegetation, though triclopyr would not affect grasses. Since the project design criteria prevent the application of triclopyr in areas within the 100-year floodplain or where the herbicide may be transported to the floodplain or surface waters, stream shade or streambank stability should not be affected.

Garlon® 3A is described as low in toxicity to fish with a 96-hour LC_{50} of 463 ppm (SERA 1996, p. 4-18) (Table 8). This reflects the toxicity of the formulation, and does not consider typical solutions used for spray application that include the use of additional surfactants. Juvenile coho salmon (0+ presmolt) exposed to Garlon® 3A (200 or 320 ppm) for a four-hour period had significantly ($P<0.05$) elevated plasma lactate levels in blood samples, which may be an indicator of acute physiological stress (Janz *et al*. 1991). However, corroboratory evidence was not found (*i.e.*, other indicators were not significantly elevated). The authors found "juvenile coho salmon were not *severely* stressed" (emphasis added) by the 4-hr Garlon® 3A exposure, although they acknowledged that wild coho salmon stocks may display "more extreme" stress responses than the subject hatchery specimens (Janz *et al*. 1991). Bioconcentration in aquatic species is minimal (SERA 1996).

The aquatic toxicity of R-11® (Table 8), the surfactant proposed for use with Garlon® 3A, is 10 to 50 times greater than LI-700® or Agri-Dex® (SERA 1997), and is regarded as "moderately toxic to fish" (FS 2000). R-11® (Wilbur-Ellis Co.) consists of octylphenoxypolyethoxyethanol, n-Butanol, compounded silicone, and unidentified inert ingredients (10%) (SERA 1997). R-11® would constitute 1% or less of the applied herbicidal solution. The effect of the surfactant on the toxicity of the applied solution is poorly understood (SERA 1997). The actual toxicity of the applied solution is likely between that identified for a 5% Garlon® 3A solution and the surfactant alone.

Table 8. The aquatic toxicity of triclopyr, Garlon® 3A, and the proposed surfactant, R-11®. LC_{50} = concentration lethal to 50% sample population. EC_{50} = concentration at which 50% of the sample population exhibits an effect.

	Triclopyr	Garlon® 3A	R-11®
Rainbow Trout 96-hr LC_{50}	8.4 ppm[(1)]	420 ppm[(2)]	3.8 ppm[(5)]
Coho Salmon 96-hr LC_{50}		463 ppm[(2)]	
Chinook Salmon 96-hr LC_{50}	7.8 ppm[(1)]	275 ppm[(2)]	
Rainbow Trout 1-hr EC (avoidance)		800 ppm[(3)]	
Rainbow Trout 6-hr EC (equilibrium)		200 ppm[(3)]	
Invertebrate 48-hr LC_{50}		1,140 ppm[(4)]	19 ppm[(5)]
Invertebrate 96-hr LC_{50}	133 ppm[(1)]		

(1) FS 2001
(2) SERA 1996.
(3) Morgan *et al*. 1991.
(4) Information Ventures, Inc. 1995.
(5) SERA 1997.

Persistence of triclopyr in soils is affected by moisture, nutrients, and temperature (Norris *et al*. 1991). TCP (3,5,6-trichloro-2-pyridinol) is the initial degradation product of triclopyr in soil. The half-life of triclopyr in western Oregon soils ranges from 75 to 81 days with detectable residues remaining 477 days after treatment (FS 2001). In Sweden, triclopyr has been found to last more than two years in soils (Norris *et al*. 1991). TCP is also the major degradation product of chlorpyrifos, an insecticide. The half-life of TCP ranges from eight to 279 days (FS 2001). A less frequent product found in smaller amounts is 2-methoxy-3, 5, 6-tricholoropyridine (TMP). The half-life of TMP is 50 to 300 days (FS 2001). Carbon dioxide is the final degradation product.

Garlon® 3A is highly soluble in water and has characteristics conducive to leaching (*i.e*., low adsorption potential) (FS 2001). Several studies have documented triclopyr entry into streams (Norris *et al*. 1991). However, a laboratory study found "little likelihood that triclopyr will leach from forest applications sites into water" (Norris *et al*. 1991). Forest and pasture field studies have similarly found "little indication that triclopyr will leach *substantially*" (emphasis added) in loamy soils (FS 2001). Photolysis appears to be the major triclopyr degradative process in natural waters (Norris *et al*. 1991) with the degradation product being oxamic acid and other non-chlorinated aliphatics (SERA 1996). Field tests show that the half-life for triclopyr in water exposed to sunlight ranges from three hours to 4.3 days (FS 2001, Norris *et al*. 1991). In sterile water, which generates a different degradation product, triclopyr has a half-life in the absence of sunlight of approximately three months (SERA 1996). No information is available for the half-life under darkness in natural waters.

