ID # 16

United States Department of the Interior

FISH AND WILDLIFE SERVICE
La Grande Field Office
3502 Highway 30
La Grande, Oregon 97850
Phone: (541) 962-8584 FAX: (541) 962-8581

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MAR 10 2009

Mr. Steven A. Ellis
Forest Supervisor
Wallowa-Whitman National Forest
P.O. Box 907
Baker City, OR 97814

Mr. Kevin Martin
Forest Supervisor
Umatilla National Forest
2517 S.W. Hailey Avenue
Pendleton, OR 97801

Subject: Umatilla and Wallowa-Whitman National Forests' Invasive Plant Project, Idaho, Oregon, and Washington (2009-2018) – Formal Consultation (*FWS reference* 13420-2008-F-0147)

Dear Mr. Ellis and Mr. Martin:

This letter transmits the Fish and Wildlife Service's (Service) Concurrence and Biological Opinion (Opinion) for the Umatilla and Wallowa-Whitman National Forests' Invasive Plant Project on both National Forests in Oregon, Washington, and Idaho. This responds to your September 16, 2008 request for initiation of formal consultation with the Service on the Project in accordance with Section 7 of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*). Your request was received by our office on September 25, 2008. Analyzed in this Concurrence and Opinion are potential effects to bull trout (*Salvelinus confluentus*) and designated bull trout critical habitat, MacFarlane's four o'clock (*Mirabilis macfarlanei*), Spalding's catchfly (*Silene spaldingii*) and Gray wolf (*Canis lupus*) from the Umatilla and Wallowa-Whitman National Forests' Invasive Plant Project.

Based on information provided in the Assessment, the Forests have determined, and we concur, that the impacts associated with the proposed project ***are likely to adversely affect bull trout and designated bull trout critical habitat, Macfarlane's four-o'clock, and Spalding's catchfly.*** In addition, the Forests determined, and the Service concurs, that the Project ***may affect, but is not likely to adversely affect, Gray wolf.*** A complete administrative record of this consultation is on file at the La Grande Field Office, La Grande, Oregon. The Concurrence and Opinion are for a period of 10 years, from the date of issuance through December 31, 2018.

We appreciate your concern for listed species. The Forests are encouraged to continue to explore opportunities to manage proactively for the benefit of native fish, wildlife and plant species, and to promote the conservation of listed species as directed by section 7 (a)(1) of the Act. If you have any questions on this Opinion or Concurrence, or require more information regarding this consultation, please contact Gretchen Sausen or me at (541) 962-8584.

Sincerely,

Gary S. Miller
Field Supervisor

Enclosure

cc:
Bill Knox, Oregon Dept. of Fish and Wildlife, Enterprise, Oregon
Nadine Craft, Oregon Dept. of Fish and Wildlife, La Grande, Oregon
Jeff Neal, Oregon Dept. of Fish and Wildlife, Pendleton, Oregon
Gene Yates, Wallowa-Whitman National Forest, Baker City, Oregon
Tracii Hickman, Umatilla National Forest, Pendleton, Oregon
Spencer Hovekamp, National Marine Fisheries Service, La Grande, Oregon
Gretchen Sausen, Fish and Wildlife Service, La Grande, Oregon

ID # 16

CONCURRENCE AND BIOLOGICAL OPINION
For the
Invasive Plant Project
Umatilla and Wallowa-Whitman National Forests
Umatilla, John Day, Walla-Walla, Imnaha, Snake, Pine, Powder, and Grande Ronde Subbasins
(Oregon, Idaho, and Washington)

Action Agencies: Umatilla National Forest
Wallowa-Whitman National Forest

Consultation Conducted by: U.S. Fish and Wildlife Service
La Grande Field Office
La Grande, Oregon

Date Issued: MAR 10 2009

Issued by: Gary S. Miller
Gary S. Miller
Field Supervisor

File No. : 13420-2008-F-0147 [8330.F0147 (08)]

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INTRODUCTION

This document transmits the Fish and Wildlife Service's (Service) Concurrence and Biological Opinion (Opinion) on the Umatilla and Wallowa-Whitman National Forests' Invasive Plant Treatment Project and its effects on the Federally threatened bull trout (*Salvelinus confluentus*) and its critical habitat, MacFarlane's four-o'clock (*Mirabilis macfarlanei*), Spalding's catchfly (*Silene spaldingii*), and gray wolf *(Canis lupus)* in accordance with section 7 of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531 *et seq*.). Your September 16, 2008 request for formal consultation, accompanied by your Biological Assessment (Assessment), was received at our office on September 25, 2008. This Concurrence and Opinion covers a period of 10 years, from the date of issuance through December 31, 2018.

The Forests have determined, and we concur, that the impacts associated with the proposed project ***may affect, and are likely to adversely affect*** bull trout and designated bull trout critical habitat, Macfarlane's four-o'clock, and Spalding's catchfly. In addition, the Forests determined, and the Service concurs, that the Project ***may affect, but is not likely to adversely affect,*** gray wolf.

This document is based on information provided in the September 16, 2008 Assessment (USDA Forest Service 2008), email correspondence, and other sources of information. A complete administrative record of this consultation is on file at the La Grande Field Office, La Grande, Oregon.

This Opinion does not rely on the regulatory definition of "destruction or adverse modification" of critical habitat at 50 CFR 402.02. Instead we relied upon the statutory provisions of the Act to complete the following analysis with respect to critical habitat.

CONSULTATION HISTORY

The following correspondence and meetings have taken place between the Forests and the Service prior to the issuance of this Opinion and Concurrence.

- On December 20, 2007, the Service received the first draft Assessment from the Forests requesting comments on the Assessment.

- On March 3, 2008, the Service responded to the Forests with comments on the first draft Assessment.

- December 20, 2007 to September 15, 2008 – multiple e-mails and phone calls from the Forests and the Level 1 team concerning the draft document.

- The Service received the second draft Assessment from the Forests, dated May 2008 requesting comments to the Assessment and provided comments to the Forests on July 11, 2008.

- On September 25, 2008, the Service received the Forests' Assessment, with a letter requesting formal consultation.

- September 16, 2008 to January 26, 2009 – several e-mails and phone calls with NMFS Level 1 team member and the Forests concerning this project, an updated proposed project description, potential effects to salmonids, and GIS bull trout spawning and rearing data per 6^{th} Field HUC.

CONCURRENCE

Gray wolf

The Forest has determined, and the Service concurs, that the proposed Umatilla and Wallowa-Whitman National Forests' Invasive Plant Project ***may affect, but is not likely to adversely affect,*** the gray wolf. The Service's concurrence is based on the following:

- The Region 6 Invasive Plants FEIS prevention standards will help to protect their prey from degraded foraging habitat due to successful control of invasive plants.
- Distribution of gray wolves within the infested areas is likely very limited, so the opportunity for wolves to be in or near treatment areas is also very limited.
- Disturbance from projects could occur, but is unlikely. In addition, the Project Design Feature (PDF) for wolves would further limit possible disturbance.
- Disturbance from invasive plant treatment projects is at a low level, short duration, and infrequent.
- Doses of any herbicides in the proposed action that would cause potential adverse effects are not plausible.

BIOLOGICAL OPINION

1. Description of the Proposed Action

The Assessment was prepared to consider the site-specific environmental consequences of treating invasive plants over the next 10 years (until invasive plant objectives are met or until changed conditions or new information warrants the need for a new decision). The proposed action is to control, contain, or eradicate invasive plants on known or newly discovered infestations. The use of biological, manual, mechanical, mulching, thermal, and chemical treatment methods are proposed. Treatments are proposed for known or newly discovered infestations, including new plant species that currently are not found on the Forest. The proposed Forests' invasive plant treatment programs are described in detail in the Umatilla National Forest Invasive Plant Treatment and Wallowa-Whitman National Forest Invasive Plant Treatment Draft Environmental Impact Statements, which are tiered to the 2005 Forest Service Pacific Northwest Region Invasive Plant Final Environmental Impact Statement (R6 FEIS) and Record of Decision (R6 ROD). Project Design Features (PDFs) were developed to eliminate or minimize the effects of invasive plant treatment on human health and natural resources. Based on current invasive plant inventories, approximately 47,500 acres of treatment sites have been identified on the Forests (Tables 1 and 2). Site restoration to reestablish native vegetation would occur following invasive plant treatments. The proposed action description below is a summary of the primary components of the action as described in the Assessment.

Table 1. Invasive plant treatment summary by ranger district on the Umatilla National Forest (in acres).

Treatment Method	Umatilla National Forest Ranger District				
	Heppner	Pomeroy	North Fork John Day	Walla Walla	Total
Biological and Physical	89	46	47	3736	3917
Chemical, Physical, and Biological - Upland	4699	3138	3933	5531	17301
Chemical, Physical and Biological - Riparian	839	1130	621	802	3392
Physical Only	2	6	24	6	39
Total	**5629**	**4320**	**4625**	**10075**	**24649**

* Physical methods are manual, mechanical, mulching, and thermal.

Table 2. Invasive plant treatment summary by ranger district on the Wallowa-Whitman National Forest (in acres).

Treatment Method	Wallowa-Whitman National Forest Ranger Districts							
	Whitman RD* (Baker)	Whitman RD (Pine)	Whitman RD (Unity)	Wallowa Valley	HCNRA	Eagle Cap	La Grande	Total
Biological and Physical*	90	30	1,297	186	86	123	143	1,955
Chemical, Physical, and Biological - Upland	951	1,762	1,269	1,596	6,232	436	1,128	13,376
Chemical, Physical, and Biological - Riparian	628	725	403	555	4,031	300	758	7,400
Physical Only	1	18	7	10	70	2	3	111
Total	**1,670**	**2,535**	**2,976**	**2,347**	**10,419**	**861**	**2,032**	**22,842**

* The Baker, Pine, and Unity Ranger Districts have been consolidated into the Whitman Ranger District; however, to increase site-specificity, this separation was maintained in this table.
** Physical methods are manual, mechanical, mulching, and thermal.

The Forests would use an integrated mix of methods, as summarized in Tables 1 and 2, to treat infested areas. Infested areas would be treated with an initial prescription and retreated in subsequent years as necessary. Herbicide application would likely be part of the treatment prescription for many sites. However, the Forest Service expects that the use of herbicides would decline in subsequent treatments, as the size of invasive plant infestations decrease. Mechanical and manual treatments would occur separately or concurrently with herbicide applications.

The appropriate treatment method for each site would be determined by applying site information to the treatment decision tree (Figure 1). Up to about 4,000 acres on each Forest may be treated annually with one or more of the treatment methods. Biological control methods are ongoing, and the number of acres managed using this type of control is likely to vary across the Forests over time.

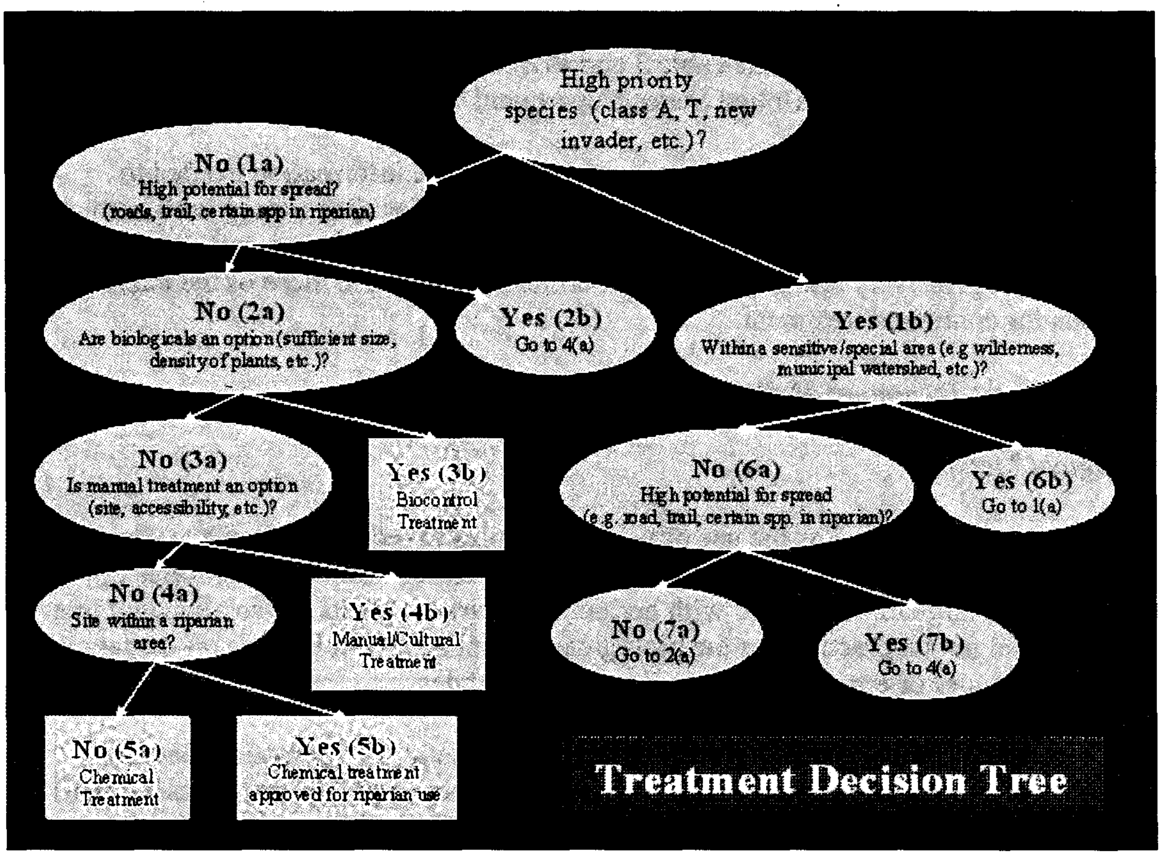

Figure 1. Invasive plant treatment decision tree.

Once treatment methods have been determined, prioritization of infestation treatments would be conducted as follows. Highest priority treatments would be focused on new invaders and early treatment of new infestations, followed in priority by containment, and then control of larger established infestations. The higher priority sites would likely be treated first, unless special funding was acquired for other sites. New detections would be considered a high priority for treatment if it is a new species, or a small infestation in an area that did not previously contain invasive plants. Priorities would change over time, based on treatment success and changes occurring on invasive sites.

Target species within each treatment site would be assigned one of the following treatment strategies:

- Eradicate - Totally eliminate an invasive plant species from a site. This objective generally applies to small infestations of aggressive species and higher priority treatment areas.

- Control - Reduce the size of the infestation over time; some level of infestation would be acceptable.
- Contain - Prevent the spread of the weed beyond the perimeter of patches or infestation areas mapped from current inventories.

The use of chemicals (herbicides and surfactants) would be conducted in accordance with Forest Service policies, regulations and Forest Plan Standards as well as product label requirements. Herbicides approved for use are listed in Table 3 and PDF F-1. Herbicide properties are described in detail in the R6 FEIS (United States Department of Agriculture [(USDA) 2005b].

Ongoing monitoring of infestations at each site would provide the information needed to determine whether follow-up treatment methods were required. For sites treated with herbicides, follow-up treatment could include herbicide application and/or manual treatments. However, the goal is to become progressively less dependent on herbicides and to use more of the alternative control methods for continued treatment.

1.1 Invasive Plant Treatment Methods

1.1.1 Biological Methods

Biological control can be defined as the use of natural enemies to reduce the damage caused by invasive plant populations. Biological control is potentially useful where eradication is not possible, sites are too large to be sprayed with herbicides, invasive plants are so abundant that other methods would not be practical, or the biological control agent is effective on the target plant species and reduces or eliminates the need to use herbicides.

Stem weevil biological control agents have proven very successful for Dalmatian toadflax (*Linaria dalmatica)* control on infested Forest and adjacent landownership sites (Assessment). Several biological control agents are available for yellow star thistle *(Centaurea solstitialis)* and diffuse knapweed (*Centaurea diffusa Lam.*) and effectiveness appears to be higher when bio-control agents work in concert with each other. Biological control agents for control of purple loosestrife (*Lythrum salicaria*) have been released on the Idaho side of the Snake River, however, the fluctuating water levels have negatively affected the establishment of a productive biological control population and effectiveness is minimal (Assessment).

Biological control agents previously released on private lands and established on the Forests will continue to spread to other nearby invasive sites, providing a potential long-term control treatment.

1.1.2 Manual and Mechanical Methods

Manual methods in the proposed action include hand pulling, clipping, stabbing, or digging out invasive plants with non-motorized hand tools. Manual methods include the use of hand-operated tools (e.g., axes, brush hooks, hoes, shovels, hand clippers) to dig up and remove invasive species (USDA 2005a). Mechanical methods involve chain saws, mowers, or other mechanized equipment, such as brush cutters, or other machinery with various types of blades to remove plants.

These techniques tend to minimize damage to desirable plants and animals, but they are generally labor and time intensive. Treatments must typically be administered several times a year over several years to prevent the weed from re-establishing. Manual and mechanical techniques are generally favored to treat small infestations in situations where a large pool of volunteer labor is available. They are often used in combination with other techniques. These techniques include weed pulling, clipping, clipping and pulling, mowing, cutting and related activities, stabbing, and girdling.

Weed pulling can be effective against some shrubs, tree saplings, and herbaceous weeds. Annuals and tap-rooted plants are particularly susceptible to control by hand-pulling. Weed wrenches and other tools can enable a person to control large saplings and shrubs that are too big to be pulled by hand. Weed pulling is not as effective against many perennial weeds with deep underground stems and roots that are often left behind to re-sprout.

Clipping removes seed heads and/or fruiting bodies to prevent germination. This method is labor intensive, but effective for small, spotty infestations. The clip and pull method consists of cutting the invasive plant stem and pulling the remaining stem and root mass from the substrate. This method is labor intensive, but can be effective for larger infestations.

Mowing, cutting, brush hogging, raking, trimming, and weed-eating can reduce seed production and restrict weed growth, especially in annuals cut before they flower and set seed. Some species, however, vigorously sprout again when cut, replacing one or a few stems with many that can quickly flower and set seed. These treatments are often used as primary treatments to remove aboveground biomass in combination with herbicide treatments to prevent re-sprouting, and as follow up treatments to treat target plants missed by initial herbicide use.

Stabbing the carbohydrate storage structure at the base of the plant can kill some plants. Depending on the species, this structure may be a root corm, storage rhizome (tuber), or taproot. These organs are generally located at the base of the stem and under the soil. Cutting off access to these storage structures can help "starve" or greatly weaken some species.

Girdling is often used to control trees or shrubs that have a single trunk. It involves cutting away a strip of bark several centimeters wide all the way around the trunk. The removed strip must be cut deep enough into the trunk to remove the vascular cambium, or inner bark, the thin layer of living tissue that moves sugars and other carbohydrates between areas of production (leaves), storage (roots), and growing points. This inner cambium layer also produces all new wood and bark.

1.1.3 Mulching

Mulching is an effective aid in controlling weeds, especially annual varieties. Mulching tools include the use of plastic, or sawdust, bark, compost, hay, or other organic materials, to block sunlight. This both controls existing weeds and prevents seedlings from becoming established.

Mulching also provides the additional benefits of conserving soil moisture, keeping the soil at a more uniform temperature, and reducing erosion.

1.1.4 Thermal Techniques

Thermal techniques may include radiant heating, spray of pressurized hot water, and spray of heated foam. A common radiant heat method consists of using a ceramic heating element to create extremely high temperatures (in the form of infrared radiation) to boil the moisture in plant cells, causing them to burst. Since cell proteins are damaged, photosynthesis stops and the plant dies. Radiant heating can be useful for small area treatments, especially on sidewalks, but the effectiveness on deep-rooted plants, sedges, or rhizomatous grasses may not be as high. The use of pressurized hot water to treat invasive plants would be conducted by using a commercial pressure washer to inject steam into soils to kill rhizomes, and may also cause pressure damage to rhizomes. Heated foam treatments would consist of delivering hot water with a foam surfactant via a treatment wand attached to a foam generator. The superheated hot foam would be applied to the targeted vegetation at a precise temperature (approximately 200 degrees Fahrenheit) and pressure. The foam traps steam, allowing it to "cook" or "blanch" the vegetation. This causes a cellular collapse of the treated aboveground vegetation. Hot foam can kill both annual and perennial weeds by starving their root systems (although for some perennials, repeat treatments may be necessary).

1.1.5 Herbicide Treatment Methods

The objective of herbicide treatments is often to either reduce the size of moderate to large infestations of invasive plants to a point at which manual or mechanical methods are effective, or to treat large expansive areas where invasive plants thrive due to the nature of the site.

The 10 herbicides authorized by the R6 FEIS would be used as appropriate to treat invasive plants. These herbicides and their typical and maximum application rates are summarized in Table 3. Mixtures of up to three herbicides may be used. An herbicide mixture may be more effective in the treatment of invasive plants at a given site. The herbicide or mixture of herbicides, and application method(s), used at a specific site would depend on the invasive plant(s) present, the biology and ecology of the invasive plant species, site location, proximity to water, size of the infestation, and other factors.

Table 3. Herbicides and application rates.

Herbicide	Typical Application Rate (lb a.i./ac)*	Highest Application Rate (lb a.i./ac)
Chlorsulfuron	0.056	0.25
Clopyralid	0.35	0.5
Glyphosate	2.0	8.0
Imazapic	0.1	0.1875
Imazapyr	0.45	1.5
Metsulfuron	0.03	0.15
Picloram	0.35	1.0
Sethoxydim	0.3	0.45

Sulfometuron	0.045	0.38
Triclopyr	1.0	10.0

* lb a.i./ac = pounds of active ingredient per acre

Herbicide application would be conducted by hand, spot spray, and broadcast spray methods. Several types of hand application methods would be used, including wicking/wiping, basal bark, cut stump, stem injection, and hack and squirt. The details of these methods are summarized in Table 4. Hand application methods are likely to be used in sensitive areas, such as near water, to reduce the risk of herbicide transfer to soils or water. Hand application methods could be done under more variable conditions than spot spraying or broadcast spraying.

Table 4. Herbicide application methods

Application Method	Description
Hand	a. Wicking and Wiping - Involves using a sponge or wick on a long handle to wipe herbicide onto foliage and stems. Use of a wick eliminates the possibility of spray drift or droplets falling on non-target plants. Herbicide can drip or dribble from some wicks. An adjuvant or surfactant is often needed to enable the herbicide to penetrate the plant cuticle, a thick, waxy layer present on leaves and stems of most plants. b. Basal Bark - This method applies a 6 to 12-inch band of herbicide around the circumference of the trunk of the target plant, approximately one foot above ground. The width of the sprayed band depends on size of the plant and species' susceptibility to the herbicide. The herbicide can be applied with a backpack sprayer, hand-held bottle, or wick. c. Frill or Hack and Squirt - The frill method, also called the "hack and squirt" treatment, is often used to treat woody species with large, thick trunks. The tree is cut using a sharp knife, saw, or ax, or drilled with a power drill or other device. Herbicide is then immediately applied to the cut with a backpack sprayer, squirt bottle, syringe, or similar equipment. d. Stem Injection - Herbicides can be injected into herbaceous stems using a needle and syringe. Herbicide pellets can also be injected into the trunk of a tree using a specialized tool. e. Cut-stump - This method is often used on woody species that normally re-sprout after being cut. The tree or shrub is cut down, and herbicide is immediately applied to the exposed cambium (living inner bark) of the stump. The cut stump treatment allows for a great deal of control over the site of herbicide application, and therefore, has a low probability of affecting non-target species or contaminating the environment. It also requires only a small amount of herbicide to be effective.
Spot Spraying	Spot applicators spray herbicide directly onto small patches or individual target plants, and can reduce inadvertent exposure of desirable plants. These applicators range from motorized vehicles with spray hoses to backpack sprayers, to hand-pumped spray or squirt bottles. Hand-pumped spray and squirt bottles can target very small plants or parts of plants.
Broadcast Spraying	A boom, a long horizontal tube with multiple spray heads, is mounted or attached to a helicopter, airplane, tractor, ATV (all terrain vehicle), or other vehicle. The boom is then positioned above the target plants while spraying herbicide, allowing large areas to be treated rapidly with each sweep of the boom. The herbicide is carried in a tank and reaches the nozzles via tubing. All herbicides are metered out from the nozzles in a controlled manner. The nozzle controls the droplet size, the area (or cone) being covered by the herbicide and it could be turned on/off with ease.

	Some nozzles could rotate. This flexibility permits the operator to carefully apply herbicide at specific rates over specific areas. Some newer boom spray equipment has monitoring equipment that delivers precise amounts of herbicide, and keeps records on rates and areas treated. Wind and other weather data, and application rates would be recorded for all broadcast applications. Flight paths and altitude would be recorded for aerial applications. Not all broadcast methods employ a boom; boom-less nozzles are currently in use that can reduce the risk of non-target effects. Backpack sprayers may also be used as a broadcast tool.

Inert compounds are those that are intentionally added to a formulation, but have no herbicidal activity and do not affect the herbicidal activity. Inerts are added to the formulation to facilitate its handling, stability, or mixing. Adjuvants are compounds added to the formulation to improve its performance. They can either enhance the activity of an herbicide's active ingredient (activator adjuvant) or offset any problems associated with its application (utility modifiers).

Surfactants are utility modifier adjuvants that make herbicides more effective by increasing absorption into the plant. Inerts and adjuvants, including surfactants, are not under the same registration guidelines as are pesticides. These compounds are classified into four categories based on the available toxicity information. If the compounds are not classified as toxic, then all information on them is considered proprietary and the manufacturer is not required to disclose their identity.

The herbicides proposed for use have product formulations that often include adjuvants (additives mixed with the herbicide solution to improve performance of the spray mixture) or surfactants (additive that helps the chemical cover plant surfaces in a uniform manner, adhere to the plant surface, and penetrate the waxy cuticle). Inert ingredients may include carriers, surfactants, spray adjuvants, preservatives, dyes, and anti-foaming agents, among other chemicals. Because many manufacturers consider inert ingredients in herbicide formulations to be proprietary, they do not list specific chemicals.

Several types of surfactants or additives proposed for use have been reviewed in risk assessments or reviews and thus meet Standard 18 in the R6 FEIS and ROD ("Use only adjuvants (e.g., surfactants, dyes) and inert ingredients reviewed in Forest Service hazard and risk assessment documents such as SERA 1997a, 1997b; Bakke 2003. Table 5 contains several examples of typical herbicide-surfactant combinations that are likely to be used in the proposed action.

Table 5. Herbicide-surfactant combinations likely to be used.

<u>Clopyralid</u>

- Transline™ (Dow AgroSciences): 0.25 – 0.5 percent non-ionic, or use surfactant manufacturer's label (also crop oils can be used)

<u>Glyphosate</u>

- Glyphosate VMF (DuPont): 0.5 – 2.5 percent nonionic
- Accord® Concentrate (Monsanto): 0.5 – 2.5 percent nonionic
- Glypro™ (Dow AgroSciences): ≥0.5 percent nonionic with >50 percent ai
- Roundup® Original (Monsanto): none needed (contains POEA-based surfactant)
- Accord® SP (Monsanto): none needed (contains surfactant – not identified)

<u>Imazapic</u>
- Plateau® (BASF): seed oil 1.5 – 2 pints/acre; post-emergence ≥0.25 percent nonionic with >60 percent ai; silicone-based, as per surfactant manufacturer's label; silicone/oil blends as per surfactant manufacturer's label

<u>Imazapyr</u>
- Arsenal® (American Cyanamid): hack/squirt – none needed; foliar, 0.25 – 1 percent non-ionic
- Chopper® (American Cyanamid): foliar, 12-50 percent seed oil or crop oil or silicone/oil blends as per surfactant manufacturer's label; hack/squirt – none needed; thin line basal or low volume basal, 100 percent crop oil or diesel fuel

<u>Metsulfuron methyl</u>
- Escort® (DuPont): 0.25 percent minimum or surfactant manufacturer's rate (non-ionic with >80 percent ai); don't use products with acetic acid (LI-700); seed oils or seed oil/silicone blends as per surfactant manufacturer's label.

<u>Picloram</u>
- Tordon® 22K (DuPont): none needed, but can add as per surfactant manufacturer's label

<u>Sulfometuron methyl</u>
- Oust®, Oust® XP (DuPont): 0.25 percent non-ionic if needed

<u>Triclopyr</u>
- Garlon™ 3A (Dow AgroSciences): for foliar, use surfactant manufacturer's label
- Garlon™ 4 (Dow AgroSciences): foliar, 1-2 qts/ac or none; basal 95-99 percent oil or 8-16 percent Mor-Act; low vol basal, 70-80 percent oil; thinline, 25-50 percent oil; contains kerosene as surfactant.
- Pathfinder™ II (Dow AgroSciences): none needed, includes a crop oil surfactant.

1.2 Early Detection, Rapid Response Treatment Strategy

For new infestations and current, but undiscovered, infestations, the Forests would use the "early detection, rapid response" (EDRR) program, consisting of the use of the treatment methods described above, as constrained by the Project Design Features (PDFs) described below. The EDRR approach enables a more efficient response to infestations than has occurred in the past. Treatments could occur anywhere on the Forests where invasive plant treatment is allowed. A treatment plan would be developed for new infestations, based on goals, objectives, and standards described in the R6 FEIS. The PDFs serve to eliminate or minimize the risk of significant effects such that, even though treatment locations are not known, the likely effects from treatment are predictable.

1.3 Project Design Features

PDFs will minimize the potential impacts of invasive plant treatment. For the purposes of the Assessment, the PDFs are considered conservation measures. The PDFs are specific Forest-level measures designed to minimize project effects and provide sideboards for EDRR in accordance with R6 ROD Standards 19 and 20. The PDFs were developed to address site-specific resource conditions within treatment areas, including (but not limited to) the current invasive plant inventory, the presence of special interest species and their habitats, potential for herbicide delivery to water, and the social environment. Implementation of the PDFs would be mandatory to ensure that treatments would have effects within the scope of those disclosed in the Assessment. The buffers would be implemented as horizontal (map) distances. The PDFs are described in detail in Appendix A.

Herbicide Use Buffers (for PDF H-1)

Herbicide application methods would become more restrictive as they occur closer to water. The PDFs and herbicide use buffers within the riparian areas were developed based on label advisories, the Screening Ecological Risk Assessment (SERA), the Berg (2005) BMP effectiveness review, and various studies of drift and runoff to streams. Tables 6, 7, and 8 specify buffers according to treatment methods, herbicides used, risk, and type of aquatic zone.

Table 6. Herbicide use buffers (distances measured in feet) for perennial and wet intermittent streams.

Herbicide	Perennial and Wet Intermittent Stream			
	Aerial	Broadcast	Spot	Hand/Select
Aquatic Labeled Herbicides				
Aquatic Glyphosate	300	100	Water's edge	Water's edge
Aquatic Triclopyr-TEA	None Allowed	None Allowed	15	Water's edge
Aquatic Imazapyr*	300	100	Water's edge	Water's edge
Low Risk to Aquatic Organisms				
Imazapic	300	100	15	Bankfull
Clopyralid	300	100	15	Bankfull
Metsulfuron Methyl	None Allowed	100	15	Bankfull
Moderate Risk to Aquatic Organisms				
Imazapyr	300	100	50	Bankfull
Sulfometuron Methyl	None Allowed	100	50	5
Chlorsulfuron	None Allowed	100	50	Bankfull
High Risk to Aquatic Organisms				
Triclopyr-BEE	None Allowed	None Allowed	150	150
Picloram	300	100	50	50
Sethoxydim	300	100	50	50
Glyphosate	300	100	50	50

*Aquatic Imazapyr (Habitat) may not be used until the risk assessment (currently underway) is completed for inert ingredients and additives.

Table 7. Herbicide use buffers for dry intermittent streams. (See Table 6 for buffer distances when flowing, or pools present, but water not flowing.)

Herbicide	Dry Intermittent Stream			
	Aerial	Broadcast	Spot	Hand/Select
Aquatic Labeled Herbicides				
Aquatic Glyphosate	100	50	0	0
Aquatic Triclopyr-TEA	None Allowed	None Allowed	0	0
Aquatic Imazapyr*	100	50	0	0
Low Risk to Aquatic Organisms				
Imazapic	100	50	0	0
Clopyralid	100	50	0	0
Metsulfuron Methyl	None Allowed	50	0	0

ID # 16

Moderate Risk to Aquatic Organisms				
Imazapyr	100	50	15	Bankfull
Sulfometuron Methyl	None Allowed	50	15	Bankfull
Chlorsulfuron	None Allowed	50	15	Bankfull
High Risk to Aquatic Organisms				
Triclopyr-BEE	None Allowed	None Allowed	150	150
Picloram	100	100	50	50
Sethoxydim	100	100	50	50
Glyphosate	100	100	50	50

*Aquatic Imazapyr (Habitat) may not be used until the risk assessment (currently underway) is completed for inert ingredients and additives.

Table 8. Herbicide use buffers (distances measured in feet) for wetlands.

Herbicide	Wetlands			
	Aerial	**Broadcast**	**Spot**	**Hand/Select**
Aquatic Labeled Herbicides				
Aquatic Glyphosate	300	100**	Water's edge	Water's edge
Aquatic Triclopyr-TEA	None Allowed	None Allowed	15	Water's edge
Aquatic Imazapyr*	300	100**	Water's edge	Water's edge
Low Risk to Aquatic Organisms				
Imazapic	300	100	15	high water mark
Clopyralid	300	100	15	high water mark
Metsulfuron Methyl	300	100	15	high water mark
Moderate Risk to Aquatic Organisms				
Imazapyr	300	100	50	high water mark
Sulfometuron Methyl	None Allowed	100	50	5
Chlorsulfuron	None Allowed	100	50	high water mark
High Risk to Aquatic Organisms				
Triclopyr-BEE	None Allowed	None Allowed	150	150
Picloram	300	100	50	50
Sethoxydim	300	100	50	50
Glyphosate	300	100	50	50

*Aquatic Imazapyr (Habitat) may not be used until the risk assessment (currently underway) is completed for inert ingredients and additives.
** If wetland, pond, or lake is dry, there is no buffer.

In addition to the monitoring already required under various Forest Plans, an inventory and monitoring plan framework is part of the proposed action as a result of tiering to the R6 FEIS and ROD (USDA 2005a). The approach included in the framework was developed via interagency discussions with National Marine Fisheries Service (NMFS) and Service personnel during ESA consultations for the R6 FEIS. A measure included within the monitoring framework that will improve the Forests' ability to detect, respond rapidly to new infestations is the requirement to maintaining an invasive plant inventory consistent with nationally accepted (e.g., NRIS/Terra) protocols. Additionally, the monitoring framework outlines the agreed-upon criteria for prioritizing monitoring of projects that may pose more risk to federally listed species. Details of the Inventory and Monitoring Plan Framework can be found in Appendix J of the Assessment.