The proposed application concentration (1,798 to 17,977 ppm) exceeds known effect threshold concentrations (Table 8). Therefore, direct contamination may affect coho salmon lifestages (*e.g.*, sac-fry, emergent fry, and age-0 juveniles) or invertebrates present in proximity to an entry point depending on the degree and extent of contamination and the ability or inclination of the organism to avoid exposure. Research in western Oregon found triclopyr in runoff nine months after application (FS 2001). This was not attributed to upslope application areas, but rather to triclopyr applications made directly to dry (during application) intermittent stream channels. In sensitivity to these potential effects, the SWCD has proposed to limit the application of Garlon® 3A outside of the 100-year floodplain or on sites where steep slopes, sandy soils or intermittent stream channels permit direct runoff into the floodplain. If accurately delineated and strictly adhered to, the treatment area limitation should prevent contamination of coho salmon habitat from occurring. The success of avoiding contamination, direct or indirect, would depend on the applicator accurately delineating those areas with potential hydrologic connections, including groundwater sources.

2.1.3.2 Cumulative Effects

Cumulative effects are defined in 50 CFR 402.02 as "those effects of future State or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation." This is step four in NOAA Fisheries analysis process.

NOAA Fisheries is not aware of any specific future non-Federal activities within the action area that would cause greater impacts to listed species than presently occurs. The action area includes significant tracts of private and state lands. Land use on these non-Federal lands include timber production, agriculture, and rural and urban development. Chemical fertilizers or pesticides are used on many of these lands, but no specific information is available regarding their degree of use within the project area. Furthermore, NOAA Fisheries does not consider the rules governing these land uses on these non-Federal lands within Oregon to be sufficiently protective of watershed, riparian, and stream habitat functions to support the survival and recovery of listed Pacific salmon species. Therefore, these habitat functions likely remain at risk due to future activities on non-Federal lands within the affected river basins.

Non-federal activities within the action area are likely to increase with a projected 34% increase in human population over the next 25 years in Oregon (DAS 1999). Thus, NOAA Fisheries assumes that future private and state actions will continue to occur at similar levels within the action area and will increase gradually over time as population density increases.

2.1.4 Conclusion

The final step in NOAA Fisheries' approach to determine jeopardy is to determine whether the proposed action(s) is likely to appreciably reduce the likelihood of species survival or recovery in the wild. In reaching its conclusion, NOAA Fisheries used the best scientific and commercial data available, including the BA and supporting documentation, incorporated by reference.

NOAA Fisheries considered the status of OC coho salmon, environmental baseline conditions, the direct and indirect effects of the proposed actions, and cumulative effects anticipated in the action areas.

NOAA Fisheries has determined that the knotweed eradication project, 2003-2006, proposed by the Lincoln County SWCD and receiving Federal funds from the FS could cause sub-lethal effects on juvenile coho salmon (*e.g.*, sac-fry, emergent fry, or age-0 juveniles) in the form of relocation due to contamination avoidance or short-term loss of prey, histopathological changes in gills and liver structure, and physiological stress from the application of glyphosate-based herbicide in riparian areas, but the short-term impairment of water quality is unlikely to prevent, or appreciably delay, attainment of habitat functions and conditions that meet the biological requirements of the listed species for survival and recovery. The proposed action therefore is unlikely to reduce pre-spawning survival or egg-to-smolt survival to levels that would appreciably reduce the likelihood of survival and recovery of OC coho salmon. In summary, our conclusion is based on the following considerations: (1) Low toxicity herbicides (Rodeo® or AquaMaster®) and surfactants (LI-700® or Agri-Dex®) are proposed for use in areas that may allow aquatic contamination to occur; (2) water is the only carrier agent used in Rodeo® or AquaMaster®; (3) glyphosate binds strongly with soils; (4) herbicide application will not occur in or over water; (5) prey base effects are likely to be spatially and temporally limited; (6) repeat applications of glyphosate have not been found to cause long-term adverse affects; (7) Garlon® 3A will not be applied in any area where it may contaminate aquatic habitats; (8) wind limits will minimize the risk of direct contamination of waterways; (9) no application will occur when precipitation is forecast to occur within 24 hours to minimize the risk of indirect contamination of water via ground transport; (10) staging areas will be located in areas that will not contaminate surface or ground water; (11) herbicide use to control knotweed will be significantly reduced after two years; and (12) aggressive knotweed control will reduce long-term total herbicide use in riparian areas of Lincoln County.

2.1.5 Conservation Recommendations

Section 7(a)(1) of the ESA directs Federal agencies to utilize their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of the threatened and endangered species. Conservation recommendations are discretionary measures suggested to minimize or avoid adverse effects of a proposed action on listed species or to develop additional information.

The following conservation recommendations are consistent with these obligations, and therefore should be implemented by the FS.

1. To minimize the amount of chemical herbicides used beside streams, the FS should work to develop effective non-chemical treatments to control invasive plants.

2. To minimize the use of chemical herbicides in the future, the FS should develop a watershed-based prevention and control strategy for invasive plants in cooperation with

non-Federal land owners, and particularly should consider Dawson and Holland's (1999) recommendations for invasive plant control.

3. To increase the efficacy of glyphosate-use and minimize the environmental availability of herbicides/surfactants, the FS should encourage the use of the injection method below the ordinary high water elevation and in tidal areas, if the treatment proves effective during 2003 field trials.

For NOAA Fisheries to be kept informed of actions minimizing or avoiding adverse effects, or those that benefit listed species or their habitat, NOAA Fisheries requests notification of the implementation of any conservation recommendation.

2.1.6 Reinitiation of Consultation

Consultation must be reinitiated 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; or, (4) a new species is listed or critical habitat is designated that may be affected by the action (50 CFR 402.16).

Additionally, if the FS fails to provide the specified annual monitoring information by the required date (see infra section 2.2.3, Term and Condition #3), NOAA Fisheries will consider that a modification of the action that causes an effect on listed species not previously considered and causes the incidental take statement of the Opinion to expire.

To reinitiate consultation, the FS must contact the Habitat Conservation Division (Oregon Habitat Branch) of NOAA Fisheries at 525 NE Oregon Street, Suite 500, Portland, Oregon 97232-2778, and reference consultation 2003/00261.

2.2 Incidental Take Statement

Section 9 and rules promulgated under section 4(d) of the ESA prohibit any taking (harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, collect, or attempt to engage in any such conduct) of listed species without a specific permit or exemption. "Harm" is further defined to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing behavioral patterns such as breeding, feeding, and sheltering. "Harass" is defined as actions that create the likelihood of injuring listed species by annoying it to such an extent as to significantly alter normal behavior patterns which include, but are not limited to, breeding, feeding, and sheltering. "Incidental take" is take of listed animal species that results from, but is not the purpose of, the Federal agency or the applicant carrying out an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to, and not intended as part of, the agency action is not considered prohibited taking provided that such taking is in compliance with the terms and conditions of this incidental take statement.

An incidental take statement specifies the effect of any incidental taking of endangered or threatened species. It also provides reasonable and prudent measures that are necessary to minimize adverse effects and sets forth terms and conditions with which the action agency must comply in order to implement the reasonable and prudent measures.

2.2.1 Amount or Extent of the Take

NOAA Fisheries anticipates that the action covered by this Opinion is reasonably certain to result in incidental take of OC coho salmon from contamination of streams with Rodeo® or AquaMaster® herbicide and the surfactant LI-700®. The amount of take in actions such as this are largely unquantifiable because take is in the form of harm, which includes habitat modification. Quantifying take associated with habitat modification is problematic because of the complexity of cause and effect relationships. Therefore, even though NOAA Fisheries expects some low level of incidental take to occur due to the actions covered by this Opinion, the best scientific and commercial data available are not sufficient to enable it to estimate a specific amount of incidental take to the species. Based on the information in the BA, NOAA Fisheries anticipates that an unquantifiable amount of incidental take could occur, predominately in a non-lethal form, as a result of actions covered by this Opinion. In instances such as these, NOAA Fisheries designates the expected level of take in terms of the extent of take allowed. For the proposed action, allowed take is limited to take in stream reaches immediately adjacent to treatment areas and extending a distance not to exceed 100 feet downstream resulting from the use of Rodeo®, AquaMaster®, and LI-700® in the manner proposed by the SWCD, including project design features. Take that occurs from actions that exceed the range of effects analyzed in this Opinion (*e.g.*, that associated with triclopyr contamination of flowing waters) or that do not follow the project design features, or that extends beyond the action area is not authorized by this Opinion.

2.2.2 Reasonable and Prudent Measures

NOAA Fisheries believes that the following reasonable and prudent measures are necessary and appropriate to avoid or minimize take of OC coho salmon resulting from implementation of this Opinion.

1. Minimize incidental take from the proposed activity by following the proposed project design features described in the BA.

2. Minimize incidental take associated with herbicide application by implementing conservation measures to minimize contamination of streams.

3. Complete an annual report for four years to ensure this Opinion is meeting its objective of minimizing the likelihood of take from the proposed activity and provide the report to the Oregon Habitat Branch of NOAA Fisheries.

2.2.3 Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the ESA, the FS must ensure SWCD compliance with the following terms and conditions, which implement the reasonable and prudent measures described above. Implementation of the terms and conditions within this Opinion will further reduce the risk of adverse effects to OC coho salmon. These terms and conditions are non-discretionary.

1. To implement reasonable and prudent measure #1 (project design features), the FS shall ensure that all project design features provided in the BA (BA, pages 7 and 8; repeated in this Opinion in section 1.2) are followed.

2. To implement reasonable and prudent measure #2 (conservation measures), the FS shall ensure:

   a. In freshwater stream reaches, glyphosate application to dry portions of the stream channel below the ordinary high water elevation is limited to the Oregon Department of Fish and Wildlife's preferred in-water work period (ODFW 2000), as appropriate for the project area.
   b. No adjuvants other than those identified in the proposed action are applied.
   c. For spray application, annual herbicide application amounts within a watershed do not exceed those predicted in the BA (page 16) by more than 10%.
   d. Beginning in 2004, annually provide to NOAA Fisheries a minimum of 60 days prior to application an estimate of the amount of glyphosate by watershed projected for use during that calendar year via the injection method.
   e. The contracted applicator is aware of the provisions of this Opinion prior to commencing herbicide application operations.
   f. The contracted applicator has a spill response plan and spill kit, and is familiar with use of the spill kit prior to commencing herbicide application operations.
   g. All chemical storage, chemical mixing, and post-application equipment cleaning is completed in such a manner as to prevent the potential contamination of any riparian area, perennial or intermittent waterway, ephemeral waterway, or wetland.
   h. For the use of Garlon® 3A, a minimum 50-foot no-treatment area is implemented adjacent to streams (perennial or intermittent), or any drainage ditch that may transport flow directly to a perennial stream.
   i. Erosion control measures (*e.g.*, silt fence, native grass seeding) are used where de-vegetation may result in the significant delivery of sediment to coho salmon habitat.