Treatment Priorities

Prioritization of infestation treatments should be based on the following decision pathway. Highest priority treatments should be focused on new invaders and early treatment of new infestations, followed in priority by containment, then control of larger established infestations. Moody and Mack (1988) demonstrated in a simple geometric model that small, new outbreaks of invasive plants eventually would occupy an area larger than the source population. Control efforts that focus on the large, main population rather than the new small satellites reduced the chances of overall success. The ability to detect and destroy the new, small infestation was crucial to control of invasive species and should be combined with efforts to control established populations. Another important point for consideration of treatments is control costs. A maintenance strategy focused on control may be more economically feasible than attempting to eradicate large populations.

Another model being used is to apply the fundamentals of wildfire management to invasive plant control. Thinking of weeds as a slow-moving wildfire can provide a valuable perspective and generate useful ideas when developing and implementing invasive plant strategies (Dewey 2003). Prevention, early detection, rapid response, contain/control, and site restoration are all terminologies that are interchangeable in wildfire management and invasive plant control. Focusing on spot fires (or new infestations), containing the size around the perimeter and mopping up (or returning to ensure all controlled sites are eradicated) may be a means to help focus planning efforts.

The methods and factors for prioritizing invasive plant sites for treatments on the Forests in Region Six generally follow a similar decision-making model. Treatment priorities are displayed in Table 9, and are based on a Forest Service guide on site prioritization and selection of treatment methods (USDA Forest Service 2001).

Table 9. Priorities for treatment and selection of treatment methods.

Priority	Description	Treatment – choice based on site-specific conditions
Highest Priority for Treatment	* Eradication of new species (focus on aggressive species with potential for significant ecological impact including but not limited to State listed high priority noxious weeds) * New infestations (e.g. populations in areas not yet infested; "spot fires"; any State or Forest priority species). * Areas of concern such as: Areas of high traffic and sources of infestation (e.g. parking lots, trailheads, horse camps, gravel pits) Areas of special concerns: (e.g. botanical areas, wilderness, research natural areas, adjacent boundaries/access with national parks) Riparian corridors where high threat species such as knotweeds occur.	1. Manual/mechanical - isolated plants or small populations. 2. Herbicide treatment if manual/mechanical is known to be ineffective or population too large. 3. Remove seed heads. This is an interim measure if cost/staff is an issue. 4. Seed to restore treated areas; use native species when possible.

Second Priority of Treatment	* Containment of existing large infestations (e.g. focus on State-listed highest priority species or Forest priority species) – focus on boundaries of infestation. * Roadsides – focus first on access points leading to areas of concern.	1. Manual/mechanical - isolated plants or small populations in spread zones. 2. Herbicide treatment for larger populations along perimeter. 3. Seed to restore treated areas to create a buffer from spread; use native species when possible.
Third Priority of Treatment	* Control of existing large infestations (e.g. State-listed and Forest second priority species)	1. Disperse bio-control agents on large infestations 2. Livestock grazing 3. Mechanical 4. Herbicide application
Fourth Priority of Treatment	* Suppression of existing large infestations when eradication/control or containment is not possible.	1. Bio-control on large infestations 2. Livestock grazing 3. Mechanical 4. Herbicide application along perimeters

The Service relied on the foregoing description of the proposed action, including all stated minimization measures, to complete this consultation. To ensure that this consultation remains valid, the Service requests that the action agency or applicant keep the Service informed of any changes to the proposed action.

1.4 Conservation Measures

Conservation measures are intended to minimize or avoid environmental impacts to listed species or critical habitat. Refer to the PDFs mentioned earlier and described in Appendix A.

1.5 Action Area

The action area is defined as all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action [50 CFR 402.02]. For the purpose of this consultation, the action area encompasses the Project area (both the Umatilla and Wallowa-Whitman National Forests) as well as the downstream and upstream extent of stream reaches affected by herbicide, sediment, flows, and fish passage. Given the scope and scale of the proposed project, the Service believes that the 500 feet reach of stream immediately below and 200 feet upstream of the Project area may be affected by invasive weed treatment activities.

2. Status of the Species/Critical Habitat

2.1 Bull Trout

2.1.1 Listing Status

The coterminous United States population of the bull trout (*Salvelinus confluentus*) was listed as threatened on November 1, 1999 (64 FR 58910). The threatened bull trout occurs in the Klamath River Basin of south-central Oregon and in the Jarbidge River in Nevada, north to various coastal rivers of Washington to the Puget Sound and east throughout major rivers within the Columbia River Basin to the St. Mary-Belly River, east of the Continental Divide in northwestern Montana (Cavender 1978, Bond 1992, Brewin and Brewin 1997, and Leary and Allendorf 1997).

Throughout its range, the bull trout is threatened by the combined effects of habitat degradation, fragmentation and alterations associated with: dewatering, road construction and maintenance, mining, and grazing; the blockage of migratory corridors by dams or other diversion structures; poor water quality; incidental angler harvest; entrainment (a process by which aquatic organisms are pulled through a diversion or other device) into diversion channels; and introduced non-native species (64 FR 58910).

The bull trout was initially listed as three separate Distinct Population Units (DPSs)(63 FR 31647, 64 FR 17110). The preamble to the final listing rule for the United States coterminous population of the bull trout discusses the consolidation of these DPSs, plus two other population segments, into one listed taxon and the application of the jeopardy standard under section 7 of the ESA relative to this species (64 FR 58930):

> Although this rule consolidates the five bull trout DPSs into one listed taxon, based on conformance with the DPS policy for purposes of consultation under section 7 of the Act, we intend to retain recognition of each DPS in light of available scientific information relating to their uniqueness and significance. Under this approach, these DPSs will be treated as interim recovery units with respect to application of the jeopardy standard until an approved recovery plan is developed. Formal establishment of bull trout recovery units will occur during the recovery planning process.

Please note that consideration of the above recovery units for purposes of the jeopardy analysis is done within the context of making the jeopardy determination at the scale of the entire listed species in accordance with Service policy (Service 2006).

2.1.2 Current Status and Conservation Needs

As noted above, in recognition of available scientific information relating to their uniqueness and significance, five segments of the coterminous United States population of the bull trout are considered essential to the survival and recovery of this species and are identified as interim recovery units: (1) Jarbidge River; (2) Klamath River; (3) Columbia River; (4) Coastal-Puget

Sound; and (5) St. Mary-Belly River. Each of these segments is necessary to maintain the bull trout's distribution, as well as its genetic and phenotypic diversity, all of which are important to ensure the species' resilience to changing environmental conditions.

A summary of the current status and conservation needs of the bull trout within these units is provided below. A comprehensive discussion of these topics is found in the Service's draft recovery plan for the bull trout (Service 2002; 2004a, b).

Generally, the conservation needs of the bull trout are often generally expressed as the need to provide the four "Cs": cold, clean, complex, and connected habitat. Cold stream temperatures, clean water quality that is relatively free of sediment and contaminants, complex channel characteristics (including abundant large wood and undercut banks), and large patches of such habitat that are well connected by unobstructed migratory pathways are all needed to promote conservation of bull trout at multiple scales ranging from the coterminous to local populations. The recovery planning process for the bull trout (Service 2002; 2004a, b) has also identified the following conservation needs for the bull trout: (1) maintain and restore multiple, interconnected populations in diverse habitats across the range of each interim recovery unit; (2) preserve the diversity of life-history strategies; (3) maintaining genetic and phenotypic diversity across the range of each interim recovery unit; and (4) establish a positive population trend. Recently, it has also been recognized that bull trout populations need to be protected from catastrophic fires across the range of each interim recovery unit.

Central to the survival and recovery of the bull trout is the maintenance of viable core areas (Service 2002, 2004a, b). A core area is defined as a geographic area occupied by one or more local bull trout populations that overlap in their use of rearing, foraging, migratory, and overwintering habitat, and in some cases in their use of spawning habitat. Each of the interim recovery units listed above consists of one or more core areas. About 114 core areas are recognized across the United States range of the bull trout (Service 2002; 2004a, b).

Jarbidge River

This interim recovery unit currently contains a single core area with six local populations. Less than 500 resident and migratory adult bull trout, representing about 50 to 125 spawners, are estimated to occur within the core area. The current condition of the bull trout in this interim recovery unit is attributed to the effects of livestock grazing, roads, angler harvest, timber harvest, and the introduction of non-native fishes (Service 2004a). The draft bull trout recovery plan (Service 2004a) identifies the following conservation needs for this unit: maintain the current distribution of the bull trout within the core area; maintain stable or increasing trends in abundance of both resident and migratory bull trout in the core area; restore and maintain suitable habitat conditions for all life history stages and forms; and conserve genetic diversity and increase natural opportunities for genetic exchange between resident and migratory forms of the bull trout. An estimated 270 to 1,000 spawning fish per year are needed to provide for the persistence and viability of the core area and to support both resident and migratory adult bull trout (Service 2004a).

Klamath River

This interim recovery unit currently contains 3 core areas and 12 local populations. The current abundance, distribution, and range of the bull trout in the Klamath River Basin are greatly reduced from historical levels due to habitat loss and degradation caused by reduced water quality, timber harvest, livestock grazing, water diversions, roads, and the introduction of non-native fishes (Service 2002). Bull trout populations in this unit face a high risk of extirpation (Service 2002). The draft bull trout recovery plan (Service 2002) identifies the following conservation needs for this unit: maintain the current distribution of the bull trout and restore distribution in previously occupied areas; maintain stable or increasing trends in bull trout abundance; restore and maintain suitable habitat conditions for all life history stages and strategies; conserve genetic diversity and provide the opportunity for genetic exchange among appropriate core area populations. Eight to 15 new local populations and an increase in population size from about 3,250 adults currently to 8,250 adults are needed to provide for the persistence and viability of the 3 core areas (Service 2002).

Columbia River

This interim recovery unit currently contains about 90 core areas and 500 local populations. About 62 percent of these core areas and local populations occur in central Idaho and northwestern Montana. The condition of the bull trout within these core areas varies from poor to good but generally all have been subject to the combined effects of habitat degradation, fragmentation and alterations associated with one or more of the following activities: dewatering; road construction and maintenance; mining, and grazing; the blockage of migratory corridors by dams or other diversion structures; poor water quality; incidental angler harvest; entrainment into diversion channels; and introduced non-native species. The draft bull trout recovery plan (Service 2002) identifies the following conservation needs for this unit: maintain or expand the current distribution of the bull trout within core areas; maintain stable or increasing trends in bull trout abundance; maintain/restore suitable habitat conditions for all bull trout life history stages and strategies; and conserve genetic diversity and provide opportunities for genetic exchange.

Coastal-Puget Sound

Bull trout in the Coastal-Puget Sound interim recovery unit exhibit anadromous, adfluvial, fluvial, and resident life history patterns. The anadromous life history form is unique to this unit. This interim recovery unit currently contains 14 core areas and 67 local populations (Service 2004b). Bull trout are distributed throughout most of the large rivers and associated tributary systems within this unit. With limited exceptions, bull trout continue to be present in nearly all major watersheds where they likely occurred historically within this unit. Generally, bull trout distribution has contracted and abundance has declined especially in the southeastern part of the unit. The current condition of the bull trout in this interim recovery unit is attributed to the adverse effects of dams, forest management practices (e.g., timber harvest and associated road building activities), agricultural practices (e.g., diking, water control structures, draining of wetlands, channelization, and the removal of riparian vegetation), livestock grazing, roads, mining, urbanization, angler harvest, and the introduction of non-native species. The draft bull trout recovery plan (Service 2004b) identifies the following conservation needs for this unit:

maintain or expand the current distribution of bull trout within existing core areas; increase bull trout abundance to about 16,500 adults across all core areas; and maintain or increase connectivity between local populations within each core area.

St. Mary-Belly River

This interim recovery unit currently contains 6 core areas and 9 local populations (Service 2002). Currently, the bull trout is widely distributed in the St. Mary River drainage and occurs in nearly all of the waters that it inhabited historically. Bull trout are found only in a 1.2-mile reach of the North Fork Belly River within the United States. Redd count surveys of the North Fork Belly River documented an increase from 27 redds in 1995 to 119 redds in 1999. This increase was attributed primarily to protection from angler harvest (Service 2002). The current condition of the bull trout in this interim recovery unit is primarily attributed to the effects of dams, water diversions, roads, mining, and the introduction of non-native fishes (Service 2002). The draft bull trout recovery plan (Service 2002) identifies the following conservation needs for this unit: maintain the current distribution of the bull trout and restore distribution in previously occupied areas; maintain stable or increasing trends in bull trout abundance; restore and maintain suitable habitat conditions for all life history stages and forms; conserve genetic diversity and provide the opportunity for genetic exchange; and establish good working relations with Canadian interests because local bull trout populations in this unit are comprised mostly of migratory fish, whose habitat is mostly in Canada.

2.1.3 Life History

Bull trout exhibit both resident and migratory life history strategies. Both resident and migratory forms may be found together, and either form may produce offspring exhibiting either resident or migratory behavior (Rieman and McIntyre 1993). Resident bull trout complete their entire life cycle in the tributary (or nearby) streams in which they spawn and rear. The resident form tends to be smaller than the migratory form at maturity and also produces fewer eggs (Fraley and Shepard 1989, Goetz 1989). Migratory bull trout spawn in tributary streams where juvenile fish rear 1 to 4 years before migrating to either a lake (adfluvial form), river (fluvial form) (Fraley and Shepard 1989, Goetz 1989), or saltwater (anadromous) to rear as subadults or to live as adults (Cavender 1978, McPhail and Baxter 1996, WDFW *et al.* 1997). Bull trout normally reach sexual maturity in 4 to 7 years and may live longer than 12 years. They are iteroparous (they spawn more than once in a lifetime), and both repeat- and alternate-year spawning has been reported, although repeat-spawning frequency and post-spawning mortality are not well documented (Leathe and Graham 1982, Fraley and Shepard 1989, Pratt 1992, Rieman and McIntyre 1996).

The iteroparous reproductive system of bull trout has important repercussions for the management of this species. Bull trout require two-way passage up and downstream, not only for repeat spawning but also for foraging. Most fish ladders, however, were designed specifically for anadromous semelparous (fishes that spawn once and then die, and therefore require only one-way passage upstream) salmonids. Therefore even dams or other barriers with fish passage facilities may be a factor in isolating bull trout populations if they do not provide a downstream passage route.

Growth varies depending upon life-history strategy. Resident adults range from 6 to 12 inches total length, and migratory adults commonly reach 24 inches or more (Pratt 1985, Goetz 1989). The largest verified bull trout is a 32-pound specimen caught in Lake Pend Oreille, Idaho, in 1949 (Simpson and Wallace 1982).

2.1.4 Habitat Characteristics

Bull trout have more specific habitat requirements than most other salmonids (Rieman and McIntyre 1993). Habitat components that influence bull trout distribution and abundance include water temperature, cover, channel form and stability, valley form, spawning and rearing substrate, and migratory corridors (Fraley and Shepard 1989; Goetz 1989; Hoelscher and Bjornn 1989; Sedell and Everest 1991; Howell and Buchanan 1992; Pratt 1992; Rieman and McIntyre 1993, 1995; Rich 1996; Watson and Hillman 1997). Watson and Hillman (1997) concluded that watersheds must have specific physical characteristics to provide the habitat requirements necessary for bull trout to successfully spawn and rear and that these specific characteristics are not necessarily present throughout these watersheds. Because bull trout exhibit a patchy distribution, even in pristine habitats (Rieman and McIntyre 1993), fish should not be expected to simultaneously occupy all available habitats (Rieman *et al.* 1997).

Migratory corridors link seasonal habitats for all bull trout life histories. The ability to migrate is important to the persistence of bull trout (Rieman and McIntyre 1993; Gilpin, *in litt.* 1997; Rieman *et al.* 1997). Migrations facilitate gene flow among local populations when individuals from different local populations interbreed, or stray, to nonnatal streams. Local populations that are extirpated by catastrophic events may also become reestablished by bull trout migrants. However, it is important to note that the genetic structuring of bull trout indicates that there is limited gene flow among bull trout populations, which may encourage local adaptation within individual populations, and that reestablishment of extirpated populations may take a very long time (Spruell *et al.* 1999, Rieman and McIntyre 1993).

Cold water temperatures play an important role in determining bull trout habitat, as these fish are primarily found in colder streams (below 59 degrees Fahrenheit), and spawning habitats are generally characterized by temperatures that drop below 48 degrees Fahrenheit in the fall (Fraley and Shepard 1989, Pratt 1992, Rieman and McIntyre 1993).

Thermal requirements for bull trout appear to differ at different life stages. Spawning areas are often associated with cold-water springs, groundwater infiltration, and the coldest streams in a given watershed (Pratt 1992, Rieman and McIntyre 1993, Baxter *et al.* 1997, Rieman *et al.* 1997). Optimum incubation temperatures for bull trout eggs range from 35 to 39 degrees Fahrenheit whereas optimum water temperatures for rearing range from about 46 to 50 degrees Fahrenheit (McPhail and Murray 1979, Goetz 1989, Buchanan and Gregory 1997). In Granite Creek, Idaho, Bonneau and Scarnecchia (1996) observed that juvenile bull trout selected the coldest water available in a plunge pool, 46 to 48 degrees Fahrenheit, within a temperature gradient of 46 to 60 degrees Fahrenheit. In a landscape study relating bull trout distribution to maximum water temperatures, Dunham *et al.* (2003) found that the probability of juvenile bull trout occurrence does not become high (i.e., greater than 0.75) until maximum temperatures decline to 52 to 54 degrees Fahrenheit.

Although bull trout are found primarily in cold streams, occasionally these fish are found in larger, warmer river systems throughout the Columbia River basin (Fraley and Shepard 1989; Rieman and McIntyre 1993, 1995; Buchanan and Gregory 1997; Rieman *et al.* 1997). Factors that can influence bull trout ability to survive in warmer rivers include availability and proximity of cold water patches and food productivity (Myrick *et al.* 2002). In Nevada, adult bull trout have been collected at 63 degrees Fahrenheit in the West Fork of the Jarbidge River (S. Werdon, Service, pers. comm. 1998) and have been observed in Dave Creek where maximum daily water temperatures were 62.8 to 63.6 degrees Fahrenheit (Werdon 2000). In the Little Lost River, Idaho, bull trout have been collected in water having temperatures up to 68 degrees Fahrenheit; however, bull trout made up less than 50 percent of all salmonids when maximum summer water temperature exceeded 59 degrees Fahrenheit and less than 10 percent of all salmonids when temperature exceeded 63 degrees Fahrenheit (Gamett 1999). In the Little Lost River study, most sites that had high densities of bull trout were in an area where primary productivity increased in the streams following a fire (B. Gamett, U. S. Forest Service, pers. comm. 2002).

All life history stages of bull trout are associated with complex forms of cover, including large woody debris, undercut banks, boulders, and pools (Fraley and Shepard 1989, Goetz 1989, Hoelscher and Bjornn 1989, Sedell and Everest 1991, Pratt 1992, Thomas 1992, Rich 1996, Sexauer and James 1997, Watson and Hillman 1997). Maintaining bull trout habitat requires stability of stream channels and maintenance of natural flow patterns (Rieman and McIntyre 1993). Juvenile and adult bull trout frequently inhabit side channels, stream margins, and pools with suitable cover (Sexauer and James 1997). These areas are sensitive to activities that directly or indirectly affect stream channel stability and alter natural flow patterns. For example, altered stream flow in the fall may disrupt bull trout during the spawning period, and channel instability may decrease survival of eggs and young juveniles in the gravel from winter through spring (Fraley and Shepard 1989, Pratt 1992, Pratt and Huston 1993). Pratt (1992) indicated that increases in fine sediment reduce egg survival and emergence.

Bull trout typically spawn from August to November during periods of decreasing water temperatures. Preferred spawning habitat consists of low-gradient stream reaches with loose, clean gravel (Fraley and Shepard 1989). Redds are often constructed in stream reaches fed by springs or near other sources of cold groundwater (Goetz 1989, Pratt 1992, Rieman and McIntyre 1996). Depending on water temperature, incubation is normally 100 to 145 days (Pratt 1992), and after hatching, juveniles remain in the substrate. Time from egg deposition to emergence of fry may surpass 200 days. Fry normally emerge from early April through May, depending on water temperatures and increasing stream flows (Pratt 1992, Ratliff and Howell 1992). Migratory forms of the bull trout appear to develop when habitat conditions allow movement between spawning and rearing streams and larger rivers or lakes where foraging opportunities may be enhanced (Frissell 1993). For example, multiple life history forms (e.g., resident and fluvial) and multiple migration patterns have been noted in the Grande Ronde River (Baxter 2002). Parts of this river system have retained habitat conditions that allow free movement between spawning and rearing areas and the mainstem Snake River. Such multiple life history strategies help to maintain the stability and persistence of bull trout populations to environmental changes. Benefits to migratory bull trout include greater growth in the more productive waters of larger streams and lakes, greater fecundity resulting in increased reproductive potential, and dispersing the population across space and time so that spawning streams may be recolonized should local populations suffer a catastrophic loss (Rieman and McIntyre 1993, MBTSG 1998, Frissell 1999). In the absence of the migratory bull trout life form, isolated populations cannot be replenished when disturbance makes local habitats temporarily unsuitable, the range of the species is diminished, and the potential for enhanced reproductive capabilities are lost (Rieman and McIntyre 1993).

2.1.5 Diet

Bull trout are opportunistic feeders, with food habits primarily a function of size and life-history strategy. Resident and juvenile migratory bull trout prey on terrestrial and aquatic insects, macrozooplankton, and small fish (Boag 1987, Goetz 1989, Donald and Alger 1993). Adult migratory bull trout feed on various fish species (Leathe and Graham 1982, Fraley and Shepard 1989, Brown 1994, Donald and Alger 1993). In coastal areas of western Washington, bull trout feed on Pacific herring (*Clupea pallasi*), Pacific sand lance (*Ammodytes hexapterus*), and surf smelt (*Hypomesus pretiosus*) in the ocean (WDFW *et al.* 1997).

Bull trout migration and life history strategies are closely related to their feeding and foraging strategies. Optimal foraging theory can be used to describe strategies fish use to choose between alternative sources of food by weighing the benefits and costs of capturing one choice of food over another. For example, prey often occur in concentrated patches of abundance ("patch model"; Gerking 1994). As the predator feeds the prey population is reduced, and it becomes more profitable for the predator to seek a new patch rather than continue feeding on the original one. This can be explained in terms of balancing energy acquired versus energy expended. In the Skagit River system, anadromous bull trout make migrations as long as 121 miles between marine foraging areas in Puget Sound and headwater spawning grounds, foraging on salmon eggs and juvenile salmon along their migratory route (WDFW *et al.* 1997). Anadromous bull trout also use marine waters as migratory corridors to reach seasonal habitats in non-natal watersheds to forage and possibly overwinter (Brenkman, *in litt.*, 2003; Brenkman and Corbett, *in litt.*, 2003; Goetz, *in litt.*, 2003a,b).

A single optimal foraging strategy is not necessarily a consistent feature in the life of a fish, but this foraging strategy can change from one life stage to another. Fish growth depends on the quantity and quality of food that is eaten (Gerking 1994) and as fish grow their foraging strategy changes as their food changes in quantity, size, or other characteristics. Resident and juvenile migratory bull trout prey on terrestrial and aquatic insects, macrozooplankton, mysids and small fish (Shepard *et al.* 1984, Boag 1987, Goetz 1989, Donald and Alger 1993). Bull trout that are 4.3 inches long or longer commonly have fish in their diet (Shepard *et al.* 1984), and bull trout of all sizes have been found to eat fish half their length (Beauchamp and Van Tassell 2001).

Migratory bull trout begin growing rapidly once they move to waters with abundant forage that includes fish (Shepard *et al.* 1984, Carl 1985). As these fish mature they become larger bodied predators and are able to travel greater distances (with greater energy expended) in search of prey species of larger size and in greater abundance (with greater energy acquired). In Lake

Billy Chinook as bull trout became increasingly piscivorous with increasing size, the prey species changed from mainly smaller bull trout and rainbow trout for bull trout less than 17.7 inches in length to mainly kokanee for bull trout greater in size (Beauchamp and Van Tassell 2001).

Migration allows bull trout to access optimal foraging areas and exploit a wider variety of prey resources. Bull trout likely move to or with a food source. For example, some bull trout in the Wenatchee basin were found to consume large numbers of earthworms during spring runoff in May at the mouth of the Little Wenatchee River where it enters Lake Wenatchee (Service 2003, in prep.). In the Wenatchee River, radio-tagged bull trout moved downstream after spawning to the locations of spawning chinook and sockeye salmon and held for a few days to a few weeks, possibly to prey on dislodged eggs, before establishing an overwintering area downstream or in Lake Wenatchee (Service 2003, in prep).

2.2 Bull Trout Critical Habitat

2.2.1 Legal Status

The Service published a final critical habitat designation for the coterminous United States population of the bull trout on September 26, 2005 (70 FR 56212); the rule became effective on October 26, 2005. The scope of the designation involved the Klamath River, Columbia River, Coastal-Puget Sound, and Saint Mary-Belly River population segments (also considered as interim recovery units). Rangewide, the Service designated 143,218 acres of reservoirs or lakes and 4,813 stream or shoreline miles as bull trout critical habitat.
The critical habitat designation includes approximately 2,708 miles of streams for the Columbia River population.

Table 10. Approximate area designated as critical habitat for the Columbia River DPS of the bull trout by critical habitat unit.

Critical Habitat Unit	Miles of Streams	Acres of Reservoir or Lakes
Clark Fork River Basin (Unit 2)	1,136	49,755
Kootenai River Basin (Unit 3)	56	1,384
Willamette River Basin (Unit 4)	111	-
Hood River Basin (Unit 5)	30	-
Deschutes River Basin (Unit 6)	78	2,713
[redacted]	[redacted]	-
[redacted]	[redacted]	-
[redacted]	[redacted]	-
[redacted]	[redacted]	-
Malheur River Basin (Unit 13)	38	-
Coeur d'Alene Lake Basin (Unit 14)	124	27,296
Lower Columbia River Basin (Unit 19)	94	-
Middle Columbia River Basin (Unit 20)	188	-

Northeast Washington River Basins (Unit 22)	25	-
Snake River Basin Washington (Unit 23)	68	-
Snake River (Unit 25)	17	-
Total	**2,708**	**81,148**

The Umatilla-Walla Walla river Basins, Grande Ronde River Basin, Imnaha-Snake River Basins, Hells Canyon Complex, and Snake River Basin in Washington are the five critical habitat units (highlighted in gray) that occur within the action area.

2.2.2 Conservation Role and Description of Critical Habitat

The conservation role of bull trout critical habitat is to support viable core area populations (70 FR 56212). Core areas reflect the metapopulation structure of the coterminus United States population of the bull trout and are the closest approximation of a biologically functioning unit for the purposes of recovery planning and risk analyses. Critical habitat units generally encompass one or more core areas and may include foraging, migration, and overwintering areas, outside of core areas, that are important to the survival and recovery (i.e., conservation) of the bull trout.

Because there were numerous exclusions associated with the final critical habitat designation process that reflect land ownership, designated critical habitat is often fragmented. These individual critical habitat segments are expected to contribute to the ability of the stream to support viable local and core area populations of the bull trout in each critical habitat unit.

The primary function of individual critical habitat units is to maintain and support core areas which (1) contain bull trout populations with the demographic characteristics needed to ensure their persistence and contain the habitat needed to sustain those characteristics (Rieman and McIntyre 1993); (2) provide for persistence of strong local populations, in part, by providing habitat conditions that encourage movement of migratory fish (Rieman and McIntyre 1993; MBTSG 1998); (3) are large enough to incorporate genetic and phenotypic diversity, but small enough to ensure connectivity between populations (Rieman and McIntyre 1993; Hard 1995; Healey and Prince 1995; MBTSG 1998); and (4) are distributed throughout the historic range of the species to preserve both genetic and phenotypic adaptations (Rieman and McIntyre 1993; Hard 1995; MBTSG 1998; Rieman and Allendorf 2001).

The Olympic Peninsula and Puget Sound Critical Habitat Units are essential to the conservation of amphidromous bull trout, which are unique to the Coastal-Puget Sound bull trout population. These critical habitat units contain nearshore and freshwater habitats, outside of core areas, that are used by bull trout from one or more core areas. These habitats, outside of core areas, contain PCEs that are critical to adult and subadult overwintering, migration, and foraging.

Within designated critical habitat areas, the PCEs for bull trout are those habitat components that are essential for the primary biological needs of foraging, reproducing, rearing of young, dispersal, genetic exchange, or sheltering. Note that only the PCEs described in paragraphs (i), (vi), (vii), and (viii) below apply to marine nearshore waters identified as critical habitat; and all except PCE (iii) apply to foraging, migration, and overwintering habitat identified as critical habitat.

The PCEs of bull trout critical habitat are as follows:

(1) Water temperatures that support bull trout use. Bull trout have been documented in streams with temperatures from 32 to 72 °F (0 to 22 °C) but are found more frequently in temperatures ranging from 36 to 59 °F (2 to 15 °C). These temperature ranges may vary depending on bull trout life-history stage and form, geography, elevation, diurnal and seasonal variation, shade, such as that provided by riparian habitat, and local groundwater influence. Stream reaches with temperatures that preclude bull trout use are specifically excluded from designation;

(2) Complex stream channels with features such as woody debris, side channels, pools, and undercut banks to provide a variety of depths, velocities, and instream structures;

(3) Substrates of sufficient amount, size, and composition to ensure success of egg and embryo overwinter survival, fry emergence, and young-of-the-year and juvenile survival. This should include a minimal amount of fine substrate less than 0.25 inch (0.63 centimeter) in diameter;

(4) A natural hydrograph, including peak, high, low, and base flows within historic ranges or, if regulated, currently operate under a biological opinion that addresses bull trout, or a hydrograph that demonstrates the ability to support bull trout populations by minimizing daily and day-to-day fluctuations and minimizing departures from the natural cycle of flow levels corresponding with seasonal variation. This rule finds that reservoirs currently operating under a biological opinion that addresses bull trout provides management for PCEs as currently operated;

(5) Springs, seeps, groundwater sources, and subsurface water to contribute to water quality and quantity as a cold water source;

(6) Migratory corridors with minimal physical, biological, or water quality impediments between spawning, rearing, overwintering, and foraging habitats, including intermittent or seasonal barriers induced by high water temperatures or low flows;

(7) An abundant food base including terrestrial organisms of riparian origin, aquatic macroinvertebrates, and forage fish; and

(8) Permanent water of sufficient quantity and quality such that normal reproduction, growth, and survival are not inhibited.

Throughout the remainder of this Opinion, the PCEs will be referred to by the corresponding number, as listed above.

Critical habitat includes the stream channels within the designated stream reaches, the shoreline of designated lakes, and the inshore extent of marine nearshore areas, including tidally influenced freshwater heads of estuaries.

In freshwater habitat, critical habitat includes the stream channels within the designated stream reaches, and includes a lateral extent as defined by the ordinary high-water line. In areas where ordinary high-water line has not been defined, the lateral extent will be defined by the bankfull elevation. Bankfull elevation is the level at which water begins to leave the channel and move into the floodplain and is reached at a discharge that generally has a recurrence interval of 1 to 2 years on the annual flood series. For designated lakes, the lateral extent of critical habitat is defined by the perimeter of the water body as mapped on standard 1:24,000 scale topographic maps.

In marine habitat, critical habitat includes the inshore extent of marine nearshore areas between mean lower low-water (MLLW) and minus10 meters (m) mean higher high-water (MHHW), including tidally influenced freshwater heads of estuaries. This refers to the area between the average of all lower low-water heights and all the higher high-water heights of the two daily tidal levels. The offshore extent of critical habitat for marine nearshore areas is based on the extent of the photic zone, which is the layer of water in which organisms are exposed to light. Critical habitat extends offshore to the depth of 33 ft (10 m) relative to the MLLW.

Adjacent stream, lake, and shoreline riparian areas, bluffs, and uplands are not designated as critical habitat. However, it should be recognized that the quality of marine and freshwater habitat along streams, lakes and shorelines is intrinsically related to the character of these adjacent features, and that human activities that occur outside of the designated critical habitat can have major effects on the PCEs of bull trout critical habitat in the marine environment.

2.2.3 Current Rangewide Condition of Bull Trout Critical Habitat

The condition of bull trout critical habitat varies across its range from poor to good. Although still relatively widely distributed across its historic range, the bull trout occurs in low numbers in many areas, and populations are considered depressed or declining across much of its range (67 FR 71240). This condition reflects the condition of bull trout habitat.

There is widespread agreement in the scientific literature that many factors related to human activities have impacted bull trout and their habitat, and continue to do so. Among the many factors that contribute to degraded PCEs, those which appear to be particularly significant and have resulted in a legacy of degraded habitat conditions are as follows: (1) fragmentation and isolation of local populations due to the proliferation of dams and water diversions that have eliminated habitat, altered water flow and temperature regimes, and impeded migratory movements (Rieman and McIntyre 1993; Dunham and Rieman 1999); (2) degradation of spawning and rearing habitat and upper watershed areas, particularly alterations in sedimentation rates and water temperature, resulting from forest and rangeland practices and intensive development of roads (Fraley and Shepard 1989; MBTSG 1998); (3) the introduction and spread of nonnative species as a result of fish stocking and facilitated by degraded habitat conditions, particularly for brook trout and lake trout, which compete with bull trout for limited resources and, in the case of brook trout, hybridize with bull trout (Leary *et al.* 1993; Rieman *et al.* 2006); (4) in the Coastal-Puget Sound region where amphidromous bull trout occur, degradation of mainstem river FMO habitat, and the degradation and loss of marine nearshore foraging and migration habitat due to urban and residential development; and (5) degradation of foraging, migration, and overwintering habitat resulting from reduced prey base, roads, agriculture, development and dams.

2.3 Macfarlane's four-o'clock

2.3.1 Listing Status

Macfarlane's four-o'clock was originally listed as endangered in 1979 (44 FR 61912). Since that time additional populations have been discovered and some populations on Federal lands are being actively managed and monitored. Macfarlane's four-o'clock was down listed to threatened in March 1996 (61 FR 10693). Federal listing did not include critical habitat.

Macfarlane's four-o'clock is endemic to portions of the Snake, Salmon, and Imnaha River Canyons in Wallowa County in northeast Oregon, and adjacent Idaho County in Idaho. It is currently found in 13 Element Occurrences (EOs) in Idaho and Oregon (2 in the Imnaha, 3 in the Snake, and 8 in the Salmon drainages). [An Element Occurrence (EO) is an area of land and/or water in which a species or natural community is, or was, present. An EO should have practical conservation value for the Element as evidenced by potential continued (or historical) presence and/or regular recurrence at a given location (Service 2008)].

2.3.2 Species Description and Taxonomy

Macfarlane's four-o'clock is a member of the four-o'clock family (Nyctinaceae). It was first described in 1936 from specimens collected along the Snake River (Service 2000). Macfarlane's four-o'clock is morphologically similar to *Mirabilis greenei*, found in the Klamath region of California and Oregon. In contrast to M. greenei, Macfarlane's four-o'clock has broader leaves and shorter, nearly round bracts (Service 2000). At least two other species of *Mirabilis* occur in the Pacific Northwest (*M. linearis and M. bigelovii var. retrorsa*), but these species do not overlap in distribution with Macfarlane's four-o'clock (Service 2000).

Macfarlane's four-o'clock is a long-lived herbaceous perennial with a thickened taproot that is very deep in relation to the above ground portion of the plant. This species typically blooms from May through June. The bright pink flowers are conspicuous, up to one inch long by one inch wide. The flowers occur in inflorescences, consisting of a group of three to seven flowers subtended by a five-lobed involucre (saucer-shaped bract). Each flower has the potential to produce one fruit and one seed (Service 2000). The flowers are funnel-shaped with a widely expanding limb. Leaves are opposite, somewhat succulent, and broadly lanceolate (spear-shaped) to ovate (egg-shaped) (Service 2000). Individual stems have been observed to live over 20 years. Seeds are typically dispersed in June and July, and seed germination probably occurs in early spring. Seed germination and establishment may be infrequent and may be dependent upon a specific suite of environmental conditions (Service 2000).

In addition to reproducing by seed, plants reproduce clonally from a thick, woody tuber that sends out many shoots. Some populations comprise several clones. Studies on its genetic structure show that the species has lower genetic diversity than species with a similar life history (Assessment). The greatest level of gene flow (pollen or seed dispersal) occurred between populations that were less than one mile apart.

2.3.3 Environment and Habitat

Macfarlane's four-o'clock occurs in river canyon grassland habitats that are characterized by regionally warm and dry conditions. This species only occurs on the Wallowa-Whitman National Forest within the action area. Sites are dry and generally open, although scattered shrubs may be present. Plants often occur on southeast to western exposures, but can be found on all aspects. Slopes may be steep or nearly flat. Soils vary from sandy to talus (consisting of gravel and cobbles) substrate. This species' populations range from approximately 1,000 to 3,000 feet in elevation (Service 2000).

Habitat for Macfarlane's four-o'clock generally consists of bunchgrass communities dominated by *Agropyron spicatum* (bluebunch wheatgrass). Associated grass species include *Sporobolus cryptandrus* (sand dropseed), *Aristida longiseta* (red threeawn), and *Poa secunda* (Sandberg's bluegrass). Additional species that may be found in Macfarlane's four-o'clock habitat include *Achillea millefolium* (yarrow), *Alyssum alyssoides* (pale alyssum), *Bromus mollis* (soft brome), *B. tectorum* (cheatgrass), *Celtis reticulata* (hackberry), *Chrysothamnus nauseosus* (rabbitbrush), and *Rhus glabra* (smooth sumac).

A habitat analysis study conducted in Oregon showed that the distribution of MacFarlane's four-o' clock appeared to be influenced by slope aspect, soil development, topographic position, and the density of non-native species (Service 2000). Apparently suitable but unoccupied habitat tended to have a greater density of exotic species than adjacent occupied habitat (Service 2000). Throughout much of the Pacific Northwest, native bunchgrass (i.e., steppe) communities have been altered by the invasion of non-native annual grasses such as *Poa pratensis* (Kentucky bluegrass) and *bromus tectorum.* Disturbances such as fire and livestock grazing tend to favor the spread of *Bromus tectorum*, and eliminate native species such as *Agropyron spicatum* and *Festuca idahoensis* (Service 2000). Nearly all sites occupied by MacFarlane's four-o' clock contain at least some *Bromus tectorum.* During the past two decades, the invasion of noxious weeds has increased within canyon grassland habitats in the Salmon and Snake River Canyons. *Centaurea solstitialis* (Yellow star thistle), *Linaria genistifolia* (toadflax), and *Centaurea maculosa (*spotted knapweed) have encroached on poor and fair quality grassland habitats, and have invaded high quality sites to a lesser extent. These three exotic species have invaded MacFarlane's four-o' clock populations in the Salmon River drainage. *Centaurea solstitialis* is the number one noxious weed threat to Macfarlane's four-o'clock habitat within the Salmon River Canyon (Service 2000).

2.3.4 Distribution, Life History, and Populations

Macfarlane's four-o'clock habitat is limited to a unique geographic area in west-central Idaho and northeastern Oregon associated with the Hell's Canyon portion of the Snake River and the lower Imnaha and Salmon Rivers.

Macfarlane's four-o'clock is a long-lived herbaceous perennial species. This plant usually emerges from the ground by early April, blooms May through June, sets seed by mid-summer (June to July), then dies back to a large, tuberous root growing deep in the soil until the following spring. This species appears to reproduce mostly via the growth of underground rhizomes, which then send up new shoots, producing new, but genetically identical, plants or ramets. All the ramets arising from and including the "mother" plant are collectively known as the genet or clone. Although few surviving seedlings have been found during monitoring or other research, sexual reproduction is believed to occur based on the high number of distinct genets at some sites (Service 2000). The relative amount of sexual versus vegetative reproduction is unknown and may differ from site to site (Service 2000).
Several researchers have observed insect visitors to Macfarlane's four-o'clock plants that may act as pollinators for this species, including bumblebees (*Bombus* spp.) and solitary bees (*Anthophora* spp. and *Tetralonia* spp.) (Service 2000). Common floral visitors to Macfarlane's four-o'clock include long-tongued bees of several genera, such as *Anthophora*, *Bombus*, *Synhalonia*, and *Melecta* (Service 2000). These insects are vital to successful sexual reproduction in this species (Service 2000). Although Macfarlane's four-o'clock is self-compatible, it apparently requires a vector for pollination (Service 2000). Although it appears that sexual reproduction is not the main mode of spread for the species, it is a critical factor for maintaining genetic diversity and may be a key to long-term survival of the species.

Individual plants may live for many years, but the size of crown growth and number of flowers produced annually varies according to temperature and precipitation (Service 2000). Due to this life cycle pattern, the time of year when activities are most likely to directly impact this species is during the spring and early summer, when the plants are actively growing, flowering, or fruiting.

Thirteen EOs of this species are currently known - three of these populations are found in the Snake River Canyon area (Idaho County, Idaho and Wallowa County, Oregon), eight in the Salmon River area (Idaho County, Idaho), and two in the Imnaha River area (Wallowa County, Oregon). The total geographic range of the species occupies an area of approximately 29 by 18 miles (Service 2000).

Estimates of population size for this species are complicated by its clonal nature. The number of stems (or ramets) does not accurately reflect the number of genetic individuals (genets) in the population (Service 2000). Although the number of ramets per genet varies considerably for this species, (Service 2000) estimated a mean of 4.88 ramets per genet.

Some previous estimates for Macfarlane's four-o'clock were based on the number of stems, not the number of individuals. For example, the Final Rule for downlisting this species from endangered to threatened status (Service 1996) stated that roughly 7,000 individuals of this species existed; however, this number was based on an estimated total number of stems, not individuals of the species. In addition, the number of ramets visible from year to year can fluctuate dramatically, and may be dependant on local environmental conditions such as the amount of March and April precipitation (Service 2000).

The population size for all Macfarlane's four-o'clock populations in Idaho and Oregon was previously considered to range from 1,500 to 3,000 individuals (7,500 to 15,000 stems), based on estimates of clonal size (Service 2000) and on population estimates for Macfarlane's four-o'clock sites in Idaho and Oregon (Service 2000). However, recent information and survey data suggest that the total population size for this species is approximately 8,000 to 9,000 individuals (39,000 to 44,000 stems) (Service 2000).

Monitoring conducted by the Bureau of Land Management (BLM) from 1981 to 1998 has documented significant annual fluctuation in stem counts and foliar cover, which are influenced by annual climatic conditions such as temperature and precipitation. Population estimates are further complicated by the fact that seedlings (new individuals produced by sexual reproduction) are very difficult to distinguish from new stems produced clonally. Forest Service botanists have not observed seedling recruitment in areas of soil disturbance since these areas are subsequently invaded by weedy species (Service 2000).

2.3.5 Reasons for Listing/Threats

The Revised Recovery Plan for Macfarlane's four-o'clock (Service 2000) extensively discusses the reasons for Federal Listing, and the threats to this species. A summary of the threats from the Recovery Plan are documented here. The effects of ungulate grazing, exotic plant species, herbicide and pesticide spraying, and recreational activities (e.g., off-road vehicles and trampling), in addition to natural and man-made disturbances (e.g., landslides, floods, highway construction), among others, have been implicated as current threats and reasons for the decline of Macfarlane's four-o'clock.

2.3.6 Conservation Needs

The recovery plan for Macfarlane's four-o'clock has identified the following conservation needs for this species: 1) protect essential habitat and implement actions that may be necessary to eliminate or control threats. Manage habitat to maintain or enhance viable populations of this species; 2) monitor Macfarlane's four-o'clock population trends and habitat conditions; 3) conduct research essential to the conservation of the species; 4) conduct surveys in potential habitat areas. Manage and protect any newly discovered Macfarlane's four-o'clock populations; 5) establish propagule (seed, cutting, or spore) banks, including a long-term seed storage facility, for this species; 6) If warranted, establish and maintain new populations in areas where Macfarlane's four-o'clock has been extirpated after intensive surveys have confirmed extirpation; and 7) validate and revise recovery objectives as needed.

2.3.7 Conservation Actions

Conservation actions include: 1) the revised recovery plan for Macfarlane's four-o'clock; 2) BLM developed management plans for three Macfarlane's four-o'clock colonies on Federal land in Idaho which has reduced threats to some of this species sites from livestock grazing and herbicide spraying; 3) the Wallowa-Whitman National Forest and BLM have ongoing monitoring efforts on federal land for this species at several sites; and 4) Macfarlane's four-o'clock seed collection and long-term storage at the Berry Botanic Garden has been initiated.

These conservation actions contributed to the downlisting of Macfarlane's four-o'clock from endangered to threatened in 1996. Refer to the Revised Recovery Plan for Macfarlane's four-o'clock for additional information on conservation actions including details of locations of monitoring and estimated sizes of Macfarlane's four-o'clock populations on BLM and Forest lands.

2.4 Spalding's Catchfly

2.4.1 Listing Status

Spalding's catchfly was listed as a threatened species on October 10, 2001 (66 FR 51598, USFWS 2001) under the authority of the Act. Designation of critical habitat was determined to be prudent; however, it will not be designated until available resources and priorities allow (66 FR 51598, USFWS 2001). The recovery plan was finalized on September 6, 2007 (Service 2007).

Spalding's catchfly (*Silene spaldingii*) is an herbaceous perennial plant. It is a regional endemic found predominantly in bunchgrass grasslands and sagebrush-steppe, and occasionally in open pine communities, in eastern Washington, northeastern Oregon, west-central Idaho, western Montana, and barely extending into British Columbia, Canada. This species is affected by a variety of factors including competition with invasive nonnative plants; habitat destruction and fragmentation resulting from agricultural and urban development; habitat degradation; adverse grazing and trampling by domestic livestock and native herbivores; herbicide treatments; annual climatic conditions (i.e., drought cycles); climate change; alterations in fire frequency, intensity, and seasonality; off-highway vehicles; and a loss of genetic variation associated with small, fragmented populations (Service 2007).

2.4.2 Species Description and Taxonomy

Spalding's catchfly is a member of the pink or carnation family, the Caryophyllaceae. It was first collected by Henry Spalding around 1846 near the Clearwater River in Idaho and later described by Sereno Watson in 1875, based on the Spalding material (Service 2007). The species has no other scientific synonyms nor has its taxonomy been questioned. Common names for Spalding's catchfly include Spalding's catchfly, Spalding's silene, and Spalding's campion. Spalding's catchfly overlaps in range and is somewhat similar in appearance with *S. scouleri*, *S. douglasii*, *S. cserei*, *S. oregana*, and *S. scaposa var. scaposa* (Service 2007). One closely related species, bladder campion (*S. latifolia ssp. alba*), is an invasive nonnative plant. It may be separated from Spalding's catchfly by bladder campion's much larger, inflated looking flowers.

Spalding's catchfly is an herbaceous perennial, a plant that withers to the ground every fall and emerges again in spring. Plants range from 20 to 61 centimeters (8 to 24 inches) in height, occasionally up to 76 centimeters (30 inches). There is generally one light-green stem per plant, but sometimes there may be multiple stems. Each stem bears four to seven pairs of leaves that are 5 to 8 centimeters (2 to 3 inches) in length, and has swollen nodes where the leaves are attached to the stem. All green portions of the plant (leaves, stems, calyx [defined below]) are covered in dense sticky hairs that frequently trap dust and insects, hence the common name "catchfly." The plant has a persistent root crown atop a long taproot (1 meter [3 feet]) in length. Typically, Spalding's catchfly blooms from mid-July through August, but it can bloom into September.

Three to 20 (up to 60) flowers are horizontally positioned near the top of the plant in a branched arrangement (inflorescence). Flowers are approximately 1 centimeter (0.5 inch) long; however, the majority of the flower petal is enclosed within a leaf like tube, the calyx, that resembles green material elsewhere on the plant and has 10 veins running from the flower mouth to the base of the flower. The visible portion of the five flower petals is small (2 millimeters [0.08 inch]), cream-colored, and extends only slightly beyond the calyx. Below the visible flower petals (blades) are four to six very small (0.5 millimeter [0.02 inch]) appendages, the same color as the blades. Seeds are small (2 millimeters [0.08 inch]), wrinkled, flattened, winged, and light brown when mature (Service 2007).

2.4.3 Environment and Habitat

This species occurs on both the Umatilla and Wallowa-Whitman National Forest within the action area. Spalding's catchfly occurs at elevations between 365 to 1,615 meters (1,200 to 5,300 feet) (summarized in Service 2007). In general, summers are hot and dry, while winters are cool to cold and moist across the range of Spalding's catchfly A drought period occurs in mid and late summer when precipitation is minimal and temperatures are high (Service 2007). Consequently, most of the vegetation does not grow in summer, but can remain active during the winter months when moisture is more readily available. The majority of growth, however, occurs in spring (Service 2007). Spalding's catchfly is different in that it grows during the summer drought when the majority of the surrounding vegetation is dormant.

Spalding's catchfly is generally found in deep loamy soils (fertile soils comprised of organic material, clay, sand, and silt) and in more mesic, moist sites such as northern slopes, swales, or other small landscape features (Service 2007). Soils in the tri-state (Idaho, Oregon and Washington) area are loess (wind-dispersed) and ash (from volcanic eruptions) influenced while soils in Montana are more glacially influenced (Service 2007). Spalding's catchfly is found on a wide range of slopes, from flat areas to slopes as great as 70 percent. Most occurrences are found on grades ranging from 20 to 40 percent slope, although this may be an artifact of where intact habitat has not been converted to other uses (Service 2007).

Spalding's catchfly is found primarily within the plant association known as the Pacific Northwest Bunchgrass Grasslands, extending from Washington and Oregon into parts of Montana and into adjacent British Columbia and Alberta, Canada (Service 2007). Pacific Northwest bunchgrasses are characterized by one or both of two main bunchgrass species, *Agropyron spicatum* (bluebunch wheatgrass) and *Fesctuca idahoensis* (Idaho fescue), with *Festuca idahoensis* sometimes co- or subdominant with *Festuca scabrella* (rough fescue) in Montana (Service 2007).

Primary grassland habitat types within the Pacific Northwest bunchgrass grasslands include: 1) *Festuca idahoensis – Symphoricarpos albus* (snowberry); 2) *Festuca idahoensis – Rosa* spp. (rose); 3) *Festuca idahoensis – Koeleria cristata* (prairie junegrass); 4) *Agropyron spicatum – Festuca idahoensis* or *Festuca idahoensis – Agropyron spicatum*; and 5) *Festuca scabrella* (Service 2007). Primary shrub habitats include: 1) *Artemesia tridentata* (big sagebrush) – *Festuca idahoensis*; and 2) *Artemesia tripartite* (three-tip sagebrush) – *Festuca idahoensis*. Primary forest habitat types include: 1) *Pinus ponderosa* (ponderosa pine) – *Festuca idahoensis*; and 2) *Pinus ponderosa – Symphoricarpos albus*. In 2004, seventy-three percent of known Spalding's catchfly occurrences are within grassland habitat types, 20 percent within shrub habitat types, and seven percent within forest habitat types (summarized in Service 2007). Although the recent discovery of several new sites in the shrub-steppe of the Canyon Grasslands significantly increases the number of plants and sites in this habitat type. Some of the most difficult nonnative invasive plants to control in Spalding's catchfly habitat include *Centaurea solstitialis* (yellow star thistle), *Cardaria draba* (whitetop), *Centaurea maculosa* (spotted knapweed), *Euphorbia esula* (leafy spurge), *Hypericum perforatum* (St. Johnswort), and *Potentilla recta* (sulfur cinquefoil).

The recovery plan has split the occupied habitat of Spalding's catchfly into five physiographic regions that are characterized by distinctive physical features. These regions are distinctive from one another in climate, plant composition, historical fire frequencies, and soil characteristics. These differences are significant in that they may translate into differences in life histories, habitat trends, consequences of fire suppression, and types of weed control as they apply to conservation of Spalding's catchfly. The five physiographic regions utilized in the recovery plan are:

(1) the **Blue Mountain Basins** in northeastern Oregon;
(2) the **Canyon Grasslands** along the Snake, Salmon, Clearwater, GrandeRonde, and Imnaha Rivers in Idaho, Oregon, and Washington;
(3) the **Channeled Scablands** of east-central Washington;
(4) the **Intermontane Valleys** of northwestern Montana; and
(5) the **Palouse Grasslands** in southeastern Washington and adjacent west-central Idaho.

Blue Mountain Basins

The Blue Mountain Basins were once contiguous Pacific Northwest Bunchgrass Grasslands. Today much of the Wallowa Valley has been converted into residential or urban areas surrounded by agricultural and grazing lands. Soils are composed of deep loess similar to the Palouse Grasslands or glacial till soils such as those at the head of Wallowa Lake.

Spalding's catchfly occurs at its highest elevation (1,555 meters [5,100 feet]) within the Blue Mountain Basins, specifically the Wallowa Valley. The basin abuts habitat characterized as Canyon Grasslands, with no clear demarcation between the two regions. In the Blue Mountain Basins, Spalding's catchfly is often found along slopes of low broad ridges and ridgebrows, some with biscuit and swale topography (Service 2007). Within the Wallowa Valley, habitat is highly dissected by urban and agricultural lands. A large Spalding's catchfly population (over

500 individuals) occurs at the north end of Wallowa Lake. This population is the largest occurring on private land, other than land owned by TNC, and is threatened by urban development.

Rangewide suitable habitat for Spalding's catchfly would include all flat, east facing, northern facing, and even southern facing (at higher elevations) slopes between 365 to 1,615 meters (1,2000 to 5,300 feet) in elevation within *Festuca idahoensis* and *Festuca scabrella* communities that are associated with Pacific Northwest bunchgrasses, sagebrush-steppe, and open pine forests. However, even within what is presently understood to be suitable habitat, Spalding's catchfly is quite infrequent (rare). If another habitat parameter was identified that would help to narrow the definition of suitable habitat for this species, field searches could become more focused. At present it appears that there are vast tracts of suitable habitat for Spalding's catchfly on private and public lands within the Canyon Grasslands, Channeled Scablands, and the Blue Mountain Basins. Identifying a mechanism to help facilitate searches on these lands may identify other large populations where conservation efforts could occur.

Canyon Grasslands

Of the five physiographic regions where Spalding's catchfly is found, the habitat of the Canyon Grasslands is the most intact, largely because the canyon walls are steep and do not lend themselves to agricultural or urban developments. The Canyon Grasslands range widely in elevation, as evidenced by the presence of Hells Canyon, the deepest canyon in the United States at a depth of 7,900 feet; (Service 2007). The lowest elevation population of Spalding's catchfly occurs within the Canyon Grasslands. The dramatic range in elevation within the Canyon Grasslands results in marked variations in the climate and vegetation. Soils within the Canyon Grasslands range from solid bedrock cliffs to deep loess and ash deposits (Service 2007).

Within the Canyon Grasslands, Spalding's catchfly is found at elevations from 365 to 1,615 meters (1,200 to 5,300 feet) generally on northerly slopes that support more mesic *Festuca idahoensis* communities. Because of their steep nature, the Canyon Grasslands are the most under-surveyed area for Spalding's catchfly, and also represent the area where large populations of Spalding's catchfly may be most easily conserved because they are more removed from human influence.

Channeled Scablands

Spalding's catchfly is reported to be primarily associated with relict flood channels within the Channeled Scablands. More specifically, Spalding's catchfly is generally found on northern facing slopes below talus or rock outcroppings, gentle northern slopes just above valley floors, or on the northern sides of biscuits (Service 2007). The species is found at elevations from 472 to 747 meters (1,550 to 2,450 feet) within the Channeled Scablands. Since we lack earlier botanical surveys, we do not know how much Spalding's catchfly may have formerly occurred within the loess islands between channels. However, its affinity for deep soils elsewhere indicates that habitat conversion has most likely reduced the number of plants found on these loess islands.

Intermontane Valleys

Spalding's catchfly populations within Montana are disjunct (separated by well over 160 kilometers [100 miles]) from Spalding's catchfly sites elsewhere. Plants have only been found near Eureka on the Tobacco Plains, in the Niarada and Flathead Lake area, and, most recently, on the Lost Trail National Wildlife Refuge. The species is found at elevations from 820 to 1,150 meters (2,700 to 3,800 feet) within the Intermontane Valleys. Spalding's catchfly is found in small isolated grasslands outside the larger valleys delineated in Figure 4 of the recovery plan, demonstrated by the recent discoveries at the Lost Trail National Wildlife Refuge. Within Montana, *Festuca idahoensis* is codominant or subdominant with *Festuca scabrella*, sometimes near the forest's edge.

Palouse Grasslands

The Palouse Grasslands are extremely fertile and may comprise the world's best wheat land. An underlying basalt layer is covered with deep deposits of loess and ash, forming long undulating dune-like plains of rich soils. These soil deposits can reach depths of 105 to 140 meters (350 to 450 feet), although generally less, and have high moisture-holding capacity and water infiltration rates. Beginning in 1880, the Palouse Grasslands have undergone a dramatic conversion to farm lands. So much so, it is estimated that today only 0.1 percent of the grasslands remain in a natural state (Service 2007). The remains of the Palouse Grasslands include small remnants in rocky areas or at field corners (Service 2007). The Camas Prairie in Idaho between the Clearwater and Salmon Rivers is included with the Palouse Grasslands here because soil properties and land conversions are similar; however, the Camas Prairie is generally higher in elevation and cooler and moister than other portions of the Palouse Grasslands (Service 2007).

Spalding's catchfly within the Palouse Grasslands is restricted to small, fragmented populations ("eyebrows," field corners, cemeteries, rocky areas, and steptoes) on private lands, and in larger remnant habitats such as research lands owned by Washington State University or patches within the lower foothills of the Blue Mountains managed by the Umatilla National Forest. Elevations occupied by Spalding's catchfly within the Palouse Grasslands range from 700 to 1,340 meters (2,300 to 4,400 feet). Of all the places where Spalding's catchfly resides, the Palouse Grasslands are the most threatened, and care is needed to maintain occupied sites and representative genetic material from these sites.

2.4.4 Distribution, Life History and Populations

Within the United States, Spalding's catchfly is known from four counties in Idaho (Idaho, Latah, Lewis, and Nez Perce), four counties in Montana (Flathead, Lake, Lincoln, and Sanders), one county in Oregon (Wallowa), and five counties in Washington (Adams, Asotin, Lincoln, Spokane, and Whitman) (summarized in Service 2007). Two occurrence records of Spalding's catchfly are known in British Columbia, Canada, and both sites are located within one mile (1.6 kilometers) of plants in Montana (Service 2007); therefore, we consider these plants to be within one single population.

It is expected that more populations of Spalding's catchfly will be found in the future as survey efforts increase. To date, survey effort has been lower on privately owned lands than on publicly managed lands. Yet even with this lower survey effort, over half the known sites and estimated plant numbers occur on privately owned lands. Thirty-two of the known populations of Spalding's catchfly (32 percent) occur on lands that are entirely in private ownership, with an additional 18 populations (18 percent) in partial private ownership (summarized in Service 2007). The participation of private landowners, including organizations such as The Nature Conservancy (TNC), will therefore be vital in the recovery of this species.

There are only ten populations of Spalding's catchfly that may be considered relatively large, each with over 500 individuals (summarized in Service 2007). The largest population, with over 10,000 plants, is at TNC's Dancing Prairie Preserve in Montana, followed by Garden Creek, Idaho, with approximately 4,000 plants. The other eight large populations range from 500 plants at Coal Creek, Washington, to some 2,385 individuals at Crow Creek on the Wallowa-Whitman National Forest in Oregon. Approximately 78 percent of the total known individuals of Spalding's catchfly are found within these few large populations. Of the 99 known Spalding's catchfly populations, just over two thirds (66 populations, or 67 percent) are small populations, each made up of fewer than 100 individuals (summarized in Service 2007). Furthermore, much of the remaining habitat occupied by Spalding's catchfly is fragmented. For example, Spalding's catchfly populations in Oregon are located at least 64 kilometers (40 miles) from the nearest known populations in eastern Washington. When such small populations with few individuals are isolated and genetic exchange is not possible, they become vulnerable to the loss of genetic variation and, ultimately, the loss of the population itself (Service 2007).

It is not known how many Spalding's catchfly individuals and how much habitat may have been lost to human-related activities during the last 150 years since European settlement of this region. Historic documentation indicates the species has always been relatively rare (Service 2007), but because most land conversions within the plant's historical range took place before botanical surveys had been done, we may never know how extensive or numerous Spalding's catchfly once was. Instead, we assume that the loss and alteration of large portions of suitable habitat have translated to a decline in population numbers.

Four population extirpations have been documented since tracking of Spalding's catchfly began in the early 1980's (summarized in Service 2007). At least three other sites that formerly supported the species have been documented as having no plants present at the last visit (Service 2007). Populations are not necessarily considered extirpated, however, if sites are revisited and Spalding's catchfly is not found, because plants at these sites may be exhibiting prolonged dormancy. Subsequent visits are needed to confirm extirpations at such sites.

At the end of the first five years of a demography study, 72 percent of Spalding's catchfly plants remained alive, suggesting the plant regularly reaches an age of 15 to 20 years (Service 2007). However, it is hypothesized some individuals may live up to 30 years of age or longer. Seedlings generally sprout in spring, form rosettes the first year, and occasionally flower the second year, but generally flowering does not occur until during or after the third season (Service 2007). Adult plants emerge in spring, usually May, as either a stemmed plant, a rosette, or occasionally as a plant with both rosette(s) and stem(s) (Service 2007). Stemmed plants may remain vegetative or may become reproductive in July or August. Plants senesce or wither in fall (September or October), reappearing the next spring (Service 2007).

Spalding's catchfly exhibits prolonged or summer dormancy; that is, plants can remain below the ground, without leaves, for up to three years when conditions are unfavorable (Service 2007). A preliminary analysis suggests prolonged dormancy tends to be higher in summers preceded by a wet summer and dry fall (Service 2007). This prolonged dormancy can make population estimates and monitoring difficult. Long-term monitoring is necessary to accurately assess population trends of Spalding's catchfly. Due to this ability to go dormant, population estimates of Spalding's catchfly, if based on visible plants, will always be lower than the actual population size (Service 2007).

Seed dispersal studies have not yet been conducted on Spalding's catchfly. However, the capsules of Spalding's catchfly serve as an open cup from which seeds are likely carried by the wind, jostled out by passing wildlife, or tossed when plants are knocked over. Plants are generally just taller than surrounding vegetation and the seeds are small, flat, and somewhat winged. The plant height and seed characteristics suggest that short-distance wind dispersal may be common. In addition, the sticky nature of the plant makes it possible for portions of the plant to break off and stick to the fur of passing animals. This method of seed dispersal is probably infrequent but may provide an opportunity for more long distance dispersal.

Measuring new recruits (seedlings) of Spalding's catchfly within native habitats can be problematic. Adult plants can produce rosettes that are similar to those of seedlings. Various characteristics have been used to distinguish adult rosettes from seedling rosettes, including: seedling rosettes with a conspicuous lack of stem material between leaves, adult rosettes with a conspicuous lack of stem material between the leaves, seedling rosettes with hairless leaves, seedling leaves with hairs only along the edges, and leaf size (Service 2007).

Spalding's catchfly reproduces only by seed, with no means of vegetative reproduction (spread by vegetative growth) (Service 2007). The species is partially self-compatible, meaning the pollen is capable of fertilizing the female reproductive structures on the same plant. Flowers of Spalding's catchfly contain both male (stamen) and female (pistil) parts. However, the male parts mature, shed pollen, and wither prior to the female parts becoming receptive (Service 2007). This reduces the chances of self-pollination within an individual flower, but still allows for pollination between different flowers on the same plant.

Collectively, studies suggest that Spalding's catchfly reproduces best when outcrossing occurs, pollinators are essential in maintaining the fitness of Spalding's catchfly, adjacent invasive nonnative plants may negatively impact reproduction, and pollinators must consistently visit Spalding's catchfly.

Spalding's catchfly's primary pollinator, the bumblebee *Bombus fervidus*, is known from southern Canada and most of the United States, except the extreme south (Service 2007). The species is common within grasslands but rare in wooded foothills, and tends to build its nests either on or just below the surface of the ground, generally within the first foot (0.3 meter) of soil (Service 2007). The queen emerges from hibernation in spring and establishes a seasonal colony that can contain over 200 individuals by fall (Service 2007). In California, the queen flies from early April to late October, workers from early May to late October, and males from early July to early October (Service 2007). *Bombus* species are generally less faithful to a particular plant species than honey bees (*Apis* spp.) within a foraging trip and do not specialize on pollination of any one species or group of plant species; in other words, they utilize a wide range of plant species for nourishment (Service 2007).

The distance that pollinators can travel is significant to plants because pollen transfer and seed dispersal are the only mechanisms for genetic exchange. In general pollinators will focus on small areas where floral resources are abundant; however, occasional longer distance pollination will occur, albeit infrequently. Studies suggest that genetic exchange via pollen transfer may be extremely rare for distances over one mile (1.6 kilometers, or 1,600 meters). This is one of the rationales used when grouping Spalding's catchfly sites within one mile (1.6 kilometers) of one another as populations.

A preliminary genetic analysis of Spalding's catchfly leaf samples were taken from five sites, one in Idaho, one in Montana, one in Oregon, and two in Washington. Samples were collected during a year with low precipitation when many plants remained dormant and consequently sample sizes were small. All sites where material was collected were known to have at least 200 individuals in good years. This study found that genetic diversity of Spalding's catchfly was comparable to that of other rare *Silene* (*S. regia* and *S. hawaiiensis*), as well as other more common species in the genus (Service 2007). The only exception was that the Dancing Prairie site in Montana had lowered genetic diversity. This finding is consistent with the results of another study, which reported lower pollinator visitation rates and a higher incidence of fruit abortion at the Dancing Prairie site (Service 2007). This study also suggested that genetic diversity varies across the species' range, indicating that sites throughout the range of Spalding's catchfly need to be protected in order to preserve the full array of genetic variability within the species (Service 2007).

2.4.5 Reasons for Listing/Threats

The Recovery Plan for Spalding's catchfly (Service 2007) discusses the reasons for Federal Listing, and the threats to this species. A summary of the threats from the Recovery Plan are provided here. The effects of invasive nonnative plants, problems associated with small, geographically isolated populations, changes in the fire regime and fire effects, land conversion associated with urban and agricultural development, adverse livestock grazing and trampling, herbicide and insecticide spraying, adverse grazing (herbivory) and trampling by wildlife species, off-road vehicle use, insect damage and disease, impacts from prolonged drought and climate change, and inadequacy of existing regulatory mechanisms have been implicated as current threats and reasons for the decline of Spalding's catchfly.

2.4.6 Conservation Needs and Biological Constraints

The long-lived nature of Spalding's catchfly, in conjunction with sporadic and rare recruitment, delayed maturity, cryptic rosettes that may disappear before monitoring, prolonged dormancy, and difficulties identifying seedlings, make it challenging to measure changes in numbers of individuals of this species. For plants exhibiting prolonged dormancy, population trend monitoring needs to occur for three or more consecutive years every 5 to 20 years to adequately assess trends at a given site (Service 2007). Although population trend and demographic monitoring is occurring at a number of sites, long-term monitoring of this kind has occurred at only one Spalding's catchfly site, the Dancing Prairie Preserve in Montana (see section H, Conservation Efforts, in the Assessment). Monitoring efforts to date have not used consistent methodologies so comparisons of key life history parameters across the range of the species are difficult.

Ground disturbing activities including fires, adverse livestock grazing and trampling, and off-road vehicle use impact Spalding's catchfly the most during the flowering and seeding period (late July to September) and during seedling and shoot emergence in early spring. Small, isolated populations relegated to remnant fragments of native habitat pose a problem as their viability into the future is questionable. Spalding's catchfly requires grasslands dominated by native vegetation, with adequate numbers of pollinators available and other Spalding's catchfly populations close enough (within 1.6 kilometers [1 mile]) to provide for pollen exchange and enhance gene flow and genetic variability.

2.4.7 Conservation Actions

Inventories for Spalding's catchfly are being conducted on all lands managed by the Federal government where the plant currently resides or where there is suitable habitat. In Oregon, TNC is in the process of inventorying its acquired Zumwalt Prairie Preserve and their Clear Lake Ridge Preserve lands have been inventoried (summarized in Service 2007). The Wallowa-Whitman National Forest has begun surveying active grazing allotments, including areas within the Imnaha River Canyon and the lower Joseph Creek area (Service 2007). Inventories on Nez Perce Tribal Land were completed in 2005 and 2006. No new populations were reported after the 2005 effort (Service 2007).

In Oregon, monitoring plots for Spalding's catchfly were established at Clear Lake Ridge in 1990, but were not revisited until 2002 (Service 2007). The Wallowa-Whitman National Forest has funding to design a set of monitoring methodologies on their land, as well as TNC lands in Oregon (Service 2007). Three permanent monitoring plots have been established on TNC's Zumwalt Prairie Preserve to collect baseline abundance data and examine the effects of burning and grazing treatments (Taylor *et al.* 2006). In addition, phenology of this species was tracked during 2006 on the Zumwalt Prairie Preserve (Dingeldein *et al.* 2006).