3. To implement reasonable and prudent measure #3 (annual monitoring and reporting requirements) the FS shall ensure:

   a. An annual report of herbicide treatments by watershed is submitted to NOAA Fisheries. The report will cover the herbicide application period (May 1 -

October 31) for the calendar year and is due December 31 of that year. The purpose of the reporting is to help estimate the extent and amount of take that may have occurred and validate assumptions regarding watershed effects. Each annual report shall contain an application record and watershed summary.

a. The application record shall contain, at a minimum, the following information by watershed:
   i. Date of application.
   ii. Site treated.
   iii. Herbicide applied.
   iv. Quantity applied.
   v. Adjuvant used.
   vi. Area treated with each formulation in square feet.
   vii. Portion of acreage in a tidal flat.
   viii. Weather conditions (*e.g.*, wind, precipitation) during application periods and notation of any precipitation occurring within a 24-hour period following treatment.

   Appendix F contains an example recording form, but any organized format may be used to present the information.
b. The watershed summary shall provide, at a minimum, the total area treated and the total herbicide applied by watershed. *Appendix G* contains an example watershed summary form, but any organized format may be used to present the information.

b. The results of experimental application treatments (field trials) are submitted concurrently with the above-mentioned watershed report. The experimental application report shall contain, at a minimum, trial results in terms of the criteria proposed in the BA (page 4), and any revisions to application methods proposed for use during the subsequent year.
c. Send the annual report to NOAA Fisheries at:

NOAA Fisheries
Oregon Habitat Branch
Reference: 2003/00261
525 NE Oregon Street, Suite 500
Portland, OR 97232

If the FS fails to provide the specified annual monitoring reports by January 31 of the following year, NOAA Fisheries may consider that a modification of the action that causes an effect on listed species not previously considered and causes the incidental take statement of this Opinion to expire. Exceptions must receive NOAA Fisheries' agreement in writing prior to the due date.

d. This programmatic incidental take statement shall expire on December 31, 2006.

3. MAGNUSON-STEVENS ACT

3.1 Magnuson-Stevens Fishery Conservation and Management Act

The objective of the essential fish habitat (EFH) consultation is to determine whether the proposed action may adversely affect designated EFH for relevant species, and to recommend conservation measures to avoid, minimize, or otherwise offset potential adverse effects to EFH resulting from the proposed action.

The MSA, as amended by the Sustainable Fisheries Act of 1996 (Public Law 104-297), requires the inclusion of EFH descriptions in Federal fishery management plans. In addition, the MSA requires Federal agencies to consult with NOAA Fisheries on activities that may adversely affect EFH. EFH means those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity (MSA §3). For the purpose of interpreting the definition of essential fish habitat: 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 (50CFR600.110).

Section 305(b) of the MSA (16 U.S.C. 1855(b)) requires that:

- 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;

- NOAA Fisheries shall provide conservation recommendations for any Federal or state activity that may adversely affect EFH;

- 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 effects 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.

The MSA requires consultation for all actions that may adversely affect EFH, and does not distinguish between actions within EFH and actions outside EFH. 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 undertaking, permitting or funding any activity that may adversely affect EFH, regardless of its location.

3.2 Identification of EFH

The Pacific Fisheries Management Council (PFMC) has designated EFH for federally-managed fisheries within the waters of Washington, Oregon, and California. The designated EFH for groundfish and coastal pelagic species encompasses all waters from the mean high water line, and upriver extent of saltwater intrusion in river mouths, along the coasts of Washington, Oregon and California, seaward to the boundary of the U.S. exclusive economic zone (370.4 km) (PFMC 1998a, 1998b). 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) (PFMC 1999). In estuarine and marine areas, designated salmon EFH extends from the nearshore and tidal submerged environments within state territorial waters out to the full extent of the exclusive economic zone (370.4 km) offshore of Washington, Oregon, and California north of Point Conception to the Canadian border. Detailed descriptions and identifications of EFH for the groundfish species are found in the final environmental assessment/regulatory impact review for Amendment 11 to *The Pacific Coast Groundfish Management Plan* (PFMC 1998a) and the Essential Fish Habitat for West Coast Groundfish Appendix (Casillas *et al*. 1998). Detailed descriptions and identifications of EFH for the coastal pelagic species are found in Amendment 8 to the *Coastal Pelagic Species Fishery Management Plan* (PFMC 1998b). 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 potential adverse effects to these species' EFH from the proposed action is based on this information.

3.3 Proposed Actions

The proposed actions are detailed above in section 1.2. The action area includes all watersheds within Lincoln County, Oregon. The majority of this area has been designated as EFH for various life stages of coho and chinook salmon, and most tidal reaches have been designated for groundfish and coastal pelagic species (Table 9).

3.4 Effects of Proposed Action

As described in detail in section 2.1.3, the proposed activities may result in adverse effects to a variety of habitat features. These effects include reduced stream shade, increased sedimentation in riparian and aquatic habitats, possible chemical contamination of freshwater and estuarine aquatic habitats, and reduced prey base within the Lincoln County pSiletz/Yaquina (HUC #17100204) and Alsea subbasins (HUC #17100205).

3.5 Conclusion

NOAA Fisheries believes that the proposed action will adversely affect the EFH for the groundfish, coastal pelagic fisheries, and Pacific salmon species listed in Table 9.

3.6 EFH Conservation Recommendations

Pursuant to section 305(b)(4)(A) of the MSA, NOAA Fisheries is required to provide EFH conservation recommendations for any Federal or state agency action that would adversely affect EFH. The conservation recommendations (section 2.1.5), the reasonable and prudent measures (section 2.2), and the terms and conditions (section 2.2.3) of this Opinion are applicable to salmon, groundfish and coastal pelagic EFH. Therefore, NOAA Fisheries incorporates each of those measures here as EFH conservation recommendations.

3.7 Statutory Response Requirement

Please note that the MSA (§ 305(b) and 50 CFR 600.920(j)) requires the Federal agency to provide a written response to NOAA Fisheries after receiving EFH conservation recommendations within 30 days of its receipt of this letter. This response must include a description of measures proposed by the agency to avoid, minimize, mitigate or offset the adverse effects of the activity on EFH. If the response is inconsistent with a conservation recommendation from NOAA Fisheries, the agency must explain its reasons for not following the recommendation.

3.8 Supplemental Consultation

The FS must reinitiate EFH consultation with NOAA Fisheries if either action is substantially revised or new information becomes available that affects the basis for NOAA Fisheries' EFH conservation recommendations (50 CFR 600.920).

Table 9. Species with designated EFH found in waters of the State of Oregon.

Ground Fish Species	Blue rockfish (*S. mystinus*)	Rougheye rockfish (*S. aleutianus*)	Flathead sole (*Hippoglossoides elassodon*)
Leopard shark (*Triakis semifasciata*)	Bocaccio (*S. paucispinis*)	Sharpchin rockfish (*S. zacentrus*)	Pacific sanddab (*Citharichthys sordidus*)
Soupfin shark (*Galeorhinus zyopterus*)	Brown rockfish (*S. auriculatus*)	Shortbelly rockfish (*S. jordani*)	Petrale sole (*Eopsetta jordani*)
Spiny dogfish (*Squalus acanthias*)	Canary rockfish (*S. pinniger*)	Shortraker rockfish (*S. borealis*)	Rex sole (*Glyptocephalus zachirus*)
Big skate (*Raja binoculata*)	Chilipepper (*S. goodei*)	Silvergray rockfish (*S. brevispinus*)	Rock sole (*Lepidopsetta bilineata*)
California skate ®. *inornata*)	China rockfish (*S. nebulosus*)	Speckled rockfish (*S. ovalis*)	Sand sole (*Psettichthys melanostictus*)
Longnose skate ®. *rhina*)	Copper rockfish (*S. caurinus*)	Splitnose rockfish (*S. diploproa*)	Starry flounder (*Platyichthys stellatus*)
Ratfish (*Hydrolagus colliei*)	Darkblotched rockfish (*S. crameri*)	Stripetail rockfish (*S. saxicola*)	
Pacific rattail (*Coryphaenoides acrolepsis*)	Grass rockfish (*S. rastrelliger*)	Tiger rockfish (*S. nigrocinctus*)	**Coastal Pelagic Species**
Lingcod (*Ophiodon elongatus*)	Greenspotted rockfish (*S. chlorostictus*)	Vermillion rockfish (*S. miniatus*)	Northern anchovy (*Engraulis mordax*)
Cabezon (*Scorpaenichthys marmoratus*)	Greenstriped rockfish (*S. elongatus*)	Widow Rockfish (*S. entomelas*)	Pacific sardine (*Sardinops sagax*)
Kelp greenling (*Hexagrammos decagrammus*)	Longspine thornyhead (*Sebastolobus altivelis*)	Yelloweye rockfish (*S. ruberrimus*)	Pacific mackerel (*Scomber japonicus*)
Pacific cod (*Gadus macrocephalus*)	Shortspine thornyhead (*Sebastolobus alascanus*)	Yellowmouth rockfish (*S. reedi*)	Jack mackerel (*Trachurus symmetricus*)
Pacific whiting (Hake) (*Merluccius productus*)	Pacific Ocean perch (*S. alutus*)	Yellowtail rockfish (*S. flavidus*)	Market squid (*Loligo opalescens*)
Sablefish (*Anoplopoma fimbria*)	Quillback rockfish (*S. maliger*)	Arrowtooth flounder (*Atheresthes stomias*)	
Aurora rockfish (*Sebastes aurora*)	Redbanded rockfish (*S. babcocki*)	Butter sole (*Isopsetta isolepsis*)	**Salmon**
Bank Rockfish (*S. rufus*)	Redstripe rockfish (*S. proriger*)	Curlfin sole (*Pleuronichthys decurrens*)	Coho salmon (*O. kisutch*)
Black rockfish (*S. melanops*)	Rosethorn rockfish (*S. helvomaculatus*)	Dover sole (*Microstomus pacificus*)	Chinook salmon (*O. tshawytscha*)
Blackgill rockfish (*S. melanostomus*)	Rosy rockfish (*S. rosaceus*)	English sole (*Parophrys vetulus*)	

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APPENDIX A

Siletz-Yaquina and Alsea Subbasin Land Ownership

Appendix A: Siletz-Yaquina and Alsea Subbasin Land Ownership.