Control of *Potentilla recta (*an invasive non native plant*)* is occurring adjacent to Spalding's catchfly populations at TNC's Zumwalt Preserve in Oregon (Service 2007). Invasive nonnative plant control is an ongoing activity on most Federal lands. Because Spalding's catchfly is a threatened species under the Endangered Species Act, Federal agencies are required to consider this species in developing guidelines for all invasive nonnative plant control activities within the plant's range.

A limited amount of invasive non-native plant control has occurred at the Chief Joseph Gravesite monument near Joseph, Oregon and an Integrated Pest Management Plan has been established for the site (Service 2007). Annual grasses exist near Spalding's catchfly sites at Crow Creek on the Wallowa-Whitman National Forest in Oregon where grazing practices are being altered to improve range condition. One *Centaurea solstitialis* patch, located on private land, is within 0.8 kilometer (0.5 mile) of one Spalding's catchfly site at Crow Creek and has been treated for five years by U.S. Forest Service personnel (J. Hustafa, USFS, pers. comm. 1999). *Centaurea maculosa* is being treated along the road to the above Spalding's catchfly site (Service 2007).

The Joseph Creek population managed by the Nez Perce Tribe does not have significant noxious weed issues. The bunchgrass community is nearly pristine with very limited amounts of *Bromus tectorum* present. A small *Crupina vulgaris* population exists within 0.4 kilometer (0.25 mile) of the site and will continue to be hand pulled by tribal staff. No domestic livestock grazing is currently allowed at this site (Service 2007).

State conservation efforts, including inventory, monitoring and demographic studies, additional sources of scientific information on this species, invasive non-native plant control efforts, and additional conservation actions have been completed or are ongoing at several Spalding's catchfly populations within each state where the species occurs. Refer to the Recovery Plan for more information on state conservation efforts (Service 2007).

3. Environmental Baseline

Regulations implementing the Act (50§CFR 402.02) define the environmental baseline as the past and present impacts of all federal, state, or private actions and other human activities in the action area. Also included in the environmental baseline are the anticipated impacts of all proposed Federal projects in the action area which have undergone Section 7 consultation, and impacts of state and private actions which are contemporaneous with the consultation in progress. The action area is defined at 50 CFR 402 to imply all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action.

3.1 Bull Trout

3.1.1 Status of the Species and Critical Habitat in the Action Area

The Columbia River bull trout distribution within the Action Area includes portions of recovery units in Oregon and Washington, and the Hells Canyon Complex within the Wallowa Whitman National Forest, Hells Canyon Recreation Area in Idaho. Subbasins and watersheds include the John Day, Umatilla, Walla Walla, Grande Ronde River, Imnaha River, Sheep, Granite, Pine-Indian, Wildhorse, Powder River, Tucannon River, and Asotin Creek.

Current known bull trout distribution within Umatilla and Wallowa-Whitman National Forests includes portions of six interim recovery units in Oregon and Washington: John Day River, Umatilla/Walla Walla Rivers, Grande Ronde River, Imnaha-Snake River, Hells Canyon Complex, and Snake River.

John Day River Interim Recovery Unit

The entire John Day basin is contained in this interim recovery unit, 8,200 square miles, including the John Day mainstem, the North, Middle and South forks of the John Day River. Historically, bull trout were found throughout most of the John Day River basin. Complete distribution is undocumented, but seasonal use of the Columbia River by bull trout from the John Day River system was likely. Presently, bull trout distribution is limited primarily to the headwaters of the North Fork John Day River, Middle Fork John Day River, and upper mainstem John Day River and tributaries, with seasonal use of the mainstem river downstream to the vicinity of the town of John Day. The North Fork has the most bull trout habitat of the three John Day subbasins.

The John Day River Recovery Unit Team has identified one core area and 12 extant local populations in the interim recovery unit. Overall, bull trout in the John Day River Recovery Unit persist at low abundance. Comprehensive adult population estimates for the Unit were not available during the preparation of the draft recovery plan. While both the migratory and resident life history forms persist in the core area, only the migratory form was evaluated relative to effective population size guidance. The Unit Team assumed that abundance levels for migratory bull trout in individual local populations was below 100 spawners per year, and therefore are at risk of inbreeding depression. Similarly, the Unit Team concluded that the core area currently supported less than 1,000 migratory adults per year and consequently was at risk from genetic drift.

A discussion of bull trout status within the John Day River interim Recovery Unit can be found in Chapter 9 of the Draft Bull Trout Recovery Plan (Service 2002).

Umatilla/Walla Walla Interim Recovery Unit

This interim recovery unit encompasses the entire drainages of the Umatilla and Walla Walla rivers. The Umatilla River basin is located wholly in Oregon, while the Walla Walla River basin includes portions in Oregon and Washington. Two core areas are defined for this interim recovery unit, one for the Umatilla basin and one for the Walla Walla basin. Currently, there are four known bull trout local populations in this unit, three in the Walla Walla River basin and one in the Umatilla River basin.

Within the Umatilla basin, bull trout local populations in the South Fork Umatilla River and Meacham Creek are considered to be at high risk of extirpation, while the local population in the North Fork Umatilla River is larger but still considered to be depressed. Bull trout in the Umatilla Core Area are classified as at increased risk from deleterious effects of genetic drift. Within the Walla Walla basin, bull trout local populations are at high risk of extirpation in the North Fork Walla Walla River, at low risk of extirpation in the South Fork Walla Walla River, and of special concern in Mill Creek. The status of bull trout in the Touchet River is largely unknown. Bull trout in the Walla Walla Core Area are not at risk from genetic drift.
Fish habitat in the Umatilla-Walla Walla interim Recovery Unit has been altered significantly by historic and current land use practices. Land uses affecting bull trout habitat in the Umatilla and

Walla Walla basins include water diversions for crop and pasture irrigation, forest management practices, poorly managed grazing practices and urbanization along rivers.

A discussion of bull trout status within the Umatilla/Walla Walla interim Recovery Unit can be found in Chapter 10 of the Draft Bull Trout Recovery Plan (Service 2002).

Grande Ronde River Interim Recovery Unit

This interim recovery unit is located in northeast Oregon and southeast Washington. In the past, bull trout occurred throughout the Grande Ronde River subbasin. Although bull trout were probably never as abundant as other salmonids in the subbasin, they were more abundant and more widely distributed than they are today.

The Grande Ronde River Recovery Unit Team identified two core areas, the Grande Ronde and the Little Minam. Wenatchee Creek (also known as Menatchee Creek) is potentially a core area but lacks sufficient survey data to include as a core area at this time. Nine local populations are identified within this interim recovery unit. The original local population of bull trout in the Wallowa River complex is believed to have been extirpated (Buchanan *et al.* 1997). In 1997, 600 bull trout from Big Sheep Creek, a tributary to the Imnaha River, were introduced into the Wallowa River above Wallowa Lake. Currently, these fish are still present in the system, but their exact population numbers are not known. Bull trout in the Unit persist at moderate levels. In the Grande Ronde Core Area, the best estimates are that approximately 4,000 bull trout spawned in each of the past few years. In the Little Minam Core Area the best estimates are that approximately 750 bull trout spawned in each of the past few years. Bull trout in the Grande Ronde and Little Minam core areas are at a diminished risk of genetic drift.

A discussion of bull trout status within the Grande Ronde River interim Recovery Unit can be found in Chapter 11 of the Draft Bull Trout Recovery Plan (Service 2002).

Imnaha-Snake River Interim Recovery Unit

This interim recovery unit encompasses the entire Imnaha River subbasin located in northeastern Oregon and Sheep and Granite subbasins in Idaho. Three core areas identified for the purpose of bull trout recovery are the Imnaha River, Sheep Creek and Granite Creek. The Imnaha Core Area contains four local populations. Bull trout in the Imnaha Core Area persist at moderate numbers; the best estimates are that approximately 4,000 bull trout have spawned annually for the past few years. The Sheep Creek Core Area contains one local population and Granite Creek Core Area contains one local population. Adult abundance in the Sheep Creek and Granite Creek core areas are unknown.

Overall, adult abundance in the Imnaha River Core Area was estimated at approximately 4,000 adults and is not considered at risk from genetic drift. Abundance estimates in the Sheep Creek and Granite Creek core areas are not available, so the risk to local populations from inbreeding depression and the risk to core areas for genetic drift could not be determined at the time of the publishing of the draft recovery plan.

A discussion of bull trout status within Imnaha-Snake interim Recovery Unit can be found in Chapter 12 of the Draft Bull Trout Recovery Plan (Service 2002).

Hells Canyon Complex Interim Recovery Unit

This interim recovery unit includes basins in Idaho and Oregon draining into the Snake River and its associated reservoirs from below the confluence of the Weiser River downstream to Hells Canyon Dam. Comprehensive data on bull trout abundance through time in the recovery unit does not exist.

Currently, there are 17 local populations and two areas with potential spawning and rearing habitat within two core areas in this interim recovery unit. Current local populations exist at low abundance and are considered to be at risk from genetic drift.

Accurate adult abundance estimates for bull trout in the interim recovery unit were not available at the time the draft recovery plan was published. Consequently, local populations could not be evaluated relative to the risk of inbreeding. The Hells Canyon Complex Recovery Unit Team currently estimates that each core area (Pine-Indian-Wildhorse and Powder River) currently contains less than 500 adult fish per year. These core areas are currently at risk from genetic drift.

A discussion of bull trout status within the Hells Canyon Complex interim Recovery Unit can be found in Chapter 13 of the Draft Bull Trout Recovery Plan (Service 2002).

Snake River Interim Recovery Unit

This interim recovery unit encompasses selected tributaries of the Snake River from Lower Monumental Dam (river mile 42) upstream to the mouth of the Grande Ronde River (river mile 169). There are two core areas in this recovery unit: the Tucannon River, which contains eight local populations; and Asotin Creek, which contains two local populations. Current knowledge indicates that local populations within the interim recovery unit consist of migratory and resident life history forms.

In portions of this interim recovery unit, bull trout have been extirpated from their former habitat. Other local populations may be fragmented and isolated in headwater locations because of natural or manmade barriers. There is not enough current survey data to make a reliable population estimate. The Snake River Recovery Unit Team believes that bull trout in the Tucannon River Core Area are at intermediate risk, while those of the Asotin Creek Core Area are at increasing risk.

Adult abundance in the Tucannon River Core Area was estimated (based on redd counts) at 600 to 700 adult spawners per year in the eight known local populations. Adult abundance in the Asotin Creek Core Area was estimated at less than 300 individuals in two known local populations, based on the results of bull trout surveys. Bull trout in the Tucannon River Core Area were considered at intermediate risk of inbreeding depression and should be considered at risk from genetic drift. Bull trout in the Asotin Creek Core Area were considered at an increasing risk of inbreeding depression and should be considered at risk from genetic drift.

A discussion of bull trout status within the Snake River Recovery interim Recovery Unit can be found in Chapter 24 of the Draft Bull Trout Recovery Plan (Service 2002).

Watersheds that contain bull trout within the Action Area

Bull trout are found in the following **fifth field** (sixth field) watersheds on the Umatilla National Forest: For specific information on habitat use, refer to the Bull Trout Draft Recovery Plan (Service 2002). More detailed information on each core area is provided in Appendix B.

- **Asotin Creek** (North Fork Asotin Creek),
- **Big Creek** (Dixson Bar, Big Creek, Corral Creek, Oriental Creek, Texas Bar)
- **Desolation** (North Fork Desolation, Upper Desolation/Battle, Kelsay, Lower Desolation)
- **Grande Ronde River/Grossman Creek** (Elbow Creek, Grande Ronde River/Bear Creek),
- **Granite Creek** (Clear Creek),
- **Lookingglass Creek** (Little Lookingglass Creek, Upper Lookingglass Creek, Lower Lookingglass Creek),
- **Meacham Creek** (Boston Canyon, Camp Creek, North Fork Meacham Creek),
- **Mill Creek** (Upper Mill Creek),
- **Upper Touchet River** (Upper North Fork Touchet River),
- **Upper Tucannon River** (Cummings Creek, Little Tucannon River, Tucannon River Headwaters, Panjab Creek),
- **Upper Camas** (Hidaway, Cable [Currently not occupied, but both are considered for relocation])
- **NF John Day River** (NF John Day River, Baldy Creek, NF John Day River Crane Creek)
- **Upper Umatilla River** (Bear Creek, North Fork Umatilla River, Buck Creek, Ryan Creek, South Fork Umatilla River, Thomas Creek),
- **Upper Walla Walla River** (North Fork Walla Walla River, Upper South Fork Walla Walla River, Middle South Fork Walla Walla River) and
- **Wenaha River** (Upper South Fork Wenaha River, Lower South Fork Wenaha River, Wenaha River/Rock Creek, Lower Butte Creek, Upper Butte Creek, Wenaha River/Cross Canyon, Upper Crooked Creek, Lower Crooked Creek, Lower Wenaha River, First Creek).

Bull trout are found in the following **fifth field** (sixth field) watersheds on the Wallowa-Whitman National Forest:

- **Upper NF John Day River** (NF John Day River Baldy Creek, Trail Creek, NF John Day River Onion Creek, NF John Day River Crane Creek)
- **Granite** (Upper Granite Creek, Beaver Creek, Clear Creek, Lower Granite Creek)
- **Upper Powder River** (Cracker Creek, Deer Creek)
- **Powder River/Rock Creek** (Upper Salmon, Lower Salmon, Muddy Creek)
- **North Powder River** (Lower Anthony Creek, Upper Anthony Creek, Upper North Powder River)
- **Wolf Creek** (Upper Wolf Creek)

- **Powder River/Eagle** (Upper Eagle Creek, West Eagle Creek, Eagle Creek/Bennett Creek, East Fork Eagle Creek, Eagle Creek/Paddy Creek, Little Eagle Creek, Lower Eagle Creek)
- **Pine Creek** (Upper Pine Creek, Clear Creek, Lake Fork Creek)
- **Lower Imnaha River** (Imnaha River/Fence Creek)
- **Middle Imnaha River** (Imnaha River/Summit Creek, Chalk Creek, Deer Creek)
- **Upper Imnaha River** (North Fork Imnaha River, Sough Fork Imnaha River, Imnaha River/Rock Creek, Imnaha River/Dry Creek, Imnaha River/Crazyman Creek)
- **Upper Big Sheep Creek** (Upper Big Sheep Creek, Lick Creek, Big Sheep Creek/Tyee Creek, Big Sheep Creek/Corral Creek, Big Sheep Creek/Marr Creek, Big Sheep Creek/Steer Creek)
- **Lower Big Sheep Creek** (Upper Little Sheep Creek, Big Sheep Creek/Lower Little Sheep Creek, McCully Creek)
- **Upper Grande Ronde River** (Tanner Gulch, Limber Jim Creek, Meadowbrook Creek, Chicken Creek, Lower Fly Creek, Warm Springs Creek)
- **Upper Catherine Creek** (North Fork Catherine Creek, South Fork Catherine Creek, Catherine Creek/Milk Creek, Catherine Creek/Brinker Creek)
- **Grande Ronde/Indian Creek** (Grande Ronde/Imbler Creek, Upper Indian Creek, Lower Indian Creek)
- **Grossman Creek** (Grande Ronde River/Clear Creek)
- **Upper Wallowa River** (Hurricane Creek)
- **Lostine River** (Upper Lostine River, Lostine River/Lake Creek, Lostine River/Silver Creek)
- **Bear Creek** (Upper Bear Creek, Lower Bear Creek)
- **Lower Wallowa River** (Deer Creek, Wallowa River/Water Canyon, Wallowa River/ Fisher Creek)
- **Minam River** (Upper Minam River, Minam River/China Cap Creek, North Minam River, Minam River/Chaparral Creek, Little Minam River, Minam River/Trout Creek, Lower Minam River)

Bull Trout Critical Habitat in the Action Area

National Forest lands are not designated as bull trout critical habitat within the action area. The project may affect some downstream critical habitat, but the miles of critical habitat affected is anticipated to be very small due to the use of the PDFs and limited miles of bull trout critical habitat (on non-federal lands) within the action area.

3.1.2 Factors Affecting Species Environment/Critical Habitat within the Action Area

This section describes factors affecting the species' environment and/or critical habitat in the action area. The environmental baseline includes all Federal, State, tribal, local, and private actions already affecting the species and/or critical habitat or that will occur contemporaneously with the proposed action. Unrelated Federal actions affecting the same species or critical habitat that have completed formal or informal consultation are also part of the environmental baseline, as are other beneficial actions.

John Day Subbasin

Altered hydrology, water quality, and stream habitat conditions throughout the John Day River Subbasin from past and present land use practices (forestry, roads, mining, agriculture, and livestock grazing) as well as introduced species and projected climate change [reduced stream flows, increased water temperatures, and increased fire frequency, (Rieman *et al.* 2007)] have impacted or, in the case of climate change, is projected to impact bull trout in this basin.

Umatilla and Walla Walla Subbasins

Fish habitat in the Umatilla and Walla Walla subbasins has been altered significantly by historic and current land use practices. Land uses affecting bull trout habitat include water diversions for crop and pasture irrigation, forest management practices, roads contributing to fish passage barriers and sediment delivery, poorly managed grazing practices and urbanization along rivers. Historic fish management practices for bull trout, illegal harvest of bull trout, efforts to eradicate bull trout, and stocking of brook trout have also been factors in the decline of bull trout. In addition, projected climate change may impact bull trout in these subbasins (Rieman *et al.* 2007).

A number of barriers or impediments to bull trout passage and rearing have been identified since 1998 (Mendel *et al.* 2002, 2003). Some of the barriers are physical conditions (e.g., structures or dewatered streambeds) that block movement (see Mendel *et al.* 2003), others are physiological barriers (e.g., temperature, sediment, lack of pools). Physiological barriers and impediments to bull trout passage and rearing were extensive in terms of stream miles affected. Water temperature appears to be the most critical physiological barrier, particularly for passage or rearing. Seasonal temperature-related barriers for bull trout generally occur in lower areas of the Walla Walla River.

Grande Ronde Subbasin

Altered hydrology, water quality, and stream habitat conditions throughout the Grande Ronde subbasin from past and present land use practices (construction and operation of dams and roads, forestry practices, mining, grazing, agricultural development, and fire management) as well as introduced species, loss of anadromous fish, angling harvest and projected climate change have impacted or, in the case of climate change, is projected to impact bull trout in this subbasin.

Imnaha River Subbasin

Historic and current land use activities have impacted bull trout local populations. Specific barriers (mostly associated with the Wallowa Valley Improvement Canal) may be inhibiting the recovery of bull trout and are identified in the draft recovery plan as a priority 2 action. Threats to bull trout in this subbasin include loss of anadromous fish, agricultural development (including the diversion on Big Sheep), grazing, floodplain roads, forestry practices, water quality (due to agricultural practices), residential development along the Imnaha, and introduced species. In addition, projected climate change may impact bull trout in this subbasin.

Pine-Indian Subbasin ,Wildhorse, and Powder River Subbasins

Currently, habitat fragmentation and degradation are likely the most limiting factors for bull trout throughout these subbasins. In the Snake River, large dams of the Hells Canyon Complex lack fish passage and have isolated bull trout among three basins: the Pine Creek and Indian Creek watersheds, Wildhorse River, and Powder River.

Isolation of local populations and habitat fragmentation due to passage barriers posed by culverts, irrigation diversions, and dams are the primary threats to bull trout in the Pine-Indian-Wildhorse core area. Agricultural and grazing practices have resulted in numerous diversions in the Pine Valley. These diversions typically have resulted in reduced instream flow and elevated stream temperatures. Although local residents have begun screening some of the intakes in this core area, many remain unscreened and may result in loss of juvenile bull trout during dispersal (HCCRUT, *in litt.* 2003b). Brook trout are a significant threat to bull trout in the Pine-Indian-Wildhorse core area. Brook trout co-occur with bull trout in many locations and numerous hybrids have been documented. The Hells Canyon Dams have isolated bull trout in this core area from local populations located upstream of Brownlee Dam and downstream of Hells Canyon Dam. The Oxbow Dam isolates bull trout in the Wildhorse drainage from the rest of the bull trout local populations in this core area. Two-way passage around Oxbow Dam is necessary for the continued survival of the Crooked River local population of bull trout.

Bull trout in certain portions of the Pine-Indian-Wildhorse core area are also threatened by bank trampling from historic and current grazing practices, leading to increased sedimentation and reduced riparian habitat that results in channel widening, and increased water temperatures. Impacts from grazing vary throughout the core area from relatively low to high; impacts are more significant in certain reaches of Clear Creek, East Pine Creek and Lake Fork Creek (HCCRUT, *in litt.* 2003b). Roads also pose a threat to most bull trout local populations in this core area due to increased sedimentation, reduced riparian habitat, and reduced streambank stability resulting from historic placement and current lack of maintenance of county and certain forest roads (HCCRUT, *in litt.* 2003b). Historic mining, particularly in upper Pine Creek and Indian (ID) Creek drainages, has resulted in potential water quality degradation of these streams. Roads provide access for anglers, resulting in incidental angling pressure and illegal harvest threats to bull trout in this core area.

In the Powder River Core Area, bull trout only remain in the uppermost parts of the watershed that have not been degraded. This core area has been significantly affected by the Snake River dams, as well as from Thief Valley and Mason Dam on the Powder River. Historic dredge tailings and current agricultural water diversions also have contributed to degraded stream habitat and/or eliminated water in the streams.

Tucannon River and Asotin Creek Watersheds

Historic land use practices have degraded bull trout habitat in this area. Dams installed in the early 1900's continue to block migration and may have significantly reduced important bull trout populations. Agricultural and irrigation practices, river channel modifications, improper livestock grazing methods, poor forestry practices, urbanization, and competition with nonnative fish species also threaten bull trout.

3.2 Macfarlane's four-o'clock

3.2.1 Known Occurrences in the Action Area

Within the action area, Macfarlane's four-o'clock only occurs on the Wallowa-Whitman National Forest and grows in river canyon grassland habitats characterized by regionally warm and dry conditions. It is endemic to low to mid-elevation canyon grassland habitats in west-central Idaho and northeastern Oregon. Precipitation occurs during winter and spring. Sites are generally open, with scattered shrubs. Plants are found on all aspects as well as slopes ranging from steep to flat. Elevations range from 300 to 900 meters (1,000 to 3,000 feet). Soils vary from sandy to talus substrate. All currently known populations occur in two counties: Idaho County, Idaho and Wallowa County, Oregon. The twelve known populations are found in the Snake River Canyon area, the Salmon River drainage, and the Imnaha River drainage (USDA Forest Service 2003).

Habitat generally consists of bunchgrass communities, most often on steep slopes. A habitat analysis study conducted in Oregon showed that distribution appeared to be influenced by slope aspect, soil development, topographic position, and the density of non-native plants (Kaye 1992). At least two populations experienced burning from wildfire. Both populations survived with no apparent effects from burning.

Within the action area, occurrences cross into different ownerships. The Snake River occurrences are all located on Forest Service land. The Salmon River occurrences are on both BLM and private land, while one site out of two in the Imnaha drainage is about half on Forest Service land, half on private land.

The best description of populations within the action area can be found in the Hells Canyon National Recreation Area (HCNRA) Final Environmental Impact Statement Comprehensive Management Plan (USDA Forest Service 2003). The following descriptions are from that document, but only discuss the Snake River and Imnaha populations.

The Snake River occurrences include the largest population in Oregon. This population (called Tryon Bar) is estimated at 3,000 plants. It is one continuous colony spread over approximately 300 acres. Another population, Pleasant Valley, Oregon is located in the Hells Canyon Wilderness along the lower slopes of the Snake River about one mile north of Pittsburg Landing (an area known for invasive plants). The population size is estimated at 100 plants distributed in clumps over one acre. The Island Gulch population on the Idaho side is a short distance north of Pittsburg Landing with an estimated 40 plants over 0.1 acre. The Mine Gulch site is just north and east of Island Gulch with a population estimated at 150 plants over two acres. The West Creek site in Idaho is estimated at 250 plants over two acres, while a grouping of several occurrences in the same Pittsburg grazing allotment are located nearby with an estimated 1,584 plants.

The Imnaha population is on both private and Forest Service land. The population estimate does not split between ownership, but about 350 plants are located on approximately 20 acres.

Given the above distribution descriptions, roughly 6,000 plants occur on Forest Service land out of the current estimate of 8,000 to 9,000 individuals. As mentioned earlier, it is difficult to establish which stems are from which individual/clone. More specific information on each individual Element Occurrence (EO) within the action area is provided in Appendix C.

3.2.2 Factors Affecting Species Environment within the Action Area

The invasion of non-native plant species continues to be a major threat to Macfarlane's four-o'clock. Colket *et al.* 2006 report all EOs in Idaho contain one or more species of invasive nonnative plants, especially *Bromus tectorum*. While these descriptive notes may be helpful in interpreting or comparing photographs taken over time or at different monitoring sites, or documenting management issues at a site, the lack of quantitative monitoring data makes it difficult to evaluate or document the success of weed control, presently one of the main Macfarlane's four-o'clock management efforts (Mancuso and Shepherd 2008).

The threat from non-native weed invasions into Macfarlane's four-o'clock sites could adversely impact the species and its recovery. There are many negative ecological impacts associated with noxious weeds which include, but not limited to: displacement of native plants, reduced biodiversity, altered normal ecological processes (e.g., nutrient cycling, water cycling), a decrease in wildlife habitat value, and increased soil erosion and stream sedimentation potential.

The effects of wildfire on the habitat of Macfarlane's four-o'clock encompass several categories, most of which are interrelated and often difficult to isolate from each other and equates to the loss of habitat for Macfarlane's four-o'clock and other native species (Billings 1994). For example, the invasion and establishment on non-native annual grasses and forbs following wildfire increases the amount and continuity of fine fuels across the landscape, which in turn increases the likelihood of frequent and intense wildfires in habitats that support Macfarlane's four-o'clock.

Organisms adapt to disturbances such as historical wildfire regimes (fire frequency, intensity, and seasonality) with which they have evolved (Landres *et al.* 1999), and different rare species respond differently to wildfires (Hessel and Spackman 1995). In general, fire regimes within forest and steppe habitats in the western United States have been highly disrupted (Whisenant 1990). In some instances, fire suppression has allowed grasslands to be invaded by trees (Lesica and Martin 2003). At the same time, in many grassland and shrub habitats fire frequencies have increased due to the expansion and invasion of annual nonnative grasses (Whisenant 1990). These invasive annual nonnative grasses fill gaps that would naturally occur between native vegetation, dramatically increasing the ability of wildfire to spread. At least six Macfarlane's four-o'clock EOs have been burned since 1990 (Idaho EO#1, EO#2, EO#6, and EO#7; in Oregon EO#1 and EO#5) and of these 5 are in the action area (all but Idaho EO#1). Almost all of the EOs have become infested with non-native plants such as *Bromus tectorum* and *Centaurea solsitialis*, making them more vulnerable to wildfires (Mancuso and Shepherd 2008; Colket *et al.* 2006).

Wildfires that occur during summer and fall months when Macfarlane's four-o'clock plants are dormant may have minimal direct effects on this species since the underground rhizomes will be largely insulated from fire (Service 2000). However, the effects of wildfires often result in adverse changes in the ecological conditions of sites that can lead to the subsequent invasion of exotic species. Additionally, increased concentrations of ungulates grazing within the burned areas, might result in increased trampling of Macfarlane's four-o'clock plants. The primary concern from wildfires appears to be during the active growing period (April through June) when the aboveground plants would be susceptible to fire kill or injury (Service 2000). Finally, while there is information that there is higher seedset in Macfarlane's four-o'clock plants with larger inflorescence displays than those with smaller displays (Barnes 1996), there is no information available about seed production and set in a post-wildfire setting.

Grazing by native herbivores and domestic livestock grazing on Macfarlane's four-o'clock was identified as a potential threat to the species in the 1996 reclassification from endangered to threatened status (Service 1996). Macfarlane's four-o'clock has been able to persist in areas presently in poor ecological condition and historically grazed by livestock since the 1870's. Preliminary data suggests grazing may have a negative effect on plant height, but additional research is needed (Johnson 1984; Kaye and Meinke 1992). Currently, the most serious impacts from livestock grazing are likely indirect, most notably related to habitat degradation.

Although it is uncertain whether most or all Macfarlane's four-o'clock populations were grazed by domestic livestock in the past, livestock grazing still occurs at some sites (U.S. Fish and Wildlife Service 2000). Livestock impact this species directly by trampling or consuming plants (Kaye 1995), and can result in reduced reproduction (i.e., seed set) for Macfarlane's four-o'clock plants. All known Macfarlane's four-o'clock EOs in Idaho and Oregon have had some level of sheep and/or cattle grazing in the past (Craig Johnson, BLM, pers. comm. 2008). In Oregon, the Forest Service has excluded grazing with fencing in Hells Canyon (EO#6) and one Forest Service administrative site (EO#5) in the Imnaha River Canyon (Yates 2007). The Forest Service fenced off Idaho EO#6 (Pittsburg Allotment) and Oregon EO#5 during the 1990s. This allotment has been vacant (not stocked) since 2003 (Gene Yates, Forest Service, pers. comm. 2008).

Since 1996, the Forest Service in Oregon has modified domestic livestock grazing to protect known Macfarlane's four-o'clock populations. The Forest Service has taken actions that include measures to remove domestic livestock from Macfarlane's four-o'clock sites before the plant starts to grow in April (Service 1996). Additionally, general range improvements have taken place within the Snake River Canyon area where Macfarlane's four-o'clock occurs due primarily to improved livestock grazing management (Yates 2007). The Forest Service portion of Oregon EO#3 has been fenced to exclude grazing. EO#1 and EO#5 (Oregon side of the Snake River) have not been grazed in over 20 years because these allotments are closed (Yates, pers. comm., 2008).

Livestock grazing was moderate to heavy at several Macfarlane's four-o'clock sites when monitoring first began in the early 1980s. Stocking rates have been greatly reduced over the years, with overall use now rated moderate to light at most sites (Mancuso and Shepherd 2008).

Although direct impacts from livestock can occur, the indirect impacts that adversely affect habitat conditions and ecological integrity are likely more problematic for the long-term persistence of Macfarlane's four-o'clock (Mancuso and Shepherd 2008).

Herbicide and pesticide spraying in areas where Macfarlane's four-o'clock is present could also lead to adverse effects if not carefully implemented. One population (which is located outside of the action area) is directly adjacent to a major highway where roadside vegetation spraying is routinely conducted by the BLM after flagging to avoid the population. An unauthorized aerial herbicide spraying incident affected the species in the vicinity of the Salmon River in Idaho County, Idaho. Plants on both federal and private lands were affected. At least 2,750 stems on BLM land exhibited foliar kill as a result of spraying in 1997. Subsequent monitoring in 1998 found that most of the plants did survive, although long term effects on the population are unknown (USDA Forest Service 2003).

3.3 Spalding's catchfly

3.3.1 Known Occurrences in the Action Area

Umatilla National Forest Action Area

Spalding's catchfly is the only federally listed plant species occurring on the Umatilla National Forest. No other listed plant species are suspected to occur on the forest at this time. Extensive range-wide loss of habitat for Spalding's catchfly is due to a combination of conversion of much of the habitat to agriculture plus degradation of the remainder, primarily by weed invasion. The fragmentation of habitat has left small, genetically isolated populations scattered across four states and five physiographic provinces (see Service 2007 for detailed descriptions of these). More than half of the remaining populations are on private land, with the majority of these unprotected (Service 2007).

Spalding's catchfly is known from only 124 sites in the world, with only seven populations consisting of more than 500 individual plants and contributing 75 percent of the known plants of the species (Service 2007). One of these seven populations is located on the Umatilla National Forest in T9N, R43E, Sections 13, 14, 15, 23, 24, and 32, within the Peola and Mackee Allotments. Both allotments have been surveyed (Wood 2006), as listed in Table 12, by Umatilla NF botanists, including specific searches for Spalding's catchfly in 1997 and 2000.

Table 12. Site locations of Spalding's catchfly in the Sourdough area.

FS GIS Site	EOR Number	Section	Allotment Pasture Name	Number of Plants Reported
20	[1]49	13	Lower Sourdough	45
21	49	13	Lower Sourdough	130
831	49	13	Lower Sourdough	150
14	49	14	Upper Sourdough	490
15	49	15	Upper Sourdough	83
61	49	23	Upper Sourdough	113
832	49	23	Mackee & Upper Sourdough	10

57	49	23	Mackee	6
76 & 77	58	24	Lower Sourdough	21
[2]Not available	[2]Not available	[2]Not available	Smoothing Iron Ridge	>500

[1] Element Occurrence Record (EOR) Numbers 50 and 56 were combined into EOR 49 in 2006 (G. Glenne, per comm. Service)
[2]These data are not available yet as this is a new population, reported July 2008, and documentation has not been completed yet.

The Sourdough area where Spalding's catchfly occurs includes at least portions of four open ridges on the south side of Lick Creek (Cabin, Sheep, Sourdough, and Bracken ridges) and their intervening draws that support plant communities typical of the Canyon Grasslands (Service 2007, Johnson and Simon 1987, Tisdale 1986). Elevations range approximately from a low of 2800 feet to a high of 4000 feet on the upper ridges. South aspects favor bluebunch wheatgrass/Sandbergs bluegrass communities, while north aspects support Idaho Fescue communities, snowberry/rose communities of shrubs in swales and draws, and occasional stringers of ponderosa pine and Douglas-fir. As elevation increases to 4500 feet and above, especially to the southwest and west of the Sourdough area, mixed conifer forest predominates. The entire area of suitable habitat on the Umatilla National Forest has been surveyed.

Wallowa-Whitman National Forest Action Area

Within the action area, Spalding's catchfly is found on the Wallowa Plateau. The three populations (made up of eleven element occurrence records) have shared ownership between the Forest Service and private landowners; therefore the area size and plant numbers on each ownership can only be approximated. Roughly 38 percent of the plants are found on Forest Service land (1,357 out of 3,502 plants). Those element occurrences entirely on Forest Service land cover roughly 8 acres; those on shared ownership cover 60 acres. While no populations have been found, habitat modeling predicts over 24,000 acres of high probability habitat for Spalding's catchfly in the Hells Canyon National Recreation Area. About 42 percent of these acreages are located in active grazing allotments or administrative horse pastures (USDA Forest Service 2003). Table 13 lists the currently identified Spalding's catchfly element of occurrences within the action area.

Table 13. Spalding's catchfly on the WW Forest are located in the Wallowa Valley District area.