Siletz-Yaquina Subbasin (HUC #17100204)

		Land Ownership (acres)		
5th Field Watershed	HUC #	Non-Federal	Federal	Total
U. Yaquina R	1710020401	52,738	418	53,156
Big Elk Cr	1710020402	37,980	18,834	56,814
L Yaquina R	1710020403	46,975	3,644	50,619
U. Siletz R	1710020404	31,881	12,581	44,462
Middle Siletz R	1710020405	41,453	14	41,467
Rock Cr (Siletz)	1710020406	26,087	1,470	27,557
L. Siletz R	1710020407	79,130	5,002	84,132
Salmon R	1710020408	44,248	14,063	58,311
Drift/Schooner Cr	1710020409	17,471	20,680	38,151
Devil's Lk/Moolack Frontal	1710020410	30,302	64	30,366
Total		408,265	76,770	485,035
Percentage		84.2%	15.8%	

Alsea Subbasin* (HUC#17100205)

		Land Ownership (acres)		
5th Field Watershed	HUC #	Non-Federal	Federal	Total
U. Alsea R	1710020501	37,237	44,026	81,263
Five Rivers/Lobster Cr	1710020502	14,743	61,611	76,354
Drift Cr	1710020503	14,656	29,641	44,297
L. Alsea R	1710020504	45,008	54,729	99,737
Beaver Cr	1710020505	21,210	10,556	31,766
Yachats R	1710020506	11,094	27,501	38,595
Total		143,948	228,064	372,012
Percentage		38.7%	61.3%	

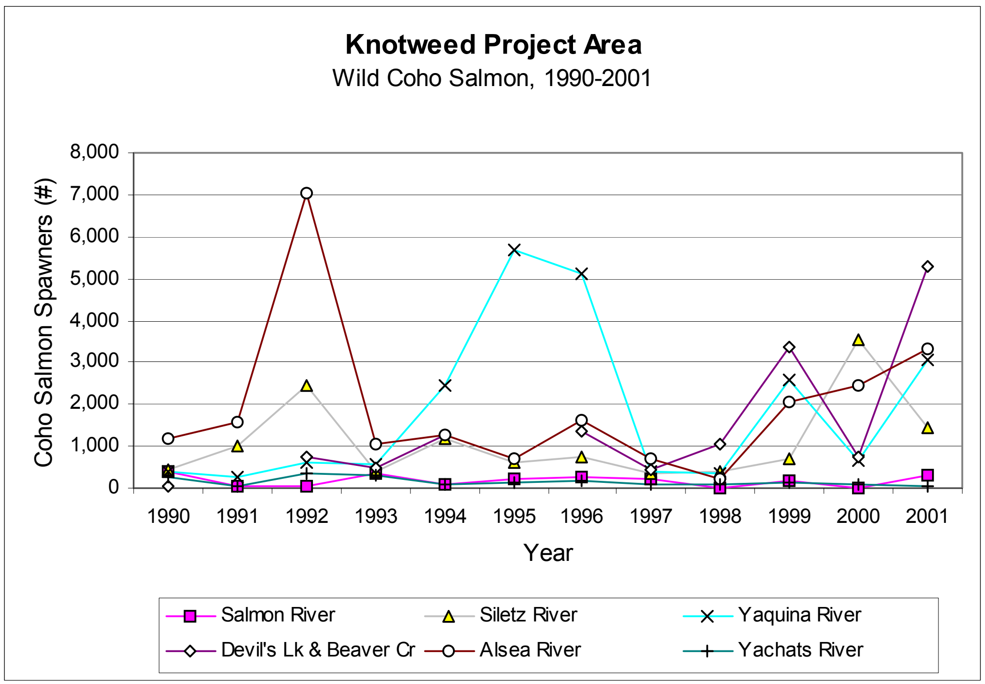
* Excluding Cummins/Tenmile/Mercer Frontal 5th field watershed (69,046 acres), which lays predominately in Lane County.

APPENDIX B

Wild Coho Salmon Spawners, 1990-2001

Appendix B:
Estimated spawning populations for naturally-produced coho salmon in the project area, 1990-2001 (Source: ODFW 2003).