State Element of Occurrence	WW GIS #	# Plants Reported	Invasive Plant Proximity (based on GIS mapping data)	Allotment
EOR - 016	1266, 1267	99-203	> ½ mile away	Crow creek
EOR - 014	0519,1337, 1338, 0518/new sites in 2004, 0600-0608	126-295/ 414	> ½ mile away	Crow creek
EOR - 013	0516, 0517	41-94	> ½ mile away	Crow Creek
EOR - 017	1268, 1269	58-79	Diffuse knapweed within 1/4 mile along Crow Creek	Swamp Creek
EOR - 019	1280	14-20	> ½ mile away	Swamp Creek
EOR - 020	1275-1279	659-1860	Diffuse knapweed within 1/4 mile along Crow Creek	Swamp Creek
EOR - 018	1265	91-300	> 1/2 mile away	Private

EOR -	61602-1274		Not within ½ mile on FS lands, however, population is also adjacent to private and roads	Bear-Gulch/Private
None yet	061604-2326 new population in Imnaha	25-30	within ½ mile from Yellow Star thistle and Scotch Thistle	Lone Pine T4N, R49E Sec.19, 20
None yet	061604-2328 new population in Imnaha	45-50	> than a mile away from known weed sites	Toomey T4N, R49E Sec.31
None yet	061604-2327 new population in Imnaha	5-10	within ½ mile from Yellow Star thistle and Scotch Thistle	Lone Pine T4N, R49E Sec.19

Rare plant species occurrence information is recorded by state Heritage Programs in a numbered record called an Element Occurrence Record (EOR) (Table 13). Each species has a set of EORs across its range. Each EOR may include one or more sites (often called subpopulations), which are defined as distinct patches of the plant on the landscape. The Forest tracks each site on its land with its own spatial database (Geographic Information System – GIS) number.

On Forest Service land, populations appear stable or increasing where multiple years (15-20 years) of inventory work has been completed (see Table 13 for locations). Populations range from 20 to over 500 plants per population. The populations on Forest Service land in Oregon are located within grazing allotments. The Mud Duck allotment is presently closed. All remaining EORs of Spalding's catchfly listed in Table 13 are within active grazing allotments. A recent Environmental Impact Statement (Joseph Creek Rangeland Analysis, USDA 2005) and associated biological assessment (USDA 2005) and biological opinion (Service 1-17-05-F-0640) for grazing effects on Spalding's catchfly in the Swamp Creek and Crow Creek Allotments were completed in 2005. Direction from this decision continues to allow for grazing within the allotments (Crow creek and Swamp Creek) where Spalding's catchfly occur; however, an adaptive approach to grazing management will be implemented with specific protections for sensitive areas. Specifically, direction and implementation will improve range condition through monitoring, reduction of trailing through the pastures, and rotation so that spring grazing is not implemented. Continued improvement in range condition in the South Crow and Doe Gulch pastures (both within the Crow creek allotment) would decrease the livestock grazing pressure on Spalding's catchfly occurrences because the mid to late seral plant communities act to reduce the level of risk to direct herbivory and trampling by livestock or other herbivores (USDA 2005).

Direction specific to Spalding's catchfly protections includes additional mitigation and monitoring. Mitigations include spring drought protections, restrictions on herding through the Doe Gulch pasture, and summer grazing protections.

3.3.2 Factors Affecting Species Environment within the Action Area

Even though grazing allotment pastures where Spalding's catchfly occurs are either closed or actively managed to protect Spalding's catchfly populations (USDA Joseph Creek Range Allotment 2005), grazing animals can cause areas of disturbance where invasive weeds can establish. The area where Spalding's catchfly occurs is considered primarily winter range for elk, although many animals are also present in summer. Elk create obvious pockets of soil disturbance at natural salt licks, watering holes, and on steep slopes and chutes. They also maintain existing trails and create new ones up and down draws and across upper slopes and along ridges. They graze and browse along the trails and also fan out across the slopes and ridges where the native bunchgrasses and forbs are most abundant and healthy.

Elk, and/or deer, sporadically browse the flowering stalks of Spalding's catchfly, probably to the greatest extent in the late season of drier years when other plants have senesced and become unpalatable. In the process of grazing the intact native plant communities, both elk and cattle can spread the propagules of numerous weedy species into even the most pristine of the upper slopes and ridges, and they continue to do so at an unknown rate. There are also roads/trails near two of the subpopulations located in the Swamp Creek allotment and along Forest Road 129 located in the Bear Gulch allotment that continues onto private lands. Although at this time no invasive species are identified near these areas it is a well known fact that roads and trails serve as primary sources for dispersal of invasive species propagules.

Much of the area where Spalding's catchfly is found falls within terrain where fire is actively suppressed. Fire fighting activities such as fire-line construction and mop-up operations could uproot and kill plants and disrupt habitat. Fire-lines can provide pathways into otherwise intact plant communities, facilitating weed invasion and displacement of desirable species. Firefighting equipment is often driven off-road to support suppression efforts, and these vehicles could dislodge or crush plants, as well as disturb soils. It is not known how Spalding' catchfly would respond to retardant application. However, most exotic weedy species respond much more quickly to pulses of available nutrients than do native species, so the fertilizing effect of retardant would likely increase the advantage of invasive exotics over the natives.

4. Effects of the Proposed Action

Effects of the action are defined as "the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated or interdependent with the action, that will be added to the environmental baseline" (50 CFR 402.02). The Service's effects analysis is based on information provided in the Assessment, as well as our assessment of baseline conditions and expected changes from the proposed action.

4.1 Bull Trout

4.1.1 Direct and Indirect Effects to the Species

Direct effects result from the agency action and immediately impact the species or its habitat at the site of the action. Indirect effects are caused by or result from the proposed action, are later in time, and are reasonably certain to occur. They may occur within or outside of the area directly affected by the action.

The effects determinations in this Opinion for both the species (bull trout) and critical habitat were made using the environmental baseline and predicting the effects of the proposed action on bull trout and bull trout critical habitat. The Assessment, R6 FEIS, and SERA Risk Assessments were reference documents used in the analysis. Rick Golden from NMFS provided essential interpretation of SERA risk assessment data and analysis. The effects of the Umatilla and Wallowa-Whitman National Forests' Invasive Plant Treatment Project are expressed in terms of the expected effect on aquatic habitat, including the PCEs, in the project area.

The invasive plant treatment activities addressed by this Opinion that may affect bull trout are manual, mechanical, and herbicide treatment of both known infestation sites, and infestation sites discovered in the future and treated under the EDRR program. Most adverse effects likely to result from the proposed action are short-term in nature and caused by invasive plant treatments in or adjacent to streams or ditches. Potential pathways of effects for bull trout through the treatment methods included in the proposed action were identified in the Biological Opinion for the R6 FEIS, and are summarized in Table 14. The potential for these effects to result from the invasive plant treatments proposed by the Forests are discussed below.

Manual and Mechanical Treatments

Manual and mechanical treatments (including mulching and thermal techniques) of streamside and instream vegetation are likely to adversely affect bull trout in some instances. Riparian vegetation creates and supports fish habitat in important ways. The roots of riparian vegetation reduce soil erosion, stabilize banks, and help to create overhanging banks. Riparian vegetation also provides shade, helping to maintain water temperature by limiting solar exposure. Thus, riparian vegetation minimizes turbidity and instream fine sediment deposition, maintains stream channel pattern and profile, and creates hiding cover. Manual and mechanical treatments can affect individual fish or eggs, water temperatures, sediment delivery to streams, instream habitat structure, and juvenile forage.

Table 14. Potential effects of treatment methods to bull trout.

	Pathways of Effects							
Treatment Methods	**Disturbance***	**Chemical toxicity**	**Dissolved oxygen and nutrients**	**Water temperature**	**Fine sediment and turbidity**	**Instream habitat structure**	**Forage**	**Riparian and emergent vegetation**
Manual	X					X	X	X
Mechanical	X			X	X		X	X
Biological				X	X			
Herbicides		X	X	X	X	X	X	X

*stepping on redds, displacing, interrupting feeding, disturbing banks

In some circumstances, manual and mechanical treatments are likely to be conducted by workers standing in the water. For example, some emergent invasive plants may be hand-pulled, and it may be necessary to cut some streamside invasive plants by using string trimmers (e.g., weed eater) or chainsaws while standing in streams. This would likely result in direct adverse effects to any bull trout present through disturbance of some individuals to the point of harassment, or injury by stepping on redds or fry. The extent and intensity of these effects would depend on the fish life stages present, the area of stream accessed, and the amount of time spent in the water.

Water temperatures are likely to be affected by manual or mechanical treatments if substantial removal of shading streamside vegetation occurs. These circumstances are likely to occur on the Forests only in rare circumstances (e.g., treatment of an invasive plant monoculture encompassing small "E" or "C" type [Rosgen 1996] stream channels).

Mechanical treatments that increase the delivery of fine sediment to surface waters may affect turbidity and fine sediment deposition in bull trout habitat. The amount of sediment delivery to bull trout habitat would vary with proximity to the treatment area, and the type, extent, and intensity of the mechanical treatment. The magnitude and duration of sediment delivery increases, as well as the existing stream conditions, would determine whether adverse effects to bull trout habitat were likely to result.

Instream habitat structure is likely to be affected as a result of hand-pulling of invasive plants located within the bankfull level of streams containing bull trout. Emergent aquatic vegetation can provide hiding cover or refuge for fish and other aquatic organisms.

Juvenile forage adjacent to treated streamside vegetation is likely to be temporarily affected by reduced inputs of leaf and other organic material, and associated insects. The magnitude of the effect would be proportional to the extent of streamside vegetation treated. Reestablishment of native vegetation would offset these effects in the long-term.

While some adverse effects to bull trout and bull trout habitat from manual and mechanical treatments are likely to occur, as discussed above, the frequency of adverse effects is likely to be low. As displayed in Table II-1 of the Assessment, approximately 12,000 acres of riparian treatments (combined herbicide, physical, and biological) are currently proposed out of a total estimated 185,000 riparian acres within the action area. This equates to proposed treatment of approximately 6.5 percent of the total estimated riparian acres in the action area. Treatment would occur over several years, less than one third of riparian areas are likely to be adjacent to bull trout habitat, and only some treatment activities would likely affect bull trout. The proposed action includes limiting treatment below bankfull. Treatment below bankfull requires activity be performed during the instream work window which will further minimize adverse effects to bull trout. Additional acres are likely to be treated under the EDRR program, but the total treatment would not exceed the limitations set in PDF H-14.

Biological Treatments

Biological controls work slowly, typically over several years, and are designed to work only on the target species. As treated invasive plants die, native plants are likely to become reestablished at the site, and would prevent a loss in soil and bank stabilization from root systems, or a loss of stream shade. PDFs P-1 and P-2 in the proposed action will apply where large areas are in need of replanting. These PDFs will minimize effects to bull trout habitat from biological treatment when necessary to treat large infestations. Therefore, adverse effects to bull trout habitat from biological treatments are not likely to occur.

Herbicide Treatments

Three herbicide application scenarios are inherent to the proposed action and are likely to result in exposure to bull trout and other salmonids. The scenarios are: 1) runoff from riparian application, 2) application within perennial stream channels, and 3) runoff from intermittent stream channels and ditches. Appendices H and I of the Assessment document numerous riparian invasive plant treatment sites with planned herbicide treatment, adjacent to streams with and without associated roads.

The acute exposure risk from each exposure scenario is analyzed below. The chronic exposure risk for the ten herbicides in the proposed action was analyzed in the Assessment for the R6 FEIS, and that analysis is incorporated by reference (USDA Forest Service 2005b), and summarized below.

The chronic effects analysis concluded that an insufficient amount of the proposed herbicides would be applied in the 10 acre/small stream scenario to result in exposure of fish and aquatic invertebrates to chronic effects threshold concentrations for the standard test durations (90 days for fish, 21 days for aquatic invertebrates). The analysis also concluded that chronic effects on algae (21 days) from herbicides other than sulfometuron are not possible from these activities. Chronic effects on aquatic macrophytes (21 days) from clopyralid, glyphosate, and sethoxydim were determined not to be possible, not likely to occur for imazapyr, metsulfuron, and sulfometuron, and likely to occur for chlorsulfuron under some conditions. The chronic exposure analysis determined that adverse effects on aquatic macrophytes are likely for chlorsulfuron when 10 or more streamside acres are treated at application rates greater than about 0.08 pounds active ingredient/acre (0.056 pounds/acre is the typical rate, and 0.25 pounds/acre is the maximum rate).

The risk of acute adverse effects on bull trout and their habitat was evaluated in terms of hazard quotient (HQ) values. Hazard quotient values are calculated by dividing the estimated environmental concentration (EEC) by the effects threshold concentration. For bull trout, the sublethal effects threshold was the estimated or measured no-observed-effect concentration (NOEC). The NOEC values were determined by using the lowest measured acute or chronic NOEC available in literature, or $1/20^{th}$ of the lowest salmonid LC_{50} value (the concentration lethal to 50 percent of individuals, typically over 96 hours), whichever was lower. Since the NOEC represents the threshold of acute sub-lethal effects, when the HQ value is greater than one, then adverse effects on fish, in the form of acute sublethal effects, are likely to occur.

Hazard quotient values were also calculated for aquatic invertebrates, algae, and aquatic macrophytes. Threshold concentrations at which herbicides are likely to adversely affect aquatic invertebrates, algae, and aquatic macrophytes equal the LC_{50} and EC_{50} (the concentration resulting in an observable effect to 50 percent of individuals) values. The LC_{50} values were used for aquatic invertebrates and some algal species, and EC_{50} values were used for the remaining algal species and aquatic macrophytes.

The LC_{50} values for bull trout and other salmonids (or representative fish species) were obtained from the risk assessments conducted by SERA for the Forest Service, research literature, or other appropriate sources. The values recommended in the risk assessments for "sensitive" species within each species group were used. If an HQ value exceeded one for algae or aquatic macrophytes an adverse effect to habitat was considered to occur.

Exposure estimates from analyses are expressed as numerical point estimates; however, the numbers are far from exact, and considerable variability and uncertainty are inherent in the estimates. Variability reflects the understanding that some analysis data input values would change under environmental situations not accounted for by the analysis process, some circumstances affecting exposure cannot be predicted, and inherent randomness in data input value estimates occur. Uncertainty reflects lack of knowledge. For example, LC_{50} values, by definition based on a lethality endpoint, are frequently used to estimate a NOEC for acute sublethal effects due to a lack of data on known sublethal endpoints and an incomplete understanding of which biological metric(s) should be measured to determine the most relevant NOEC.

The Assessment states (page III-67) that applying herbicides by spot and hand/select methods (rather than broadcast) within riparian buffers would limit the amount of herbicide available for runoff, even though higher application rates are allowed within the buffers. However, the Assessment does not adequately explain, or cite supporting literature, why using spot and hand/select methods would account for the majority of the variability and uncertainty of the "water contamination rates" (WCR) supplied in the SERA risk assessments, and significantly reduce exposure levels. The exposure estimates made in the SERA risk assessments are point estimates, and are not presented in terms of significant digits with statistical confidence intervals. Therefore, the Service and NMFS used the WCR values provided in the SERA risk assessments as the best available estimates of exposure from riparian herbicide application at specified application rates, but did not lower the WCR values for spot and hand/select application methods.

Acute Exposure of Bull trout

Exposure from Riparian Applications. This section addresses direct exposure risks to bull trout in both small streams and the margins of larger streams from runoff and percolation resulting from herbicide application in riparian areas. The analysis was conducted by comparing the WCR values for the small stream scenario analysis in the SERA risk assessments to sublethal effect thresholds agreed upon between NMFS, the Service, and the Forest Service in past invasive plant consultations. The exposure scenario is for a 10-acre herbicide application adjacent to a small stream (1.8 cfs).

Since several relevant parameters of stream margin habitat in larger streams are analogous to the modeled small stream scenario, the small stream analysis results are considered representative of stream margin habitat in larger streams. Stream margins often provide shallow, low flow habitat, may have a slow mixing rate with mainstem waters, and may also be the site at which subsurface runoff is introduced.

Early stage juvenile salmonids, particularly recently emerged fry, often utilize low flow areas along stream margins (Johnson *et al.* 1992, Quinn 2005). As juveniles grow, they migrate away from margins, occupying habitats of progressively higher velocity (Lister and Genoe 1970, Everest and Chapman 1972). Stream margins are utilized by salmonids for a variety of reasons, including nocturnal resting (Roussel and Bardonnet 1999, Polacek and James 2003), summer and winter thermal refuge, predator avoidance (Roussel and Bardonnet 1999), and flow refuge (Roussel and Bardonnet 1999). Juvenile and adult bull trout frequently inhabit side channels, stream margins, and pools with suitable cover (Sexauer and James 1997). These areas are sensitive to activities that directly or indirectly affect stream channel stability and alter natural flow patterns. For example, altered stream flow in the fall may disrupt bull trout during the spawning period, and channel instability may decrease survival of eggs and young juveniles in the gravel from winter through spring (Fraley and Shepard 1989, Pratt 1992, Pratt and Huston 1993). Pratt (1992) indicated that increases in fine sediment reduce egg survival and emergence.

The Service agrees with the spray drift analysis in Appendices E and F of the Assessment, which concludes that the PDF buffers for perennial streams are likely to protect bull trout and other salmonids from exposures to herbicide drift that exceed effects thresholds. However, herbicide exposure from riparian applications is likely to occur via runoff, when rainfall mobilizes herbicides and associated compounds through dissolution and into surface and subsurface runoff. Soil erosion can also deliver herbicides from riparian applications.

The results of the acute exposure analysis of riparian applications for bull trout are displayed in Table 15. Shaded cells highlight HQ values greater than or equal to 1. The WCR values used in this analysis are the modeled values reported in the SERA risk assessments. Typical and maximum herbicide application rates, WCR values for annual rainfall rates of 15 and 50 inches per year, three representative soil types, and NOEC values were used in the small stream exposure analysis to calculate HQ values for bull trout. The annual rainfall rates were selected as representative of the lower and upper levels occurring within the action area.

Table 15 shows that at typical application rates, only glyphosate had an HQ value exceeding 1. At maximum application rates, glyphosate, picloram, and triclopyr had HQ values exceeding 1, and sethoxydim had an HQ value equal to 1. Glyphosate HQ values exceeding 1 occurred at rainfall rates of 15 and 50 inches per year. At the typical application rate (2 pounds/acre), the HQ value of 1.1 occurred at a rainfall rate of 50 inches per year on sandy soil. Given that the effects threshold exceedence (HQ value >1) occurred at the highest rainfall rate on sandy soil (which represents runoff percolation with minimal soil interaction), and few treatment sites and little bull trout habitat are likely to be located in areas of highest rainfall, the risk of harm to bull trout resulting from riparian glyphosate application at typical rates is low. At the maximum application rate (8 pounds/acre), the effects threshold was exceeded on all soil types at 50 inches per year of rainfall, with HQ values ranging from 1.4 to 4.5. As displayed in Figure 3, riparian application of glyphosate at higher application rates on sandy soils is likely to result in harm to bull trout when site precipitation is about 20 inches per year or higher. At the lowest application rates, application on sandy soils is not likely to cause harm unless site precipitation rate is about 45 inches per year. At higher application rates on loam and clay soils, riparian application of glyphosate at higher application rates is likely to result in harm to bull trout when site precipitation is about 30 inches per year for loam, and 40 inches per year for clay.

For the picloram HQ values displayed in Table15, values exceeding 1 occurred only at 50 inches per year. At the maximum application rate (1 pound/acre), the effects threshold was exceeded on clay and sandy soil types, with HQ values of 2.5 and 1.2, respectively. As displayed in Figure 4, riparian application of picloram at higher application rates on clay soils is likely to result in harm to bull trout when site precipitation is about 25 inches per year or higher, and on sandy soils when site precipitation is about 40 inches or higher.

Table 15. Summary of HQ values for bull trout for riparian herbicide application.

		[illegible]			[illegible]		
		Clay	Loam	Sand	Clay	Loam	Sand
Herbicide	Annual Rainfall (inches)	HQ Value	HQ Value	HQ Value	HQ Value	HQ Value	HQ Value
Chlorsulfuron	15	0.000	0.000	0.000	0.002	0.000	0.000
	50	0.003	0.000	0.000	0.01	0.000	0.002
Clopyralid	15	0.000	0.000	0.000	0.001	0.000	0.000
	50	0.001	0.000	0.000	0.001	0.001	0.002
Glyphosate	15	0.02	0.05	0.1	0.09	0.2	0.5
	50	0.4	0.6	1.1	1.4	2.2	4.5
Imazapic	15	0.000	0.000	0.000	0.000	0.000	0.000
	50	0.000	0.000	0.000	0.000	0.000	0.000
Imazapyr	15	0.000	0.000	0.000	0.000	0.000	0.000
	50	0.000	0.000	0.000	0.000	0.000	0.000
Metsulfuron	15	0.000	0.000	0.000	0.000	0.000	0.000
	50	0.000	0.000	0.000	0.000	0.000	0.000
Picloram	15	0.09	0.000	0.2	0.3	0.000	0.5
	50	0.9	0.1	0.4	2.5	0.3	1.2
Sethoxydim	15	0.02	0.007	0.1	0.03	0.01	0.1
	50	0.3	0.6	0.5	0.4	1.0	0.7
Sulfometuron	15	0.000	0.000	0.000	0.000	0.000	0.000
	50	0.000	0.000	0.000	0.000	0.000	0.000
Triclopyr	15	0.06	0.06	0.06	0.6	0.7	0.6
	50	0.5	0.2	0.2	4.8	3.6	2.1

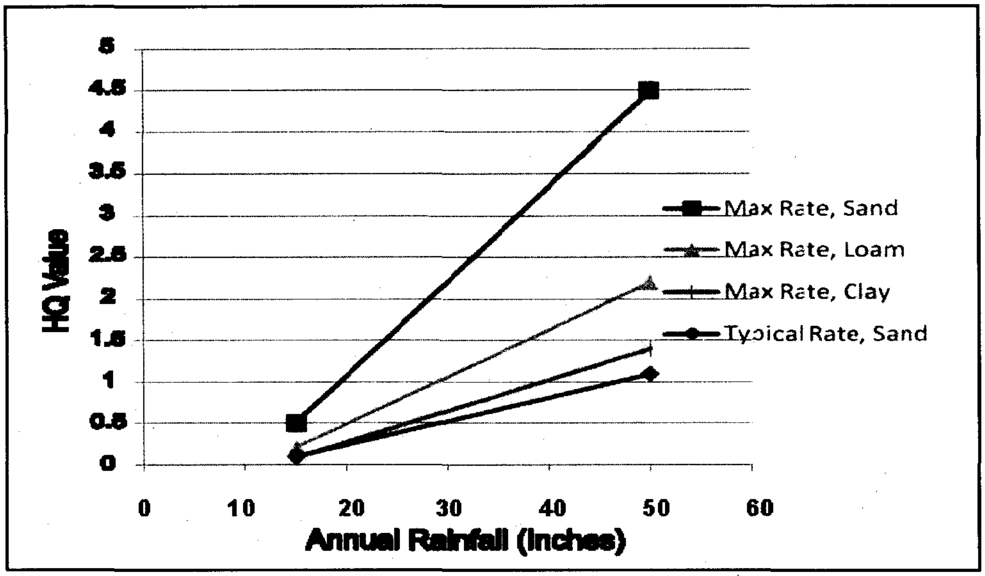

Figure 3. HQ values for riparian application of glyphosate on sand, loam, and clay soils at15 and 50 inches per year of rainfall.

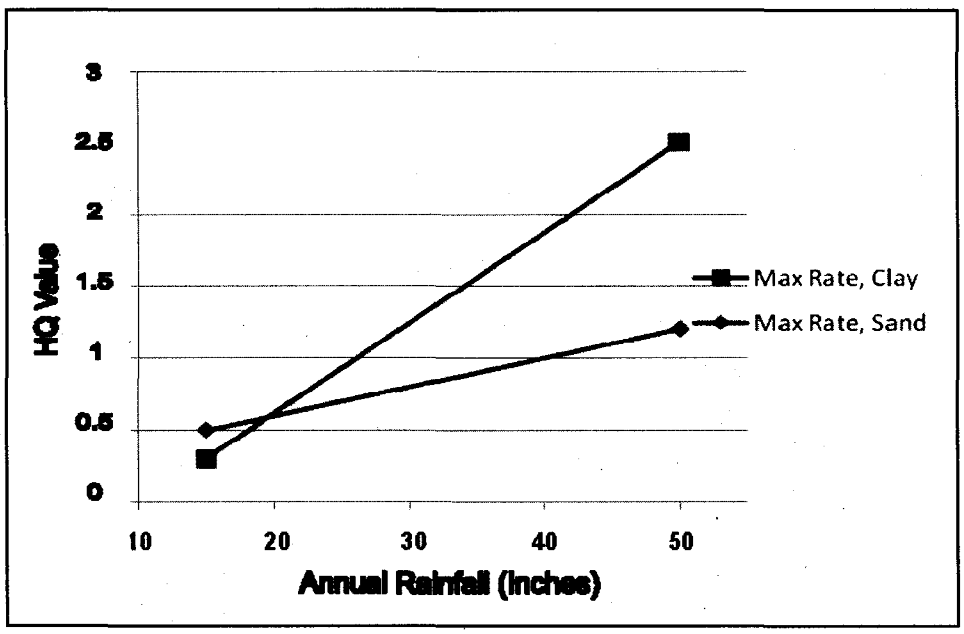

Figure 4. HQ values for riparian application of picloram on sand and clay soils at 15 and 50 inches per year of rainfall.

The HQ values for sethoxydim were calculated using the toxicity data for the Poast formulation, and incorporates the toxicity of naphtha solvent. The toxicity of sethoxydim alone for fish and aquatic invertebrates is much less than that of the formulated product (about 30 times less toxic for invertebrates, and about 100 times less toxic for fish). Since the naphtha solvent tends to volatilize or adsorb to sediments, using Poast formulation data to predict indirect aquatic effects from runoff leaching is likely to overestimate adverse effects (SERA 2001). Application buffers specified in the PDFs sharply reduce the risk of naphtha solvent presence in percolation runoff reaching streams. Therefore, the HQ value of 1.0 displayed in Table 15 for riparian sethoxydim application overstates the risk of effects to bull trout. When the application buffers for sethoxydim are employed, application in riparian areas is not likely to affect bull trout.

Triclopyr HQ values exceeding 1 occurred at a rainfall rate of 50 inches per year for all soil types. At the maximum application rate (10 pounds/acre), the effects threshold was exceeded on clay, loam, and sand soil types, with HQ values of 4.8, 3.6, and 2.1, respectively. As displayed in Figure 5, riparian application of triclopyr at higher application rates on clay and loam soils is likely to result in harm to bull trout when site precipitation is about 18 inches per year or higher, and on sandy soils when site precipitation is about 25 inches or higher.

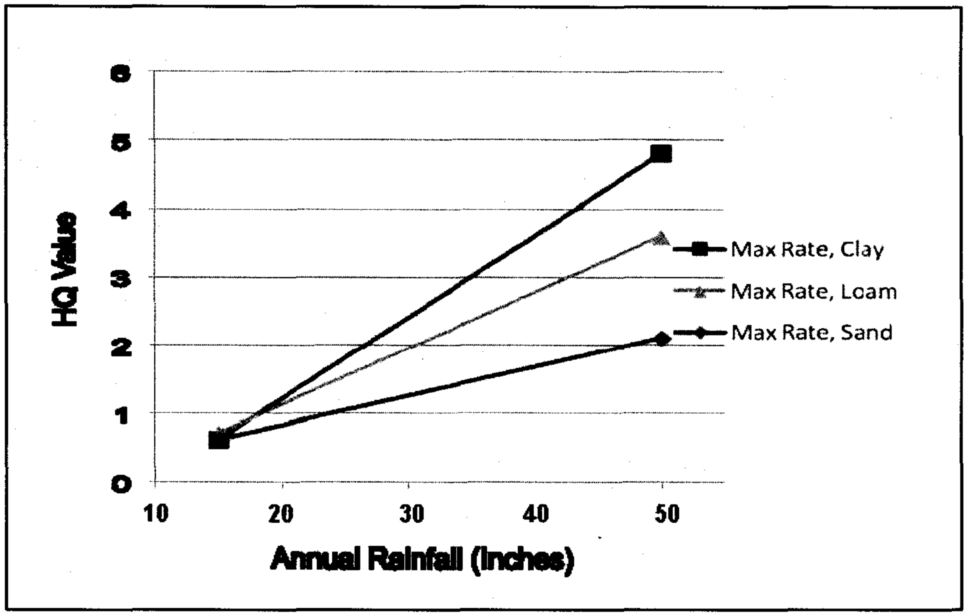

Figure 5. HQ values for riparian application of triclopyr on sand, loam, and clay soils at 15 and 50 inches per year of rainfall.

Exposure from Applications in Dry Intermittent Channels and Ditches. Based on data presented in Appendix E of the Assessment, a total of 150 miles of currently inventoried roadside treatments are located within 100 feet of fish-bearing streams on the Umatilla National Forest, and 57 miles of currently inventoried roadside treatments are within 100 feet of fish-bearing streams on the Wallowa-Whitman National Forest (some but not all of these fish-bearing streams contain bull trout). The Assessment does not state how much of this treatment area occurs within ditches. Some of the associated fish-bearing streams are likely to contain bull trout. Additional roadside treatments are likely to occur under the EDRR component of the proposed action.

Herbicides applied within ditches and intermittent stream channels may be delivered to bull trout habitat by dissolving directly into ditch or stream channel flow following rainfall, and erosion of exposed soil. The contribution from erosion is likely to vary considerably among sites and herbicides. Spot spray and hand/selective application of clopyralid, glyphosate (aquatic formulation), imazapic, imazapyr (aquatic formulation), metsulfuron methyl, and triclopyr (aquatic formulation) are proposed within ditches and dry intermittent channels. All six herbicides can be applied up to their maximum application rate. The primary determinants of exposure risk from ditch or intermittent channel treatments are herbicide properties, application rate, extent of application, application timing, precipitation amount and timing, and proximity to bull trout habitat.

Monitoring of storm runoff has documented that the highest concentrations of pollutants occur during the first storm following treatment (Caltrans 2005, USGS 2001). More specifically, the highest pollutant concentrations generally occur during the early part of storm runoff, relative to concentrations later in the runoff event (Caltrans 2005). The discharge of ditch or intermittent channel runoff in the early stages of the storm hydrograph is generally low, but early runoff is exposed to the greatest amount of pollutants available for dissolution. The ratio of low discharge to highest amount of available pollutant results from the compositing of early runoff solute concentrations that are high relative to those occurring later in the runoff event. Runoff later in the hydrograph occurs at a higher discharge, and dissolved pollutant concentrations are lower, even though mass movement of pollutants can be greater. Therefore, exposure of bull trout and bull trout habitat to the highest concentrations of herbicides resulting from application to ditches and intermittent channels is likely to occur early in storm runoff. The most significant exposure locations are likely to be at or near confluences with perennial streams.

As discussed above, the effects on pollutant concentration of the first flush of water in previously dry channels are well understood. In contrast, little monitoring data is available regarding specific concentrations of herbicides likely to occur in runoff from treated ditches. An algorithm based on the USGS (2001) monitoring report on sulfometuron and glyphosate in runoff from treated roadside plots into ditches in western Oregon has been used in previous biological opinions for Forest Service invasive plant projects (Service 2007) to estimate potential maximum concentrations in runoff from treated ditches and intermittent channels. The development of the algorithm is explained in detail in Appendix D.

The potential exposure concentrations from application of clopyralid, glyphosate, imazapic, imazapyr, metsulfuron methyl, and triclopyr triethylamine (TEA) in intermittent channels and ditches are summarized in Table 16. Based on the HQ values displayed in Table 16, glyphosate and triclopyr applied to intermittent channels and ditches tributary to bull trout streams are likely to harm bull trout if rainfall occurs 24 hours after application. The HQ values for glyphosate range from 4.8 for application at the typical rate (2 pounds/acre) to 19 for application at the maximum labeled rate (8 pounds/acre). The HQ values for triclopyr TEA range from 3.3 for application at the typical rate (1 pound/acre) to 33 for application at the maximum labeled rate (10 pounds/acre). Actual exposure concentrations, and associated HQ values, may be lower when incomplete treatment of the intermittent channel or ditch occurs, only short sections are treated, and when rainfall occurs more than 24 hours after application. As discussed above, the exposure estimates contain significant uncertainty, and actual exposures under the conditions modeled may be higher or lower.

Exposure from Applications within Perennial Streams. Under the proposed action, glyphosate, imazapyr, and triclopyr TEA can be applied within the bankfull level of perennial streams, up to the water's edge. All three herbicides can be applied up to the maximum application rates by spot spray or hand/selective methods.

Exposure from application within stream channels can occur from overspray, foliar rinse by rainfall, erosion, leaching, and site inundation. Juvenile and fry life stages are likely to be at the highest risk of exposure. Exposure of juveniles in stream margins can result from overspray, upstream storms resulting in inundation of treatment sites, rainfall at the treatment sites delivering herbicide to stream margins via percolation or surface runoff, or a combination of these factors. Juveniles utilizing stream margin habitat are likely to be present in the low flow refuge near the water's edge as the stream level rises. As inundation of recently treated areas

Table 16. Herbicide concentrations and HQ values for bull trout from herbicide application within intermittent channels and ditches. *

	Ditch/Dry Channel Application			
	Typical Application Rate		Maximum Application Rate	
Herbicide	Exposure (mg/l)	HQ Value	Exposure (mg/l)	HQ Value
Clopyralid	0.3	0.06	0.4	0.09
Glyphosate	0.5	4.8	1.9	19
Imazapic	0.09	0.0009	0.2	0.002
Imazapyr	0.4	0.08	1.3	0.3
Metsulfuron	0.03	0.01	0.1	0.03
Triclopyr	0.9	3.3	8.7	33

* Shaded cells highlight HQ values > 1.

occurs, herbicide overspray or wash-off present on the substrate surrounding treated plants, or on the treated plants, may enter solution.

Table 17 displays the potential HQ values for the three herbicides proposed for application within perennial streams. The HQ values were derived for two exposure scenarios: 1) dilution of rainfall rinse of treated foliage (75 percent of the amount applied, multiplied by herbicide wash-off fraction) into one cubic foot of water, (the SERA risk assessments state the wash-off fractions as 0.5 for glyphosate, 0.9 for imazapyr, and 0.95 for triclopyr), and 2) dilution of overspray into one foot of water (an assumed 25 percent overspray rate). Effect threshold exceedences occurred for glyphosate at both typical and maximum application rates for both scenarios, and effect threshold exceedences occurred for triclopyr at typical and maximum application rates for both scenarios, except overspray at the typical rate. No effect threshold exceedences occurred for imazapyr.

Table 17. Herbicide concentrations and HQ values for bull trout from herbicide application within perennial channels.*

Herbicide	Typical Application Rate				Maximum Application Rate			
	Conc in 1' water from foliar rinse	HQ Value	Conc in 1' water from overspray	HQ Value	Conc in 1' water from foliar rinse	HQ Value	Conc in 1' water from overspray	HQ Value
Glyphosate	0.3	2.8	0.2	1.8	1.1	11	0.7	7.4
Imazapyr	0.1	0.02	0.04	0.01	0.4	0.07	0.1	0.03
Triclopyr	0.3	1.0	0.1	0.4	2.6	10	0.9	3.5

* Shaded cells highlight HQ values > 1.

Numerous factors influence the actual concentration in stream margins associated with an instream application site. These include application rate, herbicide properties, rainfall proximity and intensity, time since application, soil permeability, and water turbulence and flow rate. Glyphosate is strongly absorbed by most soils (Yu and Zhou 2005), so exposure levels of glyphosate are likely to be attenuated when channel surface substrate contains a substantial soil component.

Label instructions for the Aquamaster aquatic glyphosate formulation recommend to "always use the higher rate of this product per acre within the recommended range when weed growth is heavy or dense or weeds are growing in an undisturbed (non-cultivated) area." The product label allows an application rate up to 8 pounds/acre. Therefore, it is assumed that application at or near the label maximum is likely to be necessary in some situations for invasive plant control on gravel bars and other below bankfull sites.

Acute Exposure of Algae and Aquatic Plants

The results of exposure analysis for algae and aquatic plants from herbicide application in riparian areas, within ditches, intermittent channels, and perennial channels, are discussed below. Exposure analysis for aquatic invertebrates did not reveal any effect threshold exceedences, and herbicide effects to aquatic invertebrates are not discussed further.

Exposure from Riparian Applications. The results of the acute exposure analysis of riparian herbicide applications for algae and aquatic plants are displayed in Table 18. Shaded cells highlight HQ values greater than or equal to 1. Exposures exceeding the acute effects threshold from riparian application occurred for chlorsulfuron only.

Table 18. HQ values for algae and aquatic plants from riparian herbicide application. *

Herbicide	Rainfall Rate	Typical Application Rate						Maximum Application Rate					
		Clay		Loam		Sand		Clay		Loam		Sand	
		Algae HQ Value	Macrophyte HQ Value	Algae HQ Value	Macrophyte HQ Value	Algae HQ Value	Macrophyte HQ Value	Algae HQ Value	Macrophyte HQ Value	Algae HQ Value	Macrophyte HQ Value	Algae HQ Value	Macrophyte HQ Value
Chlorsulfuron	15 inches	0.07	1.0	0.0000	0.0000	0.0000	0.0000	0.3	4.5	0.0000	0.0000	0.0000	0.0001
	50 inches	0.6	9.0	0.002	0.03	0.07	1.0	2.8	40	0.01	0.1	0.3	4.6
Clopyralid	15 inches	0.0002	0.0002	0.0000	0.0000	0.0000	0.0000	0.0003	0.0003	0.0000	0.0000	0.0000	0.0000
	50 inches	0.0005	0.0005	0.0004	0.0004	0.0009	0.0009	0.0008	0.0008	0.0005	0.0005	0.001	0.001
Glyphosate	15 inches	0.001	0.0000	0.002	0.0001	0.006	0.0003	0.004	0.0002	0.009	0.0004	0.03	0.001
	50 inches	0.02	0.0007	0.03	0.001	0.05	0.002	0.07	0.003	0.1	0.005	0.2	0.009
Imazapic	15 inches	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	50 inches	0.001	0.008	0.0000	0.0001	0.0002	0.001	0.002	0.02	0.0000	0.0002	0.0003	0.003
Imazapyr	15 inches	0.0001	0.001	0.0000	0.0000	0.0000	0.0000	0.0004	0.004	0.0000	0.0000	0.0000	0.0001
	50 inches	0.001	0.01	0.0000	0.0001	0.0004	0.003	0.005	0.04	0.0000	0.0002	0.001	0.01
Metsulfuron	15 inches	0.0000	0.02	0.0000	0.0000	0.0000	0.002	0.0000	0.09	0.0000	0.0000	0.0000	0.01
	50 inches	0.0000	0.2	0.0000	0.007	0.0000	0.04	0.0002	0.8	0.0000	0.04	0.0001	0.2
Picloram	15 inches	0.004	0.0000	0.0000	0.0000	0.007	0.0000	0.01	0.0001	0.0000	0.0000	0.02	0.0001
	50 inches	0.04	0.0002	0.004	0.0000	0.02	0.0001	0.1	0.0006	0.01	0.0001	0.05	0.0003
Sethoxydim	15 inches	0.006	0.006	0.002	0.002	0.02	0.02	0.008	0.008	0.003	0.003	0.04	0.04
	50 inches	0.07	0.07	0.2	0.2	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2
Sulfometuron	15 inches	0.0007	0.0004	0.0000	0.0000	0.0000	0.0000	0.006	0.004	0.0000	0.0000	0.0000	0.0000
	50 inches	0.008	0.005	0.0000	0.0000	0.0012	0.0007	0.07	0.04	0.0001	0.0001	0.0000	0.006
Triclopyr	15 inches	0.003	0.002	0.003	0.002	0.003	0.002	0.03	0.02	0.03	0.02	0.03	0.02
	50 inches	0.02	0.01	0.02	0.01	0.009	0.006	0.2	0.1	0.2	0.1	0.09	0.06

* Shaded cells highlight HQ values > 1.

Effect threshold exceedences for aquatic plants from chlorsulfuron occurred only on clay and sand soil types. On clay soils, effect threshold exceedences for aquatic plants occurred at both the typical (0.056 pounds/acre) and maximum (0.25 pounds/acre) application rates, and at the 15 and 50 inch per year rainfall levels. Since the proposed action allows application of chlorsulfuron at up to the maximum labeled rate to the bankfull level of perennial and intermittent streams, adverse effects to aquatic plants are likely to result from riparian application of chlorsulfuron between 0.056 and 0.25 pounds/acre on clay dominated soils at all rainfall levels occurring in the action area. On sandy soils, effect threshold exceedences for aquatic plants occurred at both the typical and maximum rates at the 50 inch per year rainfall level, with HQ values of 1.0 and 4.6, respectively. Therefore, adverse effects to aquatic plants are likely to occur from riparian application of chlorsulfuron at higher application rates on sandy soils only at sites with high rainfall levels.

The effect threshold value for algae was exceeded only at the maximum rate, on clay soils, at the 50 inch per year rainfall level. The HQ value was 2.8, indicating that chlorsulfuron application on clay soils is likely to adversely affect algae only when applied at higher application rates in areas of higher rainfall.

Exposure from Applications in Dry Intermittent Channels, Ditches, and Perennial Channels. The results of the acute exposure analysis of herbicide applications in intermittent channels, ditches, and perennial channels are displayed in Table 19. Shaded cells highlight HQ values greater than or equal to 1. For herbicide application in ditches and intermittent channels, imazapic and imazapyr exposure exceeded the effects thresholds for algae and aquatic macrophytes at both the typical and maximum application rates, metsulfuron exposure exceeded the effects threshold for aquatic macrophytes at the typical and maximum application rates, and triclopyr exposure exceeded the effects thresholds for algae and aquatic macrophytes at the maximum application rate.

Table 19. HQ values for algae and aquatic plants from herbicide application in intermittent channels, ditches, and perennial channels. *

	Ditches and Dry Channels				Instream Application							
	Algae		Aquatic Macrophytes		Typical Application Rate				Maximum Application Rate			
Herbicide	Typ. Rate	Max. Rate	Typ. Rate	Max. Rate	HQ value for 1' deep water - foliar rinse		HQ value for 1' deep water - overspray		HQ value for 1' deep water - foliar rinse		HQ value for 1' deep water - overspray	
	HQ Value	HQ Value	HQ Value	HQ Value	Algae	Aquatic Macrophytes	Algae	Aquatic Macrophytes	Algae	Aquatic Macrophytes	Algae	Aquatic Macrophytes
Clopyralid	0.04	0.06	0.04	0.06								
Glyphosate	0.2	0.9	0.0	0.0	0.1	0.006	0.09	0.004	0.5	0.02	0.4	0.02
Imazapic	1.7	3.3	14	27								
Imazapyr	2.0	6.5	17	57	0.6	4.9	0.2	1.8	1.9	16	0.7	6.0
Metsulfuron	0.03	0.2	130	652								
Triclopyr	0.1	1.5	0.1	1.0	0.04	0.03	0.02	0.01	0.4	0.3	0.2	0.1

* Shaded cells highlight HQ values > 1.

For herbicide application in perennial channels, the effects threshold for aquatic macrophytes was exceeded for imazapyr at both the typical and maximum application rates, for both the "foliar rinse" and "overspray" scenarios, and the effects threshold for algae was exceeded at the maximum application rate for the "foliar rinse" scenario.

Due to the high HQ values for aquatic macrophytes, the duration of exposure to significant concentrations of imazapic, imazapyr, and metsulfuron from treatments in ditches and dry channels is likely to be longer than that for fish or algae.

Summary of Effects on Bull trout

Manual and Mechanical Treatments. Based on the above exposure analysis, the response period per increased turbidity occurrence likely would generally be limited to no more than a few days, although in some circumstances significant sediment and turbidity delivery may occur for up to a week (Rick Golden, NMFS, pers. comm., 2008). Salmonids (in this case bull trout) would likely be harmed by increased suspended sediment through increased stress, hormone concentration, and increased metabolic costs (Quigley 2003); gill irritation or abrasion (which can reduce respiratory efficiency or lead to infection); and a reduction in juvenile feeding efficiency due to reduced visibility. Compromised gill function is likely to increase juvenile mortality. Reduced feeding efficiency is likely to lower growth rate. In some circumstances, individuals may find increased feeding opportunities along the sediment plume fringe as suspended fauna are transported downstream with the sediment. While in some instances fish have been observed to seek refuge from predators in turbid waters, the forced dispersal or avoidance of the sediment plume would result in the denial of refuge to most juvenile and adult bull trout present in the affected area, and increase losses to predation.

The species' response to changes in deposited fine sediment is more likely to persist for at least several weeks following storm-driven pulses of exposures. Although fine sediment may be transported great distances before depositing in areas of reduced transport potential, measurable effects are likely limited to about 500 feet from treatment sites. Suttle *et al.* (2004) demonstrated a linear effect of increasing fine sediment deposition, decreasing juvenile steelhead growth. The authors concluded that the linear effect of fine sediment deposition on growth, even at low levels, suggests that there is no threshold below which adverse effects from sediment deposition do not occur. The growth declines were associated with lower prey availability, and higher activity, aggression, and risk of injury. In addition, the reduction of intragravel cover for rearing juveniles would increase the risk of predation or forced downstream displacement. Therefore, bull trout are likely to be affected by deposited fine sediments.

Herbicide Treatments. Bull trout are likely to be present in the action area where significant herbicide concentrations (those exceeding effect thresholds and resulting in harm) occur. The likelihood of significant exposures will be greatest in small streams (those with flow less than about 5 cfs) and along the margins of larger streams near treatment areas, and at the confluences of perennial streams with treated intermittent channels and ditches. Significant exposure periods per occurrence are likely to last 24 hours or less (SERA) for those resulting from riparian applications, two hours or less for those resulting from applications in perennial channels, and four hours or less for those resulting from applications in intermittent channels and ditches (R. Golden, pers. comm., 2008).

Rearing and migrating fluvial bull trout and resident bull trout present in small streams, along stream margins, and near the confluences of perennial streams with intermittent channels and ditches would be the most likely to experience significant exposures. Adults are likely to be present in the action area, and likely to be present in small streams and stream margins where significant exposures are likely to occur (dependent on stream temperatures, flows, and life history of bull trout, and whether resident or fluvial bull trout). Adults would be most likely to experience significant exposures at the confluences of perennial streams with intermittent channels and ditches. Incubating bull trout eggs and pre-emergent fry are most likely to experience significant exposures where redds are located along stream margins or in small streams where percolation of subsurface runoff into gravels occurs.

The responses of bull trout to herbicide exposure are likely to be sublethal effects under most circumstances, rather than direct mortality from herbicide exposure. The most common sublethal endpoints in aquatic organisms are behavioral (e.g., swimming, feeding, attraction-avoidance, predator-prey interactions), physiological (e.g., growth, reproduction, development), biochemical (e.g., blood enzyme, ion levels), and histological changes (e.g., degenerative necrosis of the liver, kidneys, and gill lamellae). Sublethal exposures may result in behavioral changes, such as swimming or olfactory responses, diminished to find food, navigate, or escape from predators and may ultimately result in death. Recently, documented effects of glyphosate to salmonid olfaction by Tierney *et al.* (2006) provide an example, as the authors note that olfaction is tantamount to survival for anadromous salmonids. Some sublethal effects are rapidly reversible or diminish with time, and may result in little or no long-term consequences. In addition, individual fish may exhibit different responses to the same concentration of a toxicant.

4.1.2 Effects to Bull Trout Critical Habitat

Short-term adverse effects on water quality are likely to occur when invasive plant treatments occur adjacent to streams or within stream channels, and ground disturbance or substantial areas of bare ground result. Increased water temperatures from decreased shade are not likely to last more than one summer (PCE 1). Short-term reductions in natural cover for juveniles are likely to occur from increases in substrate embeddedness and losses in aquatic macrophytes (PCE 2). Effects from substrate embeddedness are not likely to last more than a few weeks. Effects from herbicides are not likely to last more than a few months. Increased turbidity resulting from treatment is likely to last for a few hours to a maximum of a few days (PCE 3). Inputs of herbicides as described in the exposure analysis are likely to degrade water quality for up to 24 hours (PCE 6, and 8). Increased substrate embeddedness resulting from fine sediment inputs is likely to last for a few days to a few weeks (PCE 3). Increased embeddedness would reduce access to interstitial habitat for fry and juveniles and impair spawning habitat quality in affected areas (PCE 3).

The proposed action is likely to affect migratory corridors (PCE 6) due to potential water quality impediments (described in PCE 1, 3, 8) caused by invasive plant treatments. Reductions in primary production are likely to occur as a result of herbicide exposure. Herbicide exposure analysis documented that adverse effects to algae and aquatic macrophytes are likely to occur. Fine sediment deposition is likely to result in a short-term reduction of aquatic invertebrate forage. While these effects (from sediment and herbicides) are not likely to extend more than a few hundred feet below treatment sites, and these areas are likely to be recolonized by primary producers and aquatic invertebrates within a few months, the short-term effect is likely to be a decrease in available forage at affected sites (PCE 7).

In the long-term, the removal of invasive plants may improve water quality (PCEs 1, 3, and 8). Planting riparian areas with native vegetation in place of invasive plants is likely to ultimately increase shade and reduce summer stream temperatures (PCE 1).

The very limited miles of downstream bull critical habitat and PDFs (conservation measures) described in the proposed action are expected to substantially minimize the extent and duration of these habitat effects, such that it is unlikely that the function or conservation role of the critical habitat will be adversely affected in the long-term by these activities.

4.1.3 Interrelated/Interdependent Effects

Interrelated actions are those that are a part of a larger action and depend on the larger action for their justification. Interdependent actions are those that have no independent utility apart from the action under consideration. Both interdependent and interrelated activities are assessed by applying the "but for" test, which asks whether any action and its associated impacts would occur "but for" the proposed action.

The Forests, the Service, and NMFS (Level 1 team) did not identify any interrelated or interdependent actions during consultation.

4.2 Macfarlane's four-o'clock

4.2.1 Direct and Indirect Effects to the Species

Based on current invasive weed mapping efforts (WWNF GIS database), five populations of MacFarlane's four o'clock are considered to be at risk from invasive species encroachment into known populations and associated habitats (Table 20). Recent visitation (May 2007) to sites located in Hells Canyon area indicate many of the sites are infested with cheat grass (*Bromus tectorum*) as well; however this invasive species is not tracked using weed mapping efforts. Additional invasive plants identified near MacFarlane's four-o'clock sites include toadflax, rush skeletonweed, and Himalayan blackberry.

Invasive weed acres identified within modeled MacFarlane's four-o'clock habitat are approximately 1,563 acres, 10 acres of which are located within proposed aerial sites. The invasive species consist of the above mentioned species (Table 20).

The majority of Macfarlane's four-o'clock plants are known to occur on Forest Service land (6,000 out of 9,000 plants). A predictive model used for the HCNRA Comprehensive Management Plan (CMP) determined that 39,090 acres of potential habitat also existed in the HCNRA. Noxious weed treatment within the potential habitat was found to may affect, but was not likely to adversely affect Macfarlane's four-o'clock (USDA Forest Service 2003). This was only for ground-based treatments.

Table 20. MacFarlane's four-o'clock site locations and proximity to invasive plants on the Wallowa-Whitman National Forest, Hells Canyon National Recreation Area District.

State Element of Occurrence	WW GIS #	Invasive Plant Proximity (based on GIS mapping data)	Grazing/Recreation/Roads
EO #001 (Oregon)	0207,0532-0534	Yellow Hawkweed ~ 1000ft down river	Allotment closed, roads hiking trails not considered primary dispersal vectors due to remoteness of area
EO #005 (Oregon)	13245	none	No grazing, roads or trails nearby
EO #002 (Oregon)	0495	Not known- private land	Private land
EO #003 (Oregon)	0496	Scotch thistle < 1500ft, private nearby	Active, populations partially fenced, powerline road dissects population.
EO #006 (Idaho)	0488	Yellow Star thistle located nearby and considered a threat. Teasel is also nearby	Vacant allotment, and roads and trails not considered to be dispersal vectors due to remoteness
EO #009 (Idaho)	0490	none	Vacant allotment and , roads hiking trails not considered primary dispersal vectors due to remoteness of area
EO #007 (Idaho)	0487	none	Vacant allotment, however unauthorized ATV use noted in old jeep road
EO #010 (Idaho)	0494	Yellow star thistle, puncture vine, Japanese knotweed, scotch thistle, purple loosestrife, common crupina, Aegilopsis, and teasle are nearby and considered a threat.	Vacant allotment, high use road nearby
EO #011 (Idaho)	0493	none	Vacant allotment, roads and trails not considered to be dispersal vectors
EO #012 (Idaho)	0492	none	Vacant allotment, roads and trails not considered to be dispersal vectors
EO #013 (Idaho)	0491	Yellow star thistle nearby and considered a threat	Vacant allotment, roads and trails not considered to be dispersal vectors
EO #900 (Idaho)	1359	none	Vacant allotment, roads and trails not considered to be dispersal vectors

Populations in the action area are threatened by invasive plants. If invasive species treatments were found to be necessary, manual, mechanical or chemical methods would be used. Choice of method would depend on the invasive species; manual methods would be the treatment of choice in most cases, except for those species where manual techniques are proven ineffective or access for manual treatments is impossible. A biological control, *Mecinus janthinus*, a stem-boring weevil, was released at Oregon EO#001 in 2004. This site is being monitored at least every two years to determine if the insect establishes a population and that damage to toadflax occurs. Monitoring results indicate that the control agent is perpetuating, but a large colony is yet to establish. The insects have inflicted little damage to toadflax to date.

Manual Treatments

There is some risk that accidental pulling or trampling could damage individual plants and injure above ground structures with little risk of individual mortality. Risk of these effects would be reduced by such techniques as flagging areas containing individual plants prior to treatments (as directed by Regional Standard #20), so workers would avoid individuals.

Mechanical Treatments

Mowing or string trimming, the most likely methods used, could sever or crush plants or plant parts and would have the most potential for impact. Risks of these effects would be reduced by such techniques as flagging areas containing individual plants prior to treatments and careful hand pulling of invasive plants closer to the populations (as directed by Regional Standard #20), so equipment could avoid individuals.

Chemical Treatments

Even though individual plants could be damaged or killed from the accidental application or drift of the herbicide from ground based applications, the risk of impact would be reduced with implementation of required PDFs. Risk of effects could also be mitigated by such techniques as timing of application during dormancy, flagging individuals, hand pulling of invasive plants closer to the populations or through selective application such as defined spot spray, shielding spray or hand wiping (as directed under Regional Standard #20, USDA 2005) and appropriate PDFs (Table 21).

Aerial herbicide application is not proposed within one mile of the nearest MacFarlane's four-o'clock occurrence and no impacts to these individuals are expected from aerial drift associated with aerial application. EDRR standards and all PDFs would apply to the application of herbicides on new invasive plants established in the future. EDRR does not allow the aerial application of herbicide; therefore, other measures would be used to control new populations of invasive plants. Even though individual plants could be damaged or killed from the accidental application or drift of the herbicide from aerial application, the risk of impact would be minimized with implementation of required PDFs. PDFs require surveys in unsurveyed potential habitat prior to treatment. If new occurrences are found within a treatment area, all applicable PDFs will be applied.

Table 21. Potential effects to Macfarlane's four-o'clock from herbicide and herbicide drift (from the Assessment)

Herbicide	Direct Effects without PDFs	Direct Effects with PDFs	Indirect Effects to Macfarlane's four-o'clock habitat – non-target plants with PDFs
Chlorsulfuron: Selective on broadleaf weeds some and grasses. PDFs protect individual plants from direct spray, drift, runoff, wind erosion. No aerial application	Yes	Possible short-term effects	Possible short-term effects to habitat
Clopyralid: Extremely selective: Asteraceae, Fabaceae, Polygonaceae, Solanaceae families	No Nyctaginaceae is not target family	No	Possible short-term effects to grasses (habitat), but grasses are very tolerant of this herbicide
Glyphosate: Non-selective; PDFs to protect from direct spray; runoff not a concern.	Yes	Possible short-term effects	Possible short-term effects to habitat
Imazapic: Selective against some broadleaves & some grasses. PDFs to protect from direct spray, drift, runoff & timing after use of other herbicides	Yes	Possible short-term effects	Possible short-term effects to habitat
Imazapyr: Non-selective. PDFs to protect plants from direct spray, drift, runoff	Yes	Possible short-term effects	Possible short-term effects to habitat
Metsulfuron methyl: Selective for some broad-leaf and woody species; can damage conifers. PDFs to protect individual plants from direct spray, drift, runoff, wind erosion. No aerial application	Yes	Possible short-term effects	Possible short-term effects to habitat
Picloram: Selective: rate and season dependant; pre-emergent and soil active. PDFs to protect from direct spray drift, runoff; buffers; fall application by TES plants & other special situations	Yes Target Families are: Compositae, Leguminosae, Polygonaceae, and Apiaceae families. Less affected families: Brassicaceae, Liliaceae, and Scrophularaiaceae. Unknown effects assume worst case.	Possible short-term effects	Possible short-term effects to habitat
Sethoxydim: Selective for annual & perennial grasses & target invasive plants. Soil activity prevents germination of grasses. Absorbed rapidly by foliage and roots. Systemic. Broadleaf and sedges are tolerant	No. Broadleaf plants are tolerant	No	Possible short-term effects to habitat
Sulfometuron methyl: Non-selective Pre- and post-emergent. Target: annual and perennial broadleaf weeds, some grasses and some woody tree species. PDFs to protect plants from direct spray, drift, runoff, wind erosion. No aerial application	Yes	Possible short-term effects	Possible short-term effects to habitat

Short-term – 5 years or less

Herbicide Effects on Pollinators of Macfarlane's four-o'clock. Common floral visitors to Macfarlane's four-o'clock include bees of several genera. Although this species is self-compatible, it apparently requires a vector for the pollinator and is a critical factor for maintaining genetic diversity and may be a key to long-term survival of the species.

Uncertainty exists regarding the effects of herbicides on non-target plant species and pollinators because native species are not the usual test species for EPA toxicity studies. The EPA performs studies predominantly on pollinators of crop species (honeybees). Boutin *et al.* (2004) concluded that it was likely that the current suite of tested species was not representative of the habitats found adjacent to agricultural treatment areas, and suggested the current suite of tested species might cause an unacceptable bias and underestimated risk. Given all the uncertainties related to pollinators, the risks must be weighed in relation to impacts to native plant communities and ecosystem processes as a whole in relation to the ability of the proposed alternative to control, eradicate, and/or contain invasive species.

Over the past two decades, the threat of invasive species has become broadly recognized (Blossey *et al.* 2001), with the majority of studies focused on larger scale issues related to invasive species establishment in areas such as native plant population structure and alteration of native plant communities, competitiveness of invasive plants and invasibility of certain plant communities (Levine *et al.* 2004). Limited research is available that addresses impacts from invasive plants on mutualistic relationships between plant pollinators and native plant communities. One study has indicated that exotic plants may compete better for native plant pollinators by producing more desirable nectar and therefore increasing fitness and reproductive ability of the non-native plant (Levine *et al.* 2004). Presently, little is known about native plant pollinators. It is estimated that there may be between 130,000 and 200,000 invertebrate and vertebrate species that regularly visit the flowers of higher plants, which depend on these animals to assure cross-pollination. The majority of flowering plants in the world (88 percent) are pollinated by beetles, followed by wasps (18 percent) and bees (16.6 percent of flowering plants) (Buchman and Nabhan 1996). Research efforts are just beginning to investigate basic aspects of plant-pollinator interactions and how these relationships impact management decisions for plant conservation in natural systems (Kearns *et al.* 1998).

Very little information is available on the effect of herbicides on native pollinators. Most information is about the non-native honey bee. It is known that pollinators can be directly affected by spray or indirectly when plants needed as food for adults or larvae are eliminated by herbicides. Effects on pollinators were derived from risk assessment information regarding direct spray on honey bees (USDA 2005) (Table 22). Herbicide labels were also used for more species-specific information. By using label information about controlled species, effects to closely related species can only be extrapolated. Table 22 shows the active ingredients used in the proposed action are not expected to have toxic effects when directly sprayed on honey bees at the typical Forest Service application rate. Glyphosate and triclopyr may have some toxic effects if applied at the maximum application rate proposed by the Forest Service (SERA, 2003-glyphosate; SERA, 2003-Triclopyr).

Table 22. Potential doses for bees in a direct spray scenario (from Assessment)

Herbicide	Typical Application Rate	Potential Dose for Bee	Toxic Level for Bee
Chlorsulfuron	0.056 lb/ac	8.98 mg/kg	>25 mg/kg (LD50)
Clopyralid	0.35 lb/ac	56.1 mg/kg	909 mg/kg (no mortality)
Glyphosate	2.0 lb/ac	321 mg/kg	540 mg/kg (NOAEC)
Imazapic	0.13 lb/ac	16 mg/kg	387 mg/kg (no mortality)
Imazapyr	0.45 lb/ac	72.1 mg/kg	1000 mg/kg (no mortality)
Metsulfuron Methyl	0.03 lb/ac	4.81 mg/kg	270 mg/kg (NOEC)
Picloram	0.35 lb/ac	56.1 mg/kg	1,000 mg/kg (no mortality)
Sethoxydim	0.3 lb/ac	60.1 mg/kg	107 mg/kg (NOAEL)
Sulfometuron Methyl	0.045 lb/ac	7.21 mg/kg	1,075 mg/kg (NOEC)
Triclopyr BEE	1.0 lb/ac	160 mg/kg	>1,075 mg/kg (LD50)
Triclopyr TEA	1.0 lb/ac	160 mg/kg	>1,075 mg/kg (LD50)
NP9E (main generic ingredient in most surfactants)	1.67 lbs/ac	268.00 mg/kg	unknown

* LD50 (lethal dose 50) = The dose of a chemical calculated to cause death in 50 percent of a defined experimental animal population over a specified observation period; NOAEC = No observable Adverse Effects Concentration; NOEC = No observed effect concentration; NOAEL = exposure level at which there are not statistically or biological significant differences in the frequency or severity of any adverse effect in the exposed or control.

Potential impacts to pollinators that reside near and would likely be available to pollinate listed plants would be minimized by using techniques that minimize effects to listed plants. PDFs I-1 through I-12 were developed to minimize effects to listed plants and would also minimize effects to pollinators that reside near enough to pollinate these plants.

The proposed action estimates that 0.9 percent (0.16 percent annually) of the Wallowa-Whitman National Forest land base will be treated with chemicals. It projects that herbicide use will decrease over time as current infestations are treated. Applying EDRR to newly discovered sites allow treatment with the most effective methods, preventing establishment and expansion of new sites; however, EDRR does not allow aerial application of herbicide. The remaining Forest Service land base not treated with herbicides should provide adequate habitats for native pollinators to survive and re-establish in areas where they might be impacted. In relation to indirect impacts to Macfarlane's four-o'clock and its habitat it is assumed that any treatment that reduces invasive plants within a native plant community will result in a positive impact on the community as the native component is restored. Treatments in the Proposed Action may affect, and are likely to adversely affect Macfarlane's four-o'clock individuals. PDFs, as required, would reduce risk to populations from chemical treatments

Biological

Even though control agents are reviewed and approved by the USDA Animal and Plant Health Inspection Service (APHIS) prior to release in this country, there is a slight risk that an approved agent the Forest Service releases may unintentionally affect native plants (USDA 2005). There are no known direct effects to Macfarlane's four-o'clock from bio-control agents released for control of knapweed. There also remains the possibility that regardless of what the Forest

Service does, unapproved agents or agents known to affect non-target plants, including Macfarlane's four-o'clock, will spread from neighboring lands to National Forest lands. There are very few post-release studies on the effects of bio-control introductions on non-target plants or animals (Simberloff and Stiling 1996, Howarth 2000). Perhaps the most relevant studies of direct non-target effects concern the thistle seedhead weevil, *Rhinocyllus conicus*, introduced into North America for the control of Eurasian thistles in the genus *Carduus,* primarily musk thistle, *C. nutans* (Zwolfer and Harris 1984, Turner *et al.*1987, Louda *et al.* 1997). The original releases were made in Canada in 1968 and releases in both the U.S. and Canada continue today. Approval for the release of this insect was granted knowing that the weevil's host range included three native North American thistle genera. At that time, there was little concern for possible negative impacts on native thistles. In addition, female egg-laying behavior was expected to restrict the weevil's host range. Current evidence shows this weevil continues to expand it's geographic and host range, which now includes a close relative of the federally listed threatened Pitcher's thistle (*Cirsium pitcheri*) (Louda *et al.* 1997). Recent research rebuts the idea that the host-specificity of this weevil has changed since the original testing 30 years ago (Arnett and Louda 2002). Agents known to affect non-targets with a likelihood of encountering those non-targets if introduced are no longer approved for release (USDA 2003). APHIS continues to work on refining regulations and procedures for introducing biological control agents.

Biological controls may move into areas where the species occurs or may be released in areas where invasive species presently co-exist (toadflax). Controls for toadflax, knapweed, or yellow star thistle would be the most likely bio-control agents to be released or found. These bio-control host species are not related to the Macfarlane's four-o'clock, and therefore no effects are expected.

4.2.2 Interrelated/Interdependent Effects

Interrelated actions are those that are a part of a larger action and depend on the larger action for their justification. Interdependent actions are those that have no independent utility apart from the action under consideration. Both interdependent and interrelated activities are assessed by applying the "but for" test, which asks whether any action and its associated impacts would occur "but for" the proposed action.

The Forests, the Service, and NMFS (Level 1 team) did not identify any interrelated or interdependent actions during consultation.

4.3 Spalding's catchfly

4.3.1 Direct and Indirect Effects to the Species

Roughly 50 percent of all populations found in Oregon are on National Forest lands. This is a very approximate estimate since land ownerships tend to be shared for this species and separate population information by ownership is not available. Three populations were found in the Imnaha River basin in the Hells Canyon National Recreation Area in 2004 (populations 061604-2326 and 2327) and 2005 (population 061604-2328). Approximately 80 percent of the 24,000 acres of potential habitat determined through modeling have been surveyed. At the present time, no Spalding's catchfly populations are infested with or have invasive plants within 1000 feet; however, there are invasive plants nearby that could move closer to these areas. Future inventories may also identify newly established sites. If invasive species treatments were found to be necessary, manual, mechanical, or chemical methods would be used. Choice of method would depend on the invasive species; manual methods would be the treatment of choice in most cases, except for those species where manual techniques are proven ineffective. Biological controls are not expected to be actively introduced, but could move into occurrence areas from outside sources.

Manual Treatments

While accidental pulling or trampling would be the most likely damage to this plant, injury would likely be limited to above ground structures and only with a low risk of individual mortality. Risk of these effects would be mitigated by such techniques as flagging areas containing individual plants prior to treatments (as directed by Regional Standard #20), so workers would avoid individuals.

Mechanical Treatments

Mowing or string trimming (the most likely methods used) could sever or crush plants or plant parts. Injury would likely be limited to structures above the root crown and only with a low risk of individual mortality. Risk of these effects would be reduced by such techniques as flagging areas containing individual plants prior to treatments and careful hand pulling of invasive plants closer to the populations (as directed by Regional Standard #20), so equipment could avoid individuals.

Chemical Treatments

Individual plants could be damaged or killed from the accidental application or drift of the herbicide from ground based applications. The risk of impact would be reduced with implementation of required mitigation PDFs (Table 23). Risk of effects would be reduced by such techniques as timing of application during dormancy, flagging individuals, hand pulling of invasive plants closer to the populations or through selective application such as defined spot spray, shielding spray or hand wiping (as directed under Regional Standard #20) and PDFs. Aerial herbicide application is not proposed within five miles of the nearest Spalding's catchfly occurrence. PDFs require surveys prior to treatment of unsurveyed potential habitat.

Treatment of invasive weed populations, forest-wide and in this area specifically, has been variable in the past. Effectiveness at controlling invasive weeds forest-wide is estimated to be approximately 35 percent (Erickson 2006, as summarized in the Assessment). This low level of effectiveness is attributed to forest direction to use herbicides as the last method of control and does not include herbicide treatment of any new sites after the 1995 Environmental Assessment for Weeds without additional NEPA analysis. On the Umatilla National Forest, recent aggressive chemical control of populations along Lick Creek Road and up Sourdough Gulch has contained and/or reduced the most easily accessible infestations, helping to reduce seed sources. However, not all populations have been eliminated and Scotch thistle in particular has escaped up several side draws. Small stands of it are increasing fast in areas that are less accessible for treatment. No Spalding's catchfly were affected from herbicide and herbicide drift.

Herbicide Effects on Pollinators of Spalding's catchfly. The primary pollinator of Spalding's catchfly is the bumblebee *Bombus fervidus* (Service 2007). The effects of herbicides to pollinators of Spalding's catchfly are the same as those described in the Macfarlane's four-o'clock section and very little information is available on the effect of herbicides on native pollinators.

Two populations of Spalding's catchfly have invasive plants within ¼ mile. It is unlikely that pollinators near Spalding's catchfly populations would be affected by herbicides and their adjuvants unless new invasive plant populations are found closer to Spalding's catchfly and are treated under the EDRR strategy. Potential impacts to pollinators that reside near and would likely be available to pollinate listed plants would be minimized by using techniques that minimize effects to listed plants. PDFs I-1 through I-12 were developed to minimize effects to listed plants and would also minimize effects to pollinators that reside near enough to pollinate these plants.