Watershed	Spawning Habitat (mi)	Number of Wild Coho Salmon Spawners												
		1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	Average
Salmon River	70	385	39	28	364	107	212	271	237	8	175	0	310	178
Siletz River	129	441	984	2,447	400	1,200	607	763	336	394	706	3,553	1,437	1,106
Yaquina River	117	381	280	633	549	2,448	5,668	5,127	384	365	2,588	647	3,039	1,842
Devil's Lk & Beaver Cr	58	23	-	756	500	1,259	-	1,340	425	1,041	3,366	738	5,274	1,227
Alsea River	257	1,189	1,561	7,029	1,071	1,279	681	1,637	680	213	2,050	2,465	3,339	1,933
Yachats River	12	280	28	337	287	67	117	176	99	102	150	79	52	148
Total	643	2,699	2,892	11,230	3,171	6,360	7,285	9,314	2,161	2,123	9,035	7,482	13,451	6,434



APPENDIX C

News Release: NOAA 2003-R117

NOAA 2003-R117
FOR IMMEDIATE RELEASE
Contact: Brian Gorman

3/21/03

NOAA FISHERIES-LED GROUP FORECASTS STRONG RETURNS OF KEY NORTHWEST SALMON RUNS IN 2003

Adult coho and chinook salmon from the West Coast now in the ocean and preparing to return to their native streams or hatcheries are showing up in historical numbers, according to early estimates compiled by a group led by the National Oceanic and Atmospheric Administration's (NOAA) National Marine Fisheries Service (NOAA Fisheries). NOAA is an agency of the Commerce Department.

Preliminary numbers show "ocean abundance" estimates for Oregon coastal and Columbia River naturally spawned and hatchery coho up 185 percent over the recent 10-year average of actual returns. Predications for 2003 indicate that the number of adult salmon may reach more than 984,000.

"This high forecast of coho about to return to Northwest rivers is great news," said Bob Lohn, regional administrator of the NOAA Fisheries Northwest regional office in Seattle. "It's way above last year's estimate of 434,100 adults and could represent the fourth consecutive year of potential coho returns near or above a million fish."

A team of state, tribal, and NOAA Fisheries biologists presented the numbers to the Pacific Fishery Management Council at its meeting in Sacramento, Calif., last week. Although actual ocean abundance of salmon can vary from these estimates, the council sets annual harvest levels for salmon fishing on the West Coast based on these pre-season numbers

The council will decide how many salmon may be harvested and release those numbers in April for approval by NOAA Fisheries. The majority of the returning salmon for which the council sets harvest limits, such as Oregon coastal and Columbia River coho, are from hatcheries and are generally not listed under the Endangered Species Act (ESA). The harvests are designed to minimize impacts on salmon listed under the ESA.

In addition to Oregon Coast coho, the preliminary forecasts for Washington coast and Puget Sound coho returns are also showing significant increases over recent actual returns. Predictions call for more than 215,500 naturally spawned coho to return to Washington coast rivers in 2003, a 138-percent increase over 2001 actual returns. Furthermore, Puget Sound naturally spawned coho are predicted to be nearly double that of 2001's actual returns of 280,000 with an estimated return of 536,400 (complete 2002 actual returns are not yet available).

Similarly, the preliminary numbers show high forecasts for many Northwest chinook runs. For example, Columbia Basin upriver summer chinook continue to return at levels not seen since the 1950s. Columbia Basin upriver summer chinook returns are forecast to be near 90,000 for 2003.

Also this year, Mid-Columbia River fall brights are estimated to return at record levels, with about 105,000 fish expected. These forecast returns for both Columbia Basin upriver summer chinook and Mid-Columbia River fall brights represent a tripling of the actual returns from just three years ago.

“This is yet the latest in a continuing positive trend that we’re seeing for Pacific Northwest salmon runs, ” said Lohn. “These estimates are good news for fishermen and are evidence that our efforts to recover salmon runs are having effect.”

Lohn underscored that these high forecasts for many runs do not eliminate the region’s need to continue recovery efforts of ESA-listed salmon runs. “While a number of ESA-listed salmon runs are exhibiting marked improvement, many listed runs remain in a condition that requires our continued diligence to ensure that they all share in the improved returns,” said Lohn.

NOAA Fisheries biologists said favorable ocean conditions are contributing to the strong returns, but also said that conservation efforts already undertaken in the Northwest have played a role in improving the numbers of naturally spawned coho and chinook.

NOAA’s National Marine Fisheries Service (NOAA fisheries) is dedicated to protecting and preserving our nation’s living marine resources through scientific research, management, enforcement and the conservation of marine mammals and other protected marine species and their habitat.

The Commerce Department’s National Oceanic and Atmospheric Administration (NOAA) is dedicated to enhancing economic security and national safety through the prediction and research of weather and climate-related events and providing environmental stewardship of our nation’s coastal and marine resources.

On the Net:

NOAA: http://www.noaa.gov

NOAA Fisheries: http://www.nmfs.noaa.gov

Stock Abundance Analysis for 2003 Ocean Salmon Fisheries:
http://www.pcouncil.org/salmon/salpreI03/salpreI03.html

APPENDIX D

FS and BLM Evaluated Environmental Baseline

Appendix D: Summary of habitat indicator environmental baseline conditions for 5th field watersheds evaluated by the FS and BLM (2002) within the Lincoln County SWCD Knotweed Eradication Project area.