The proposed action estimates that 0.9 percent (0.16 percent annually) of the Wallowa-Whitman National Forest land base will be treated with chemicals. It projects that herbicide use will decrease over time as current infestations are treated and EDRR to newly discovered sites allow treatment with the most effective methods (refer to the EIS). The remaining Forest Service land base not treated with herbicides should provide adequate habitats for native pollinators to survive and re-establish in areas where they might be impacted. In relation to indirect impacts to Spalding's catchfly and its habitat, it is assumed that any treatment that reduces invasive plants within a native plant community will result in a positive impact on the community as the native component is restored.

Biological Treatments

There are no known direct effects to Spalding's catchfly from bio-control agents released for control of knapweed. Refer to Biological Control Effects to Macfarlane's four-o'clock for more information (pg. 73).

There is a slight possibility that the approved root moth *Agapeta zoegana,* a bio-control for knapweed species, may impact an associated native grass species (Idaho fescue) commonly found with Spalding's catchfly. Callaway, DeLuca and Belliveau (1999) found the reproductive out put of native Idaho fescue planted with spotted knapweed was lower when the introduced root moth had attacked neighboring knapweed. These results have not been confirmed in a field setting and, due to the monitoring being conducted on Spalding's catchfly subpopulations on the Forest, impacts to associated native vegetation in the surrounding areas would identify any associated concerns.

Table 23. Summary of potential effects to Spalding's catchfly due to the use of herbicides with and without implementation of Project Design Features (PDFs). Persistent chemicals, such as Picloram, can only be used within the distance specified in the PDF.

Herbicide	Direct Effects without PDFs	Direct Effects with PDFs	Indirect Effects to Spalding's catchfly habitat – non-target plants with PDFs
Chlorsulfuron: Selective on broadleaf weeds some and grasses PDFs protect individual plants from direct spray, drift, runoff, wind erosion. No aerial application	Yes	Possible short-term effects	Possible short-term effects to habitat
Clopyralid: Extremely selective: Asteraceae, Fabaceae, Polygonaceae, Solanaceae families	No Caryohpyllaceae is not target family	No	Possible short-term effects to grasses (habitat), but grasses are very tolerant of this herbicide
Glyphosate: Non-selective; PDFs to protect from direct spray; runoff not a concern.	Yes	Possible short-term effects	Possible short-term effects to habitat
Imazapic: Selective against some broadleaves & some grasses. PDFs to protect from direct spray, drift, runoff & timing after use of other herbicides	Yes	Possible short-term effects	Possible short-term effects to habitat
Imazapyr: Non-selective. PDFs to protect plants from direct spray, drift, runoff	Yes	Possible short-term effects	Possible short-term effects to habitat
Metsulfuron methyl: Selective for some broad-leaf and woody species; can damage conifers. PDFs to protect individual plants from direct spray, drift, runoff, wind erosion. No aerial application	Yes	Possible short-term effects	Possible short-term effects to habitat
Picloram: Selective: rate and season dependant; pre-emergent and soil active. PDFs to protect from direct spray drift, runoff; buffers; fall application by TES plants & other special situations	Yes Target Families are: Compositae, Leguminosae, Polygonaceae, and Apiaceae families. Less affected families: Brassicaceae, Liliaceae, and. Scrophularaiaceae. Unknown effects assume worst case.	Possible short-term effects	Possible short-term effects to habitat
Sethoxydim: Selective for annual & perennial grasses & target invasive plants. Soil activity prevents germination of grasses. Absorbed rapidly by foliage and roots. Systemic. Broadleaf and sedges are tolerant	No. Broadleaf plants are tolerant	No	Possible short-term effects to habitat
Sulfometuron methyl: Non-selective Pre- and post-emergent. Target: annual and perennial broadleaf weeds, some grasses and some woody tree species. PDFs to protect plants from direct spray, drift, runoff, wind erosion. No aerial application	Yes	Possible short-term effects	Possible short-term effects to habitat

Short-term – 5 years or less

Site Restoration/Revegetation

At the present time, no site restoration or revegetation from invasive plant establishment and eradication is necessary in or around known Spalding's catchfly occurrences. Unknown future situations may occur that could require these methods. Regional standards related to these methods direct the forest to development of a long-term site strategy for restoration and/or revegetating invasive plant sites prior to treatment and use of native plant materials as first choice in revegetation for restoration and rehabilitation. Additionally, revegetation and restoration guidelines after invasive plant control would be used as a tool (Appendix G in the Assessment). Direct and indirect effects to future unknown Spalding's catchfly in need of restoration/revegetation would likely have the same impacts as those described previously under manual and mechanical control methods.

4.3.2 Interrelated/Interdependent Effects

Interrelated actions are those that are a part of a larger action and depend on the larger action for their justification. Interdependent actions are those that have no independent utility apart from the action under consideration. Both interdependent and interrelated activities are assessed by applying the "but for" test, which asks whether any action and its associated impacts would occur "but for" the proposed action.

The Forests, the Service, and NMFS (Level 1 team) did not identify any interrelated or interdependent actions during consultation.

5. Cumulative Effects

Cumulative effects include the effects of future State, tribal, local or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

Only the land and roads within the National Forest system would be treated in the proposed action. The Forest, however, is intermingled with other federal, state, county, and private ownerships. Management activities and actions on neighboring lands may contribute to spread or containment of invasive plants on National Forest system lands, and vice versa. Herbicides are commonly applied on lands other than National Forest system lands for a variety of agricultural, landscaping and invasive plant management purposes.

Herbicide use occurs on tribal lands, state, county and other Federal lands, private forestry lands, rangelands, utility corridors, road rights-of-way, and private property. Only restricted use herbicides have a mandatory reporting requirement to the states. Therefore, accurate accounting of the total acreage of invasive plant treatment for all land ownerships is unavailable. However, risk assessments indicate no measurable amounts would be in the waters adjacent to the treatment area.

Project PDFs also are designed to reduce the chance of drift reaching streams minimizing direct and indirect effects. Treatments from this proposed action would not likely result in a measurable change when combined with treatments on private lands.

6. Conclusion

After reviewing the current status of bull trout and its critical habitat, MacFarlane's four-o'clock, and Spalding's catchfly; the environmental baseline for the action area; the effects of the proposed project activities; and anticipated cumulative effects, it is the Service's biological opinion that the action as proposed is not likely to jeopardize the continued existence of the Columbia River Basin DPS of bull trout, Macfarlane's four-o'clock, and Spalding's catchfly and is not likely to destroy or adversely modify designated critical habitat for the bull trout. The Service reached these conclusions for the following reasons.

6.1 Bull Trout

- Some bull trout are likely to experience exposures to significant concentrations of herbicides, turbidity, fine sediment deposition, and increased water temperatures that exceed effect thresholds and result in harm. However these exposures are likely to be minor in magnitude (generally sublethal) and extent (generally less than 500 feet of stream per treatment site), and occur infrequently.

- Conservation measures (Project Design Features) incorporated into the project proposal will likely minimize direct and indirect effects to bull trout from project activities.

- The amount of riparian treatment (above bankfull, above the stream channel) per 1.6 miles of stream is limited to 10 acres per year per 6th field HUC by the proposed action, and the amount of treatment below bankfull (within the stream channel) is not to exceed 2 acres per year per 6th field HUC subwatershed.

- The number of significant exposures is likely to vary from year to year, and will depend on the number and nature of the riparian and in-channel sites treated, the amount of time elapsed between manual, mechanical, and herbicide treatments and rainfall, and the intensity of rainfall.

- There is the potential for juveniles, fry, or eggs to be directly harmed by workers walking or standing in stream channels. This adverse effect will be minimized by the proposed action that requires that treatment below bankfull will only occur during the instream work window.

- Long-term effects on instream habitat (enhancement of native riparian vegetation) from invasive plant treatment activities (reducing noxious weed populations) are anticipated to be beneficial.

- Due to the low magnitude and extent of effects resulting from implementation of the proposed action, the abundance, productivity, distribution, and connectivity of bull trout will not be significantly affected.

The Service concludes that the Umatilla and Wallowa-Whitman National Forests' Invasive Plant Treatment Project has the potential to adversely affect bull trout and bull trout habitat. The project is not expected to appreciably reduce either the survival or recovery of bull trout. Although the level of incidental take predicted to result from the proposed action could not be quantified, the spatial and temporal scope of that incidental take, and the non-lethal nature of most of it, means the incidental take will not have a meaningful impact on reproduction, numbers or distribution of bull trout.

6.2 Bull trout Critical Habitat

- The majority of the action area does not include critical habitat (federal lands are not included in the designation), therefore only a very small area of critical habitat (downstream of the proposed action but within the action area on private lands) may be affected.

- The small size, severity, and instream duration of the project and conservation measures (PDFs) described in the proposed action are expected to minimize the extent, duration, and magnitude of habitat effects, such that it is unlikely that the function or conservation role of the critical habitat will be adversely affected in the long-term by this activity.

- Long-term effects on instream critical habitat (enhancement of native riparian vegetation) from invasive plant treatment activities (reducing noxious weed populations) are anticipated to be beneficial.

6.3 Macfarlane's four-o'clock

- The primary potential effect from this project would be short-term damage to individuals or small groups of plants due to unintended direct application or drift from aerial spray herbicide treatments. Under the Umatilla and Wallowa-Whitman National Forests' Invasive Plant Treatment Project, aerial treatments are expected to be infrequent, widely spaced, and of short duration.

- Because the 12 known populations are widely spaced and individuals and groups are scattered within them, the likelihood of an unintended application affecting the population as a whole is very low. The potential effects will be further minimized by the implementation of conservation measures (PDFs).

- The possible loss of scattered individuals or small groups due to unintended herbicide exposure will not significantly affect Macfarlane's four-o'clock at the population level.

Therefore, the Umatilla and Wallowa-Whitman National Forests' Invasive Plant Project is not expected to appreciably reduce the reproduction, numbers, or distribution of Macfarlane's four-o'clock.

6.4 Spalding's catchfly

- The primary potential effect from this project would be short-term damage to individuals or small groups of plants due to unintended direct application or drift from aerial spray herbicide treatments. Under the Umatilla and Wallowa-Whitman National Forests' Invasive Plant Treatment Project, aerial treatments are expected to be infrequent, widely spaced, and of short duration.

- Because the 66 known populations of Spalding's catchfly are widely spaced over several states; with individuals and groups scattered within them, the likelihood of an unintended application affecting the population as a whole is very low. The potential effects will be further minimized by the conservation measures (PDFs).

The possible loss of scattered individuals or small groups due to unintended herbicide exposure will not significantly affect Spalding's catchfly at the population level. Therefore, the Umatilla and Wallowa-Whitman National Forests' Invasive Plant Treatment Project is not expected to appreciably reduce the reproduction, numbers, or distribution of Spalding's catchfly.

7. Incidental Take Statement

Section 9 of the Act and Federal regulations pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or attempt to engage in any such conduct. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing behavioral patterns including breeding, feeding, or sheltering. Harass is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, 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 this project is not considered to be prohibited taking under the Act provided that such taking is in compliance with this Incidental Take Statement.

Sections 7(b)(4) and 7(o)(2) of the Act generally do not apply to listed plant species. However, limited protection of listed plants from take is provided to the extent that the Act prohibits the removal and reduction to possession of Federally listed endangered plants or the malicious damage of such plants on areas under Federal jurisdiction, or the destruction of endangered plants on non-Federal areas in violation of State law or regulation or in the course of any violation of a State criminal trespass law.

The measures described below are non-discretionary, and must be undertaken by the Forests so that they become binding conditions of any grant or permits issued to others conducting the work, as appropriate, for the exemption in section 7(o)(2) to apply. The Forests have a continuing duty to regulate the activity covered by the incidental take statement. If the Forests (1) fails to assume and implement the terms and conditions or (2) fail to require their grantees or permitees to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the Forests must report the progress of the action and its impact on the species to the Service as specified in the incidental take statement [50 CFR §402.14(i)(3)].

7.1 Amount/Extent of Take Anticipated

As described in the effects of the action discussion, the Service expects that the protective riparian buffers, minimization measures, and restricted application methods proposed by the Forests will prevent herbicides from causing incidental take of bull trout under most treatment scenarios. However, some treatment actions may cause incidental take of bull trout. The incidental take is expected to be in the form of non-lethal harm, caused by short-term exposures of bull trout to sub-lethal concentrations of herbicides and associated compounds. Sub-lethal effects include short-term impairments (hours) of normal functions and behaviors such as olfaction, respiration, and feeding. These effects may occur as a result of herbicide applications (e.g., emergent vegetation treatments, riparian applications, or applications in roadside ditches and intermittent streams which connect directly to bull trout rearing habitat). Herbicides proposed for use by the Forests are not expected to reach streams in concentrations that would kill bull trout.

The number of significant exposures is likely to vary from year to year, and will depend on the number and nature of the riparian and in-channel sites treated, the amount of time elapsed between manual, mechanical, and herbicide treatments and rainfall, and the intensity of rainfall. There is the potential for juveniles, fry, or eggs to be directly harmed by workers walking or standing in stream channels. This adverse affect will be minimized by the proposed action that requires that treatment below bankfull will only occur during the instream work window.

The proposed action consists of two components, treatment of currently inventoried infestation sites, and treatment of infestation sites discovered in the future. Consequently, the amount and extent of take have both site-specific and programmatic components.

Despite the use of best scientific and commercial data available, the Service cannot quantify the specific number of individual fish that will be incidentally taken by this action. The Service anticipates that incidental take of individual bull trout would be difficult to detect or quantify because of the sublethal nature of the take and the low likelihood of finding the affected juveniles or adults. We expect that the number of individual fish exposed to sublethal concentrations of herbicides will be low, and would only be associated with treatments within and adjacent to bull trout spawning and rearing habitat. In the absence of sufficient data to quantify the number of individuals affected, the Service relies on estimates of habitat affected as a reasonable surrogate for describing the extent of take.

As displayed in Table II-1 of the Assessment, approximately 12,000 acres of riparian treatments (combined herbicide, physical, and biological) are currently proposed. However, only a few of the 79 sixth-field HUC subwatersheds in the action area which contain spawning and rearing bull trout (Table 24) are likely to be affected each year. While some adverse effects to bull trout and bull trout habitat from manual and mechanical treatments are likely to occur, the frequency of adverse effects is likely to be low. Manual treatment would occur over several years; less than one third of riparian areas are likely to be adjacent to bull trout habitat, and only some treatment activities would likely affect bull trout. For treatments that occur below bankfull, in subwatersheds that contain spawning and rearing bull trout habitat, the maximum number of acres that can be treated annually is 158 (79 6th field HUCS X 2 acres). The Service estimates that no more than half (79 acres/year) will actually occur in bull trout spawning and rearing sections of the streams.

Table 24. Number of fourth and sixth-field HUCs in the action area that contain spawning and rearing bull trout.

Fourth-Field HUC Name	Fourth-Field HUC Number	Number of Sixth-Field HUCs that contain spawning and rearing bull trout in Action Area
Hell's Canyon	17060101	4
Imnaha River	17060102	11
Lower Snake - Asotin	17060103	1
Upper Grande Ronde River	17060104	12
Wallowa River	17060105	13
Lower Grande Ronde	17060106	10
Lower Snake - Tucannon	17060107	3
Walla Walla	17070102	8
Umatilla	17070103	2
North Fork John Day	17070202	14
Middle Fork John Day	17070203	1
Wallowa-Whitman and Umatilla National Forest GIS Data sent to Service from Gene Yates on 1/27/09		Total = 79

Within the 79 six-field HUCs that contain bull trout, there are only 60.8 miles of roads for the Umatilla National Forest and 29.5 miles for the Wallowa-Whitman National Forest proposed for treatment within 100 feet of fish bearing streams where the watershed contains bull trout (refer to Appendix E in the Assessment) and where runoff from intermittent streams and roadside ditches may occur. The Service estimates that no more than half of these miles (30.4 for the Umatilla National Forest and 14.75 miles for the Wallowa-Whitman National Forest), and the associated riparian acres, will actually occur within 100 feet of bull trout spawning and rearing areas where take would be anticipated.

These are conservative estimates of expected levels of take. In addition, project implementation of these areas is uncertain, and the two PDFs listed below will restrict the actual number of acres treated within riparian and instream areas.

1. Treatments above bankfull, within the riparian areas, would not exceed 10 acres per year along any 1.6 mile of stream (PDF H-14)

2. Annual treatments below bankfull would not exceed 2 acres of stream channel per 6th field HUC

The estimated extent of take is based on assumptions in the exposure analysis in the SERA risk assessments and in this Opinion that herbicide application would not occur less than 24 hours before rainfall. As stated above, the Service expects the protective buffers, protective measures (project design features), and restricted application methods proposed by the Umatilla and Wallowa-Whitman National Forests will prevent herbicides from causing incidental take of bull trout under most treatment scenarios and any effects are likely to be sublethal under most circumstances. However, the PDFs do not completely eliminate the potential for incidental take since herbicides may be used in sites where they are likely to reach water where bull trout are present. In addition, the in-water work periods greatly minimize but do not completely eliminate the potential of incidental take from activities below bankfull that contribute sediment into the stream, harass bull trout, or cause actual trampling of eggs and fry.

7.2 Effect of Take

In the accompanying Opinion, the Service determined that this level of anticipated take is not likely to result in jeopardy to the species or destruction or adverse modification of critical habitat.

7.3 Reasonable and Prudent Measures

The Service believes that the following reasonable and prudent measures (RPMs) are necessary and appropriate to minimize impacts of incidental take of bull trout.

The Umatilla and Wallowa-Whitman National Forests shall minimize incidental take by:

1. Minimize the amount and extent of incidental take from treatment activities (from herbicides and manual/mechanical treatments) by implementing precautionary measures that minimize the spread of invasive plants, keep chemicals out of the water, and reduce erosion potential.
2. Report annual invasive plant control proposals to the Service via the Level 1 Team by March 1, prior to the start of the spray season (2009 to 2018). The proposals will include the treatment methods, herbicide application methods and rates, objectives of treatments, locations, maps of treatment areas, acreages, proposed start and stop dates, and special mitigation measures that will be applied.
3. Provide an annual report by January 31 to the Service on activities implemented during the 2009 to 2018 seasons and the results of Regional monitoring efforts. If no activities occur, a report of no action is still required by January 31, following each spray season (2009 to 2018).

7.4 Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the Act, the Forests must comply with the following terms and conditions, which will implement the reasonable and prudent measures described above. These terms and conditions shall be incorporated as mandatory requirements of any permit issued. Implementation of the terms and conditions within this Opinion will further reduce the risk of impacts to bull trout within the action area. These terms and conditions are non-discretionary.

1. The following terms and conditions are necessary for the implementation of RPM 1:

   a. Ensure vehicles and equipment do not transport invasive plant materials.
   b. Ensure that annual treatments above bankfull, within riparian areas, not exceed 10 acres along any 1.6 mile reach of a stream per 6th field HUC.
   c. Ensure that annual treatments below bankfull not exceed 2 acres of stream channel per 6th field HUC.
   d. Ensure that treatments below bankfull are conducted during the instream work window.
   e. Do not use any products other than those products evaluated in this Opinion.
   f. Ensure application of herbicide aerially is not used for treatment of EDRR sites.
   g. Ensure that herbicide application methods are more restrictive the closer to water (follow table 6, 7 and 8 in the proposed action).
   h. Ensure that POEA surfactants, urea ammonium nitrate or ammonium sulfate, are not used in applications within 150 feet of surface water, wetlands or on roadside treatment areas, including ditches, having high potential to deliver herbicide.
   i. Ensure that an herbicide transportation and handling safety/spill response plan is in place as described in PDF G.
   j. Ensure that aerial application rates for picloram does not exceed (0.25lb/a.i./acre), and clopyralid does not exceed typical application rates (0.35lb a.i./acre).
   k. Ensure that chlorsulfuron, metsulfuron methyl, sulfometuron methyl and triclopyr is not applied aerially.
   l. Herbicide applicators will obtain a weather forecast for the area prior to applying herbicides to ensure no imminent precipitation or wind events are likely to occur during or immediately after spraying.
   m. No broadcast of high aquatic risk herbicides on roads that have a high risk of delivery to water (generally roads in RHCAs). These herbicides are picloram, non-aquatic triclopyr (Garlon 4), non-aquatic glyphosate, and sethoxydim.
   n. Ensure that foaming only be used on invasive plants that are further than 150 feet from streams and other water bodies.
   o. Ensure that aerial applications do not exceed typical application rates.

2. The following terms and conditions are necessary for the implementation of RPM 2:

   a. Develop annual invasive plant treatment plans with the Service, including treatment methods, herbicide application methods and rates, objectives of treatments, locations, maps of treatment areas, acreage, proposed start and completion dates, sensitive areas, and special mitigation for activities involving herbicides by March 1, prior to the spray season. We recognize that not all treatments under the EDRR program may be identified prior to March 1. These actions will be included in the annual year-end report. The pre-project reporting requirement will commence prior to initiation of treatments in 2009; will follow for each subsequent spraying season on March 1; and will end for this consultation on December 31, 2018. The annual invasive plant treatment plans should contain the following information for projects planned in bull trout core area watersheds:

i. Location: 6th field HUC, 12 digit code, and name
ii. Timing: Anticipated project start and dates
iii. Treatment/Restoration Type: Identify all proposed activity types that apply.
iv. Project Description: Brief narrative of the project and objectives
v. Extent: Number of stream miles or acres of below-bankfull treatments, and number of riparian acres to be treated.
vi. Species Affected: Listed fish and or wildlife species or critical habitat affected by the project.

3. The following terms and conditions are necessary for the implementation of RPM 3:

a. Using the format of the annual invasive plant treatment plan listed above, annually report to the Service by January 31, following the end of each spray season for the duration of this Opinion (2009 to 2018 spray seasons), the results of the project implementation and results of Regional monitoring efforts for projects implemented in bull trout core area watersheds:

i. Timing: Actual project start and end dates
ii. UNF/WWNF contact information: Project lead name
iii. Post-project assessment: Report the results of monitoring efforts completed under the Regional Monitoring Framework. Send reports to the La Grande Field Office, 3502 Highway 30, La Grande, OR 97850.

7.5 Reporting Requirements

If a dead, injured, or sick endangered or threatened species specimen (including a bull trout) is located, initial notification must be made to the nearest Service Law Enforcement Office, located at 9025 SW Hillman Court, Suite 3134, Wilsonville, OR 97070; phone: 503-682-6131. Care should be taken in handling sick or injured specimens to ensure effective treatment or the handling of dead specimens to preserve biological material in the best possible state for later analysis of cause of death. In conjunction with the care of sick or injured endangered and threatened species or preservation of biological materials from a dead animal, the finder has the responsibility to carry out instructions provided by Law Enforcement to ensure that evidence intrinsic to the specimen is not unnecessarily disturbed.

Review Requirement: The Reasonable and Prudent Measures, with their implementing Terms and Conditions, are designed to minimize incidental take that might otherwise result from the proposed action. These measures should decrease the level of take of bull trout to the degree possible, given the circumstances surrounding the proposed action. With implementation of these measures, the Service believes that some bull trout may be incidentally taken as quantified above. If, during the course of the action, this minimized level of incidental take is exceeded, such incidental take would represent new information requiring review of the reasonable and prudent measures provided, the Forests must immediately provide an explanation of the causes of the taking and review with the Service the need for possible modification of the reasonable and prudent measures.

8. Conservation Recommendations

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

1. Use herbicide formulations with the least toxicity to fish and other aquatic organisms whenever possible.
2. Continue to investigate the use of alternate forms of weed control that do not involve the use of chemicals toxic to aquatic organisms.
3. Monitor invasive plant treatment sites with a priority to riparian locations and listed plants to determine if expected beneficial habitat changes take place.
4. Continue to survey and monitor bull trout populations and habitat in the action area to gather baseline and population trend information.
5. Document Columbia spotted frog adult, subadult, and tadpole presence/absence in the action area and take appropriate measures to protect these areas from herbicide treatment.
6. Document any new plants or occurrences for McFarlane's four-o'clock, and Spalding's catchfly in the action area and take appropriate measures to protect these new plant occurrences.
7. Evaluate and implement actions to restore native vegetation in treatment areas, giving priority to locations with McFarlane's four-o'clock, Spalding's catchfly, bull trout spawning and rearing habitat, and Columbia spotted frog habitat.
8. Monitor pollinators of listed plants and monitor the effects to pollinators from herbicide treatments.

In order for the Service to be kept informed of actions minimizing or avoiding adverse effects or benefiting listed species or their habitats, the Service requests notification of the implementation of any conservation recommendations.

9. Reinitiation – Closing Statement

This concludes formal consultation for the potential effects of Umatilla and Wallowa-Whitman National Forests' Invasive Plant Treatment Project on bull trout, bull trout critical habitat, Macfarlane's four-o'clock, and Spalding's catchfly. As provided in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this Opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this Opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. Whenever the amount or extent of incidental take is exceeded, any operations causing such take must cease, pending reinitiation of consultation with the Service.

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Appendix A. Project Design Features

A-Pre-Project Planning

A-1: Prior to treatment, confirm species/habitats of local interest, watershed and aquatic resources of concern (e.g., hydric soils, streams, lakes, roadside treatment areas with higher potential to deliver herbicide to water, municipal watersheds, domestic water sources), places where people gather, and range allotment conditions. Apply appropriate PDFs described below.

For EDRR sites, follow the decision tree (see Figure 1) to determine the type and method of treatment and apply applicable PDFs.

B-Coordination with Other Landowners and Agencies

B-1: Work with owners and managers of neighboring lands to respond to invasive plants that straddle multiple ownerships. Coordinate treatments within appropriate distances based on invasive plant species reproductive characteristics, and current use of area.

C-To Prevent the Spread of Invasive Plants during Treatment Activities

C-1: Ensure vehicles and equipment (including personal protective clothing) do not transport invasive plant materials.

D-Wilderness Areas

D-1: For EDRR in wilderness, invasive plants could be treated using non-mechanical hand methods or herbicides. Herbicide treatments may use application methods such as wicking, stem injection, spray bottle, hand pressurized pumps, battery or solar powered pumps and propellant-based systems such as those that use pressurized carbon dioxide.

E-Non-herbicide Treatment Methods

E-1: Limit the numbers of workers on any one site at any one time while treating areas within 150 feet of creeks.

E-2: Fueling of gas-powered equipment with tanks larger than 5 gallons would not occur inside the RHCA unless there is no other alternative.

F-Herbicide Application

F-1: Herbicides would be used in accordance with label instructions, except where more restrictive measures are required as described below. Herbicide applications would only treat the minimum area necessary to meet site objectives. Herbicide formulations would be limited to those containing one or more of the following 10 active ingredients: chlorsulfuron, clopyralid, glyphosate, imazapic, imazapyr, metsulfuron methyl, picloram, sethoxydim, sulfometuron methyl, and triclopyr. Herbicide application methods include wicking, wiping, injection, spot, and broadcast, as permitted by the product label and these PDF. The use of triclopyr is limited to spot and hand/selective methods. Herbicide carriers (solvents) are limited to water and/or specifically labeled vegetable oil.

F-2: Herbicide use would comply with standards in the Forest Plans as amended by the R6 2005 ROD, including standards on herbicide selection, restrictions on broadcast use, tank mixing, licensed applicators, and use of adjuvants, surfactants and other additives.

F-3: Polyethoxylated tallowamine (POEA) surfactants, urea ammonium nitrate or ammonium sulfate would not be used in applications within 150 feet of surface water, wetlands or on roadside treatment areas, including ditches, having high potential to deliver herbicide.

F-4: Lowest effective label rates would be used. No broadcast applications of herbicide or surfactant would exceed typical label rates. Nonylphenol Ethoxylates (NPE) surfactant would not be broadcast at a rate greater than 0.5 lbs. a.i./ac (pounds of active ingredient per acre). Favor other classes of surfactants wherever they are expected to be effective.

F-5: Herbicide applications would occur when wind velocity is between two and eight miles per hour to reduce the chance of drift. During application, weather conditions would be monitored periodically by trained personnel.

F-6: To minimize herbicide application drift during broadcast operations, use low nozzle pressure; apply as a coarse spray, and use nozzles designed for herbicide application that do not produce a fine droplet spray (e.g., nozzle diameter to produce a median droplet diameter of 500-800 microns).

F-7: Use of sulfonylurea herbicides (chlorsulfuron, sulfometuron methyl, and metsulfuron methyl), will require soils to be mapped prior to treatment. Treatment of powdery, ashy dry soil, or light sandy soil can only be treated if rainfall is expected within 24 hrs of treatment.

F-8: Additional design features specific to aerial application corresponding to Assessment Appendix F-Aerial Spray Guidelines:

> **F-8a**: Application of herbicide aerially will not be used for treatment of EDRR sites.
>
> **F-8b**: Chlorsulfuron, metsulfuron methyl, sulfometuron methyl and triclopyr will not be applied aerially.
>
> **F-8c**: Provide a minimum buffer of 300 feet for aerial application of herbicides near developed campgrounds, recreation residences and private land (unless otherwise authorized by adjacent private landowners).
>
> **F-8d**: Prohibit aerial application of herbicides within congressionally designated municipal watersheds.

F-8e: Effectiveness Monitoring required for "a representative sample" of the spray area in a project involving aerial application of herbicide to insure impacts to non-target species are within tolerance.

F-8f: All aviation activities shall be in accordance with FSM 5700 (Aviation Management), FSH 5709.16 (Flight Operations Handbook) FSM 2150 (Pesticide Use Management and Coordination), FSH 2109.14, 50 (Quality Control Monitoring and Post-Treatment Evaluation).

F-8g: Buffers for herbicide use and application methods are proposed for perennial and wet intermittent streams, dry streams and lakes and wetlands. These buffers are displayed below in Tables 6, 7, and 8.

F-8h: Buffer distances for federally listed species of local interest (SOLI) will follow Recovery Plan recommendations. No aerial application would occur within 300 feet of non-federally listed SOLIs. Spray cards to monitor drift can be used in conjunction with monitoring and adaptive management to adjust buffers if needed.

F-8i: Aerial spraying of invasive species will not occur in areas with 30 percent or more live tree canopy cover. For live tree canopy cover between 10-29 percent an on-site decision whether or not to aerial spray would be based on factors such as target invasive species, herbicides (specificity) proposed for treatment, and potential impacts to non-target tree species present.

F-8j: Aerial spray units (and perennial seeps, ponds, springs, and wetlands in proposed aerial units) will be ground-checked, flagged and marked using GPS prior to spraying to ensure only appropriate portions of the unit are aerially treated. A GPS system will be used in spray helicopters and each treatment unit mapped before the flight to ensure that only areas marked for treatment are treated. Plastic spray cards will be placed out to 350 feet from and perpendicular to perennial creeks to monitor herbicide presence.

F-8k: Press releases will be submitted to local newspapers indicating potential windows of treatment for specific areas. Signing and on site layout will be performed one to two weeks prior to actual aerial treatment.

F-8l: Grazing permittees would be notified at annual permittee meeting that aerial application will be conducted. Permittees would also be notified of specific time frames in which treatment would occur to ensure grazing animals are removed from the area.

F-8m: Enforceable temporary area, trail, and road closures would be used to ensure public safety during aerial spray operations.

F-8n: Constant communications will be maintained between the helicopter and the project leader during spraying operations. Ground observers will have communication with the project leader. Observers will be located at various locations adjacent to the treatment area to monitor wind direction and speed as well as to visually monitor drift and deposition of herbicide.

F-8o: Aerial swath displacement buffers would be applied as needed as described in Assessment, Appendix F, Table F-2.

F-8p: Aerial application rates for picloram would not exceed (0.25lb/a.i./acre), and clopyralid would not exceed typical application rates (0.35lb a.i./acre).

G-Herbicide Transportation and Handling Safety/Spill Prevention and Containment

An herbicide transportation and handling safety/spill response plan would be the responsibility of the herbicide applicator (Forest Service applicator or contractor, as applicable). At a minimum the plan would:

- Address spill prevention and containment.
- Estimate and limit the daily quantity of herbicides to be transported to treatment sites.
- Require that impervious material be placed beneath mixing areas in such a manner as to contain small spills associated with mixing/refilling.
- Require a spill cleanup kit be readily available for herbicide transportation, storage and application (minimum FOSS Spill Tote Universal or equivalent).
- Outline reporting procedures, including reporting spills to the appropriate regulatory agency.
- Ensure applicators are trained in safe handling and transportation procedures and spill cleanup.
- Require that equipment used in herbicide storage, transportation and handling are maintained in a leak proof condition.
- Address transportation routes so that traffic, domestic water sources, and blind curves are avoided to the extent possible.
- Specify conditions under which guide vehicles would be required.
- Specify mixing and loading locations away from water bodies so that accidental spills do not contaminate surface waters.
- Require that spray tanks be mixed or washed further than 150 feet of surface water.

- Ensure safe disposal of herbicide containers.

- Identify sites that may only be reached by water travel and limit the amount of herbicide that may be transported by watercraft (See H14).

H- Soils, Water and Aquatic Ecosystems:

H-1: Herbicide buffers have been established by herbicide and application method for perennial and wet intermittent steams; dry streams; and lakes and wetlands. These buffers are displayed in Tables 6, 7, and 8 (in the Assessment). The largest buffer for an individual ingredient would apply to tank mixtures.

H-2: No broadcast of high aquatic risk herbicides on roads that have a high risk of delivery to water (generally roads in RHCAs). These herbicides are picloram, non-aquatic triclopyr (Garlon 4), non-aquatic glyphosate, and sethoxydim.

H-3: In riparian and aquatic settings, vehicles (including all terrain vehicles) used to access invasive plant sites, apply foam, or for broadcast spraying would remain on roadways, trails, parking areas to prevent damage to riparian vegetation, soil, water quality and aquatic habitat.

H-4: Avoid use of clopyralid on high-porosity soils (coarser than loamy sand).

H-5: Avoid use of chlorsulfuron on soils with high clay content (finer than loam).

H-6: Avoid use of picloram on shallow or coarse soils (coarser than loam.) according to herbicide labels. No more than one application of picloram would be made within a two-year period.

H-7: Avoid use of sulfometuron methyl on shallow or coarse soils (coarser than loam.) No more than one application of sulfometuron methyl would be made within a one-year period.

H-8: Lakes and Ponds – No more than half the perimeter or 50 percent of the vegetative cover within established buffers or 10 contiguous acres around a lake or pond would be treated with herbicides in any 30-day period. This limits area treated within riparian areas to keep refugia habitat for reptiles and amphibians.