Habitat Indicator	**Properly Functioning**	**At Risk**	**Not Properly Functioning**
Water Quality			
Temperature		Schooner/Drift Cr (Siletz)	Upper Alsea, Big Elk Cr (Yaquina), Drift Creek (Alsea)
Sediment/Turbidity	Upper Alsea	Schooner/Drift Cr (Siletz), Drift Creek (Alsea)	Big Elk Cr (Yaquina)
Chemical Concentrations/ Nutrients	Upper Alsea	Schooner/Drift Cr (Siletz), Drift Creek (Alsea)	Big Elk Cr (Yaquina)
Access			
Physical Barriers			Upper Alsea, Big Elk Cr (Yaquina), Drift Creek (Alsea)
Habitat Elements			
Substrate/Sediment		Upper Alsea, Schooner/Drift Cr (Siletz), Drift Creek (Alsea)	Big Elk Cr (Yaquina)
Large Woody Debris			Upper Alsea, Big Elk Cr (Yaquina), Schooner/Drift Cr (Siletz), Drift Creek (Alsea)
Pool Frequency		Upper Alsea, Schooner/Drift Cr (Siletz), Drift Creek (Alsea)	Big Elk Cr (Yaquina)
Pool Character and Quality		Big Elk Cr (Yaquina), Drift Creek (Alsea)	Upper Alsea, Schooner/Drift Cr (Siletz)
Refugia	Upper Alsea	Drift Creek (Alsea)	Big Elk Cr (Yaquina), Schooner/Drift Cr (Siletz)
Off Channel Habitat		Upper Alsea, Drift Creek (Alsea)	Big Elk Creek (Yaquina), Schooner/Drift Cr (Siletz)
Channel Condition and Dynamics			
Width/Depth Ratio			

Habitat Indicator	Properly Functioning	At Risk	Not Properly Functioning
Streambank Condition	Upper Alsea	Drift Creek (Alsea)	Big Elk Creek (Yaquina)
Floodplain Connectivity		Drift Creek (Alsea)	Upper Alsea, Big Elk Creek (Yaquina)
Watershed Conditions			
Road Density and Location		Big Elk Creek (Yaquina), Drift Creek (Alsea)	Upper Alsea, Schooner/Drift Cr (Siletz)
Disturbance History			Upper Alsea, Big Elk Creek (Yaquina), Drift Creek (Alsea), Schooner/Drift Cr (Siletz)
Riparian Reserves	Upper Alsea		Big Elk Creek (Yaquina), Drift Creek (Alsea), Schooner/Drift Cr (Siletz)
OVERALL WATERSHED CONDITION RATING		Schooner/Drift Cr (Siletz), Drift Creek (Alsea)	Upper Alsea, Big Elk Creek (Yaquina)

APPENDIX E

Calculated Rodeo® or AquaMaster® application rates

Appendix E: Calculated Rodeo® or AquaMaster® application rates for the Lincoln County Soil and Water Conservation District knotweed eradication project (given: 648 grams glyphosate per liter Rodeo® or AquaMaster®).

	Proposed Application Rate (gal/ac)				Proposed Application Rate (g gly/ac)				Proposed Application Rate (kg gly/ha)			
Location	2003	2004	2005	2006	2003	2004	2005	2006	2003	2004	2005	2006
Siletz River	1.4	1.4	1	1	3434	3434	2453	2453	8	8	6	6
Salmon River	1.43	1.43	1	1	3504	3504	2453	2453	9	9	6	6
Yaquina River	1.4	1.42	1.4	1	3434	3475	3434	2453	8	9	8	6
Beaver Creek	1.5	1.5	1	1	3679	3679	2453	2453	9	9	6	6
Alsea River	1.4	1.4	1	1	3434	3434	2453	2453	8	8	6	6
Yachats River	1.4	1.36	1	1	3434	3345	2453	2453	8	8	6	6
Ocean Tribs North	1.4	1.43	1	1	3434	3504	2453	2453	8	9	6	6
Ocean Tribs South	1.4	1.4	1	2	3434	3434	2453	4905	8	8	6	12

APPENDIX F
Annual Site Record Example

Lincoln County Soil and Water Conservation District
Knotweed Eradication Project - Annual Site Record

Year: _____________

Watershed: ______________________________ Sheet _______ of _______

		Formulation Applied							
		Herbicide			Adjuvant				
Date	Site	Name	%	Quantity	Name	%	Treatment Area (sq. ft.)	Weather (at application)	Rain ≤24 hr
37813	Example 1	Rodeo	5%	2.1 gal	LI-700	0.5%	1.5	2 mph wind, dry	none
37813	Example 2	Rodeo	100%	0.1 gal	none	n/a	0.1	n/a, injection	n/a
37814	Example 3	Garlon 3A	5%	0.7 gal	R-11	1%	0.5	calm, dry	fog, no rain

APPENDIX G

Annual Watershed Summary Example

Lincoln County Soil and Water Conservation District
Knotweed Eradication Project - Annual Watershed Summary

Year: _____________ Sheet _______ of _______

Watershed	Rodeo®/AquaMaster®		Garlon® 3A		Coho Lifestage Affected[1]
	Treatment Area (sq. ft.)	Herbicide Quantity (gal)	Treatment Area (sq. ft.)	Herbicide Quantity (gal)	
Siletz River					
Salmon River					
Yaquina River					
Beaver Creek					
Alsea River					
Yachats River					
Ocean Tribs North					
Ocean Tribs South					
Total					

(1) Lifestages include egg, rearing, and/or adult.