H-9: Wetlands – Wetlands would be treated when soils are driest. If herbicide treatment is necessary when soils are wet, use aquatic labeled herbicides. Favor hand/selective treatment methods where effective and practical. No more than 10 contiguous acres or fifty percent individual wetland areas would be treated in any 30-day period.

H-10: Foaming would only be used on invasive plants that are further than 150 feet from streams and other water bodies.

H-11: Herbicide use would not occur within 100 feet of wells or 200 feet of spring developments. For stock tanks located outside of riparian areas, use wicking, wiping or spot treatments within 100 feet of the watering source.

H-12: When chemicals need to be carried over water by boat, raft or other watercraft, herbicides will be carried in water tight, floatable containers of 1 gallon or less.

H-13: Aerial applications would not exceed typical application rates.

H-14: Annual treatments above bankfull, within riparian areas, would not exceed 10 acres along any 1.6 mile reach of a stream per 6^{th} field HUC.

H-15. Annual treatments below bankfull would not exceed 2 acres of stream channel per 6^{th} field HUC (based on email from Gene Yates, Wallowa-Whitman National Forest, to the Level 1 Team on 11/13/2008).

I - Vascular and Non-Vascular Plant and Fungi Species of Local Interest (SOLI)

I-1: Botanical surveys may be necessary prior to treatment applications to identify vascular and non-vascular SOLI occurrence in or near areas proposed for invasive plant treatments. Consultation with the district or forest botanist would be done prior to invasive plant treatments to evaluate survey needs. If suitable habitat is present and surveys are needed, they will be conducted by qualified personnel and surveys around proposed invasive plant treatments will be as follows: 300 to1,000 feet of planned aerial treatments (see I7), 100 feet of planned broadcast treatments, 10 feet of planned spot treatments and/or 5 feet of planned hand herbicide treatments.

I-2: In the absence of botanical surveys: no aerial herbicide treatment will occur within 300 to 1000 feet of SOLI habitat (see section I6), and no ground based broadcast, spot, or hand treatments will occur within 100 feet of SOLI habitat.

I-3: Buffer distances for known botanical SOLI's occurrences are:

I-4: Picloram will not be used within 50 feet of the threatened plant species Spalding's catchfly and MacFarlane's four-o-clock

I-5: In the vicinity of Spalding's catchfly, MacFarlane's four-o' clock and all other SOLI, restoration and cultural treatments, including seeding and/or use of fertilizer, will be under the direct supervision of the district or forest botanist to ensure that plant communities are restored to their desired condition without negative impacts to existing SOLI populations or individuals. The vicinity areas will be evaluated on a case by case basis.

I-6: When vascular or non-vascular SOLI plant species are within 10 feet of saturated or wet soils at the time of herbicide application, only hand methods (wiping, stem injection, etc.) would be used. Avoid the use of picloram and imazapyr in this situation, and use aquatic triclopyr with caution as typical application rates can result in concentrations greater than estimated or measured "no observable effect concentration" to aquatic plants (R6 2005 FEIS, Table 4-47).

I-7: Aerial herbicide applications will follow Recovery Plan recommendations for listed species (Service 2000, 2007). Presently, two federally listed species (Spalding's catchfly and MacFarlane's four-o' clock) are documented on the forest. The Recovery plans recommend no aerial herbicide within 1000 feet of occurrence for Spalding's catchfly and not adjacent to Macfarlane's four-o'clock. A 1,000 foot buffer for aerial application will be used for both species. For non-federally listed SOLI, no aerial herbicide applications would occur within 300 feet of known location of SOLI and spray cards to monitor drift would be used to monitor drift and adjust buffers if needed.

I-8: A USDA Forest Service botanist would use monitoring results to refine buffers in order to adequately protect vascular and nonvascular plant species of local interest.

I-9: The impacts of herbicide use on plant SOLI are uncertain, especially regarding lichen and bryophytes. The potential for variances in aerial drift due to uncontrolled weather conditions during treatment may also be uncertain. To manage this uncertainty, representative samples of herbicide treatment sites adjacent to vascular and non-vascular plant SOLI's would be monitored. Non-target vegetation within 1000 feet of aerial treatment sites, 500 feet of herbicide broadcast treatment sites and 20 feet of herbicide spot and hand treatment sites would be evaluated before treatment, immediately after treatment, and two to three months later as appropriate. Treatment buffers would be expanded if damage is found as indicated by: (1) Decrease in the size of the SOLI plant population; (2) Leaf discoloration or chlorophyll change.

I-10: Compliance monitoring would occur before implementation to ensure that prescriptions, contracts and agreements integrate appropriate PDFs. This will be done via a pre-work review.

I-11: Implementation monitoring would occur during implementation to ensure PDFs are implemented as planned. An implementation monitoring form will be used to document daily field conditions, activities, accomplishments, and/or difficulties. Contract administration mechanisms would be used to correct deficiencies. Herbicide use will be reported as required by the Forest Service Health Pesticide Use Handbook (FSH 2109.14). The reports required by the Forest Service Health Pesticide Use Handbook will be submitted to the Level I teams annually.

I-12: Effectiveness monitoring would occur before, during and after treatment to determine whether invasive plants are being effectively controlled and to ensure non-target vegetation, especially native vascular and non-vascular species of local interest, is adequately protected.

J - Wildlife Species of Local Interest

J-2: Gray Wolf

J-2a: Treatments within 1 mile of active wolf dens would be timed to occur outside the season of occupancy (April 1 through June 30).

J-2b: Treatments within 0.50 mile or 0.50 mile line-of-sight of occupied rendezvous sites would be timed to occur outside the season of occupancy unless treatment activity is within acceptable ambient noise levels and human presence would not cause wolves to abandon the site (as determine by a local specialist).

J-2c: Consultation with the Service would be reinitiated (unless determined otherwise by the Service) if/when wolf dens or rendezvous sites are discovered in the vicinity of treatment sites.

K-Public Notification

K-1: High use areas, including administrative sites, developed campgrounds, visitor centers, and trailheads would be posted in advance of herbicide application or closed. Areas of potential conflict would be marked on the ground or otherwise posted. Postings would indicate the date of treatments, the herbicide used, and when the areas are expected to be clear of herbicide residue.

K-2: The public would be notified about upcoming herbicide treatments via the local newspaper or individual notification, fliers, and posting signs. Forest Service and other websites may also be used for public notification.

L-Special Forest Products

L-1: Triclopyr would not be applied to foliage in areas of known special forest products or other wild food collection areas.

L-2: Special forest product gathering areas may be closed for a period of time to ensure that no inadvertent public contact with herbicide occurs.

L-3: Popular berry and mushroom picking areas would be posted, marked on the ground or otherwise posted.

L-4: Special forest product gatherers would be notified about herbicide treatment areas when applying for their permits. Flyers indicating treatment areas may be included with the permits, in multi-lingual formats if necessary.

O-Human Health (See R6 2005 FEIS, Appendix Q for more information)

O-1: Worker Health

O-1a: Backpack Application - Triclopyr application rate will not exceed 1.0 lbs a.i./ac.

O-1b: Backpack Application - Sulfometuron methyl application rate will not exceed 0.2 lb a.i./ac.

O-1c: Backpack Application - NPE surfactant will not exceed 1.67 lb a.i./ac.

O-1d: Ground Boom Application - Picloram application rate will not exceed 0.5 lb a.i./ac.

O-1e: Ground Boom Application - Sulfometuron methyl application rate will not exceed 0.12 lb a.i./ac.

O-2: Public Health

O-2a: Triclopyr application rate will not exceed 1.0 lbs a.i./ac. Use selective spray techniques to further reduce dermal exposure. Favor other herbicides wherever they are likely to be effective.

O-2b: Those PDFs developed for water quality and protection of aquatic organisms will provide reduction in potential doses of herbicides in drinking water.

P-Restoration

P-1: Long-term site strategy for highly disturbed areas that are highly susceptible to invasion, such as old fields or old homesteads, follow guidelines and techniques outlined in Guidelines for Revegetation for Invasive Weed Sites on National Forests and Grasslands in the Pacific Northwest (Erickson *et al.* 2003)

P-2: On dry grassland habitat below 3000 feet in the Hells Canyon National Recreation Area and other highly disturbed areas where live vegetative groundcover will be reduced by 70 percent of existing vegetation by herbicide treatment, restoration and/or revegetation would occur following Guidelines for Revegetation for Invasive Weed Sites on National Forests and Grasslands in the Pacific Northwest (Erickson *et al.* 2003) and R6 2005 FEIS standards.

P-3: In areas where broadcast herbicide is used to treat highly infested areas, evaluation of potential re-infestation by new or nearby invasive plants would be considered and restoration and/or revegetation measures would be implemented to ensure protection of native vegetation and soils.

Appendix B. Description of Bull Trout Core Areas within the Action Area.

The following provides a description of each bull trout core area and threats to bull trout within the core areas.

North Fork John Day River Core Area. Overall trend for bull trout in the North Fork John Day Core Area bull trout is upward; however, in recent years the trend appears to be downward. Habitat fragmentation, connectivity and water quality issues still abound. The threats associated with mining still exist, but have been reduced through improved administration and cooperation between the Forest Service and local miners. The presence of brook trout throughout the core area, including the high mountain lakes, continues to be a serious threat. Development of a program to reduce or eliminate brook trout, and reintroduction and reestablishment of bull trout within these lakes would greatly speed recovery. Both the resident and migratory (fluvial) life forms of bull trout are still present within the core area. The relatively small population size continues to be a concern. This core area has started towards recovery, but it may take many years before habitat improves sufficiently to allow the population increases needed to reach recovery.

Middle Fork John Day River Core area. There are no significant trends in redd abundance in this basin. Bull trout are most likely stable but the core area has a small population. Bull trout in the Middle Fork John Day River persist at low abundance levels. In 1999, population surveys were conducted in Clear Creek, Big Creek, Deadwood Creek, and Granite Boulder Creek to estimate abundance. Total numbers of bull trout consisting of primarily juvenile and subadult fish, were estimated to be 1,950 individuals in Big Creek, 640 individuals in Clear Creek, and 368 individuals in Granite Boulder Creek (Hemmingsen 2001c). In the 1999 and 2000 surveys of Clear Creek, eight redds were observed each year (Malheur National Forest 2001).

Upper John Day Core Area. No trend can be determined due to a lack of data.

Powder River Core Area. The Hells Canyon Complex Management Unit Team estimates that the Powder River core area currently contains less than 500 adult fish per year. This core area is currently at risk from genetic drift. Redd counts were conducted in three streams during reconnaissance-level surveys in 1999 which included Anthony Creek, Lake Creek, and Wolf Creek. The results from the redd surveys indicated that 0.3 bull trout redds per mile were documented in Anthony Creek, 0.5 bull trout redds per mile in Lake Creek, and 1.5 bull trout redds per mile in Wolf Creek (Fedora and Walters 2001).

Bull trout only remain in the uppermost parts of the watershed that have not been degraded. The limited data available for abundance along with the opinions of resource professionals who work in this area suggest that populations are depressed from historic levels and that isolation has placed the remaining populations in danger of genetic inbreeding.

Bull trout in the Powder River core area have suffered large effects from the creation of the Snake River dams (Brownlee, Oxbow, and Hells Canyon) as well as from Thief Valley and Phillips Reservoirs that have further isolated bull trout populations to only the forested headwater streams. Historical dredge tailings and current agricultural water diversions have degraded stream habitat and/or eliminated water in the streams.

Pine -Indian-Wildhorse Core Area. In Pine Creek, spawning surveys have continued through the present. Numbers of redds continues to fluctuate with a high in 2004 of 108 total redds observed to a low of 64 in 2006. Redd densities are conservative estimates and include only those redds that were obviously visible. No obvious long term trend is discernable from this data at this time on a basin wide scale. However in Main and East Fork Pine Creek there is an apparent recent increasing trend in spawning activity. Conversely, in Aspen and Elk Creeks, other Pine Creek local populations, the recent spawning surveys appear to document a decreasing trend.

Grande Ronde Core Area. In general, there is a high level of uncertainty about the trend of the populations. There are insufficient years of bull trout spawning data to conclude a trend for the Wenaha. (G. Mendel, WDFW, pers. comm., 2008). The overall population trends for Lostine/Bear, Lookingglass, and Catherine Creek local populations within this core area are estimated to be stable (for the past 8 years; and in recent years, there appears to be a short-term downward trend in the Lookingglass and Catherine Creek populations). (Sausen 2008; P. Sankovich, USFWS, pers. comm. 2008; T. Bailey, ODFW, pers. comm. 2008; D. Crabtree, USFS, pers. comm. 2008; and G.Sausen, USFWS pers. comm. 2008).

Little Minam Core Area. The overall population trend for the Little Minam population is estimated to be stable for the survey period (P.Sankovich, USFWS, 2008; T.Bailey, ODFW, pers. comm. 2008; Bellerud *et al.* 1997; Hemmingsen *et al.* 2001a, 2001b, 2001c, 2001d, 2001e) even though the data shows a recent decrease in trend, but this may be due to reduced survey efforts (P.Sankovich, USFWS, 2008 and T.Bailey, ODFW, pers. comm. 2008).

Imnaha Core Area. Bull trout appear stable overall but this varies by local population. Average redd count data are only available for Big Sheep and Imnaha populations; they have averaged 7.2 redds/mile or 250 total redds from 2000 to 2007 for these streams. 2000 had a low of 2.8 redds/mile or 104 redds and 2005 and 2007 had a high of 10.4 and 11.1 redds/mile or 292 and 311 redds, respectively (Sausen 2008). The overall population trends for the above two populations are estimated to be stable (for the past 8 years) (Sausen 2008; P.Sankovich, USFWS, pers. comm. 2008; T.Bailey, ODFW, pers. comm. 2008; and G.Sausen, USFWS pers. comm. 2008).

The resident population in Big Sheep Creek is estimated at less than 2,000 individuals, above and below the WVIC and including all tributaries (USFS 2001). The resident population in Little Sheep Creek is fewer than 500 (USFS 2003). The resident population of McCully Creek, which formerly flowed into Little Sheep Creek, is estimated at approximately 2,500 individuals (Smith and Knox as referenced in Buchanan *et al.* 1997). Preliminary results from 2007 bull trout abundance sampling by the Service in McCully Creek reported 4,129 bull trout captured which is higher than the 2,500 estimate that was reported in Buchanan *et al.* 1997 (Mike Hudson, Service, pers. comm. 2008).

Umatilla Core Area. Both redd counts and fish sampling conducted in the Umatilla Basin since 2004 suggest that the bull trout breeding population has been declining (see Figure 2).

Identification of population trends from fish sampling data collected in the NF Umatilla River from 2003 to 2007 is difficult due to small sample sizes and high variability. However, Budy *et al.* (2007, 2008) conclude that there has been a decreasing trend since 2003.

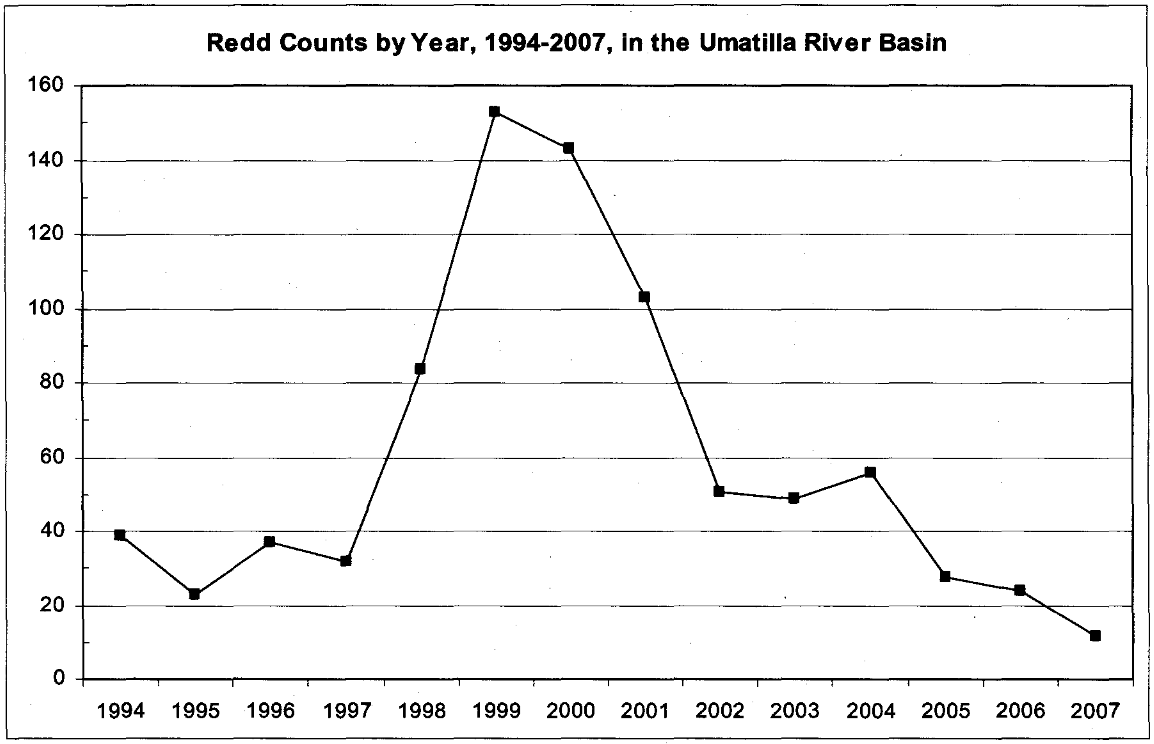

Figure 2. Redd Counts by Year in the Umatilla River Basin (Source: Unpublished data from ODFW, Umatilla National Forest, and USFWS).

Walla Walla Core Area

South Fork Walla Walla

Redd survey data from 1994 – 2007 for the South Fork Walla Walla River indicates a bell shaped curve with the trend over the last four years sloping down. The number of redds counted during the 2007 index redd surveys in the South Fork Walla Walla River (upper Walla Walla River local population) was similar to index counts conducted during 2006, but were relatively low overall (Anglin *et al.* 2008).

Mark-Recapture studies suggest the migratory portion of this population is in decline. Population estimates for smaller bull trout, which may be primarily resident, indicate a slight increase from 2002 – 2006 (Anglin *et al.* 2008).

Based upon information gathered over the past six years for the South Fork Walla Walla River, an estimated population trend was made using linear regression of log transformed annual changes in population growth rate (lambda) as a function of time step (Budy *et al.* 2008; Morris and Doak 2002).

Based on the population growth rates (lambda) calculated from population estimates, it appears that bull trout greater than 220 mm in the South Fork Walla Walla River (lambda =0.86, 95 percent CI = 0.98 – 1.17) are decreasing. A lambda value greater than 1 indicates positive population trend, a value equal to 1 indicates no change in population growth rate, and a value less than 1 indicates that the population is declining.

Table 11. Lambda values estimating population trend for South Fork Walla Walla River based on mark-resight population estimates.

Size	Lower CI	Mean	Upper CI
>220mm	0.61	0.86	1.2
>370mm	0.58	0.86	1.3

Because the 95 percent confidence intervals are wide and overlap 1, we cannot make conclusions about trend in the South Fork Walla Walla with certainty at this time (Budy *et al.* 2007). Further data collection (a longer time series) and an update of the population growth rate estimate using a non-biased open mark-recapture Pradel-type model in program MARK will allow tightening of the confidence intervals and provide more certainty about our conclusions.

Mill Creek

Redd survey data for the last 10 years for Mill Creek indicates that there is a decreasing trend by roughly 50 percent (Mendel pers. comm. 2008). Furthermore, both direct estimates of adult abundance and redd counts indicate that the fluvial adult population in Mill Creek has significantly declined by more than 50 percent (linear regressions of natural log transformed adult and redd counts, coefficients = -.08 and -.09, respectively, P=0.03 for both) during 1998-2007 (Howell, pers. comm. 2008a). That decline is the result of lower survival and resulting abundance in 2006-2007. Similar analysis of redd counts from 1997-2006 for the Low Creek population suggest a stable to slightly increasing population (coefficient = 0.06, P=0.09) (Howell pers. comm. 2008a).

Since 1994 the number and distribution of surveys on Mill Creek and its tributaries has been fairly constant (Mendel *et al.* 2006). This allows for annual comparisons of total redds for the Mill Creek system, with a peak of just over 220 redds in 2001. In 2005, a total of 142 redds were seen in the Mill Creek system. Eighty-seven redds were seen on Mill Creek from the forks down to the forestry boundary below the intake dam and 55 redds were found in the tributaries, with 43 of those redds in Low Creek (Mendel *et al.* 2006). In 2006, 93 redds were documented in the Mill Creek System, with 53 redds in the mainstem and 40 in the tributaries (Mendel pers. comm. 2008). In 2007, 59 redds were documented in the mainstem (Mendel pers. comm. 2008). 2007 redd data is not available for the tributaries.

Surveys were conducted in the mainstem Walla Walla River between Cemetery Bridge and Burlingame Dam to determine the location and frequency of fish passage barriers resulting from low streamflows. Streamflows at the time of the surveys were presumably 25-30 cfs from the Little Walla Walla Diversion at Milton-Freewater, downstream, as measured at the gage downstream from Nursery Bridge Dam (Anglin *et al.* 2008). Following the survey, streamflow data from the Washington Department of Ecology (WDOE) was accessed and determined that flows on the survey dates ranged from 12.9 to 13.4 cfs at Pepper Bridge (WDOE 1998).

Based on passage criteria, a total of 92 low flow passage barriers (e.g. riffles) were identified, 84 of which occurred between Tumalum Bridge and Burlingame Dam, a section of the Walla Walla River that is barely 10 km in length. Barriers limiting the movement of adult and subadult migratory bull trout may disrupt their life history, and result in isolation and exposure to increased predation (Anglin *et al.* 2008).

In addition, approximately 25 percent of bull trout captured in 2007 in downstream areas had scars or wounds, apparently from avian or mammalian predators. Based on observations of this high rate of unsuccessful predation, there are likely substantial numbers of bull trout lost annually to successful predation. Low flow conditions are exposing bull trout to the potential for increased predation and mortality. The Walla Walla River and several tributaries also do not currently meet water quality standards for temperature (WDOE website).

As previously discussed, low flow, water quality impairments, and fish passage issues are currently known to occur throughout most of the lower and middle portions of the Walla Walla River and several tributaries, and therefore likely impacts a majority of the migratory bull trout from the Mill Creek and South Fork Walla Walla River local populations.

Tucannon Core Area. Bull trout in the Tucannon Core Area appear to be in severe decline based on partial redd survey data, as not all redd survey reaches were completed in 2007. Redd surveys were not done in 2006 because of large fires within the basin. Furthermore, the number of adult migratory bull trout captured moving upstream (at the Tucannon Hatchery trap) to spawning streams were down significantly with only 52 fish captured in 2007, as compared to 261 and 283 in 2003 and 2004, respectively (Mendel, email pers. comm. 2008). Many of the bull trout observed at the trap were also in poor health with new or recent injuries (cuts and scrapes) around their head and gills.

In 2007, the total redds observed for the upper Tucannon River and Bear Creek was the lowest documented since redd surveys began in 1990 (Mendel *et al.* 2008). In 2007, 13 redds were documented in the upper Tucannon River, the long-term average for this area is 57 redds. In 2007, only 4 redds were documented in Bear Creek. Within Bear Creek, redd surveys have not been completed consistently over the years. However, five years of redd data between the years of 1999 and 2005, documented an average of 41 redds for the same reach as surveyed in 2007. Redd survey data for the Panjab and Meadow Creek basin also indicate a declining trend with only 6 redds observed in 2007. Like Bear Creek, redd surveys have not been done consistently over the years in the Panjab and Meadow Creek basin, but in general, surveys documented from 11 to 49 redds in similarly surveyed reaches in most years between 1999 and 2005 (Mendel *et al.* 2008).

Asotin Creek Core Area. The status and trend of bull trout in this core area was considered "depressed" and "unknown" based on information available at the time of listing (USFWS 1998). Very little new information exists for bull trout in this core area that would change this determination. Recent surveys, although limited, have failed to document bull trout in several watersheds where they were documented historically. During recovery planning, the recovery unit team for this area determined that bull trout are at an increasing risk of extirpation as there are only two known streams where reproduction has been documented. There is a very limited amount of data to make this determination. The population is known to be very low. In 1999, 59 redds were observed in the North Fork Asotin Creek and 9 were observed in Cougar Canyon. In 2006, 9 redds were observed in the North Fork Asotin Creek and 3 were observed in Cougar Canyon (Mendel *et al.* 2008). Redd surveys have not been completed in most years due to the remote nature of these two streams.

Appendix C. Element Occurrences for MacFarlane's four-o'clock within the Action Area.

Tryon Bar/Snake River (Oregon EO #001)

This population is the largest in Oregon, with at least 3,000 plants estimated. It is near (just north of) Tryon Bar on the Oregon side of the Snake River in the Hells Canyon Wilderness. The population is one continuous colony that includes an estimated several thousand plants spread over approximately 300 acres. The predominant aspect is east, and the slope angle averages over 70 percent (although a few plants are on less than 10 percent slope).

The Tryon Bar population is in the Canyon Cattle and Horse Allotment, which is currently vacant; livestock have not grazed this area since about 1979. After the Canyon Allotment became vacant, it was sometimes permitted for use by livestock on a temporary basis to accommodate cattle displaced from adjacent allotments by wildfire. This included use of the Mormon/Sleepy area during 1990 and 1991, after the Teepee Butte fire. However, known Macfarlane's four-o'clock populations are several miles away from this area and it is unlikely they were impacted from grazing (USDA Forest Service 2003).

There are no roads or developed recreation sites within several miles of this site. A few individual plants (<10) are near a recreation trail, but they represent a very small fraction of the population. Between 1979 and 1991, the Forest Service used portions of the vacant Canyon Allotment (including the Tryon Allotment area) for winter pasture for administrative stock. Typically 60-80 head of horses and mules used the area from November through April. The stock reportedly stayed up near Tryon Ranch and on the bench or above, which would not be in the known population (USDA Forest Service 2003). The area is no longer used for this purpose.

The area where this population occurs burned in the Eastside Complex fire in September of 2000. The site is composed of light fuels, mainly bunchgrass and forbs. This area burned lightly and in a mosaic pattern. Some areas were not burned at all. A visit to the site in May of 2001 and again in 2002 showed no apparent mortality to Macfarlane's four-o'clock, which would be expected, because the plant was dormant at the time of the fire. The main human-related activities that could affect the site are hiking, horseback riding, and hunting. However, due to the remote location, and steepness of the terrain, these are probably not significant uses of this particular area.

Pleasant Valley/Snake (Oregon EO #005)

Located in the Hells Canyon Wilderness, this population is situated on the lower slopes of the Snake River, about 100 meters south of Pleasant Valley Creek and about one mile north of Pittsburg Landing, on the Oregon side of the river. An Idaho Power botany crew found this population in 1997, who reported about 100 plants. This area burned in the Salt Creek fire in the summer of 1996. In May of 2001 Forest Service staff visited this site and tallied about 90 clumps or plants in a "healthy" population with no indications of disturbance. In 2002, the site was again visited in 2002 when three new clumps were located opposite Pleasant Valley Creek on a south aspect. Both were large vigorous clumps. The total population was estimated between 90 and 100 clumps. There is no domestic grazing, roads, or trails near this population.

Buck Creek/Imnaha (Oregon EO #002)

This population of Macfarlane's four-o'clock is on private land along the Imnaha River, within the boundary of the HCNRA. This population has also been referred to as the Packsaddle and Kettle Creek sites. Two hundred plants are reported in one acre. The Macfarlane's four-o'clock plants are on a steep, rocky hill. No serious impacts from cattle have been noted, although evidence of cows has been observed within the area of the population. The Eastside fire of 2000 burned near, but not into, this population. The plants are not near any public roads or trails, so impacts from recreation are probably minimal. There is visual evidence of grazing of the private land in this site. Cattle trails have been observed in the vicinity of the four-o'clock, but grazing of it or other grasses in the area have not been observed. A 1992 report speculated that cattle might have used the trails to access other areas, but did not graze in the vicinity of the four-o'clock due to the steep slopes that range from 30-50 percent. The use of this land for cattle grazing is not related directly or indirectly to any government allotment (USDA Forest Service 2003). This population lies entirely on private land, and there are no direct, indirect, inter-related or inter-dependent government activities that may impact this population. Therefore, the Forest Service and the Service have no jurisdiction over the activities of the private landowners as they relate to this population.

Fall Creek/Imnaha (Oregon EO #003)

This site has been referred to as Fence Creek and also Dug Bar, and Dug Bar Road sites. It is near Fence Creek, but is actually closer to Fall Creek. It is adjacent to the Dug Bar road, but it is nowhere near Dug Bar itself. Some of this population is on private land, which is outside the congressionally designated boundary of the HCNRA, so it would be difficult for the Forest Service to acquire.

There are approximately 350 plants in 20 acres, some of which are on private land. The aspect ranges from south to east facing with the slope angle between 20-60 percent. Soil is deep sandy loam to coarse lithosol. Plant associations are bluebunch wheatgrass and Idaho fescue types. The soil in much of the population is very loose and is easily eroded by people or animals walking on it. Long term monitoring plots had been installed in this population; however, monitoring was discontinued for a variety of reasons by the people conducting the monitoring.

The federal portion of this population is located in the Packsaddle Pasture of the Log Creek Cattle and Horse Allotment. The permit allows for between 50 and 200 cattle in this pasture from March 1st to April 15th each year. The Annual Operating Plans from 1991 forward state "cattle entering the Packsaddle Unit during March and April will not graze in the southern end of the unit after March 15th. This will provide protection for endangered plant species." In 2000 the WWNF constructed a fence around most of the portion of the population that lies on NFS land. The fence was built during the time of year when no plants were visible, so it was not possible to ensure the fence encompassed every plant. Natural barriers and riders are used to move cattle away form the remainder of the population after March 15th. Cattle from other allotments are permitted to trail through this site.

The Dug Bar Road (Forest Service Road #4260) goes right by the uphill edge of the Fall Creek population. In 1991, it was noted that road grading had buried several plants with dirt that had been pushed off the side of the road. Posts were erected at each end of the population along the road to alert the grader operators of the location of the population. The road between these two posts is no longer graded, and the plants adjacent to the road appear to have recovered from the dirt that was piled on them (USDA Forest Service 2003).

Recreation use is probably not a factor at this site, as it is on a steep hill, and quite distant from the Imnaha River. However, this population is locally well known, and the fence or population may be vulnerable to vandalism. The Eastside fire of 2000 burned near, but not into, this population.

West Creek (Idaho EO #006)

The West Creek site is a large population of 250 plants located adjacent to the Big Canyon Road (FS Road #1805). The West Creek site is in the Pittsburg Allotment, which became vacant in 2003. Up to this time, cattle had grazed this pasture through March of each year. Most of the Macfarlane's four-o'clock had been fenced in 1998 to exclude grazing by cattle. The population lies on a steep north-facing slope and had been impacted by cattle before it was fenced. It is probably not being impacted by the nearby road or Canyon visitors. The West Creek site also contains a large patch of teasel (*Dipsacus sylvestris*), an exotic weedy plant that may be impacting Macfarlane's four-o'clock plants. Yellow star-thistle, an aggressive weed is known to occur within ¼ mile and poses a threat to this site. This site is monitored at least every two years.

Pleasant Valley/Island Gulch (Idaho EO #009)

The Pleasant Valley site lies a short distance north of Pittsburg Landing near the Snake River. This population occurs on a steep hill about 50 yards above a dirt spur road that leads to the Snake River. The part of the road that is just below the population of plants is not a "system" road. An open road (#493B) curves to the north of the population. The spur that passes under the population is legally closed. Although not posted closed on the Idaho side of the HCNRA, roads are closed unless posted open. This site had not been fenced from cattle, but grazing impacts had not been observed. This population is in the recently vacated Pittsburg Allotment, Dam Lot pasture, where grazing was scheduled over the winter through March. This population is probably not being impacted by the nearby road or recreation area visitors because there is no evidence of driving impacts.

Mine Gulch/Snake (Idaho EO #007)

The Mine Gulch site has been referred to as the Island Gulch site also. This population of about 150 plants is just a little north and east of the Pleasant Valley/Island Gulch site. Most of the plants are growing on a small rocky ridge and down a steep hill into a gulch. There is a closed road (jeep trail) on the northwest edge of this population. Signs designating the closure were posted at the end of the open road in the spring of 2000. In 2002, the site was visited and recent ATV use (tracks) was noted on the closed road. Some plants growing directly adjacent this road and a few that grow out of the roadbed itself showed stunted growth, believed to be a result of unauthorized off-road vehicle use. Located in the now vacant Pittsburg Allotment, this site had not been fenced from past cattle grazing and trailing impacts had been noted in the past. Although the plants are near an inactive mining claim, the area is closed to new mining claims, so mining is no longer a threat here.

Kurry Creek (Idaho EO #010)

The Kurry Creek site is just south of Kurry Creek and just east of Pittsburg Landing. The edge of the population is adjacent to the Pittsburg Landing road. This is a small population; only 17 plants have been reported. This population is in the recently vacated Pittsburg Allotment, although it was fenced to exclude grazing in the early 1990's, when the allotment was in use. The reconstruction of the Pittsburg road in early 1993 may have impacted some plants that were adjacent to the road. A concrete barricade was placed along the edge of the road so future maintenance actions would not affect this site. Yellow star-thistle, an aggressive noxious weed, as well as Scotch thistle and puncture vine, are found nearby and threaten to invade this site.

West Kurry Divide #1 (Idaho EO #011)

The West Kurry Divide #1 site lies about one mile east of the large West Creek/Snake population. It is a large population (1,500), with many of the plants on open, loose, almost cinder-like soil, which appears to be very prone to erosion. This population is in the Stonehouse pasture of the recently vacated Pittsburg Allotment. The permitted period of livestock use was between March 20th and April 31st. Impacts from cattle (exposed rhizomes due to erosion) were noted in 1997.

West Kurry Divide #2 (Idaho EO #012)

The West Kurry Divide #2 is a single plant located on the ridge, west of the West Kurry Divide #1 population. This population is in the Stonehouse pasture of the Pittsburg Allotment. The permitted period of livestock use is between March 20th and April 31st. Observations regarding cattle use are not available at this site. Yellow star thistle, an aggressive noxious weed is known to occur within ¼ mile and could threaten this site.

West Kurry Divide #3 (Idaho EO #013)

The West Kurry Divide #3 site is found growing with hackberries in some places, which is uncharacteristic for Macfarlane's four-o'clock. This population is in the Lower West Creek pasture of the recently vacated Pittsburg Allotment. The permitted period of livestock use had been scheduled between March 20th and April 31st. Evidence of cattle impacts (trails and hoof prints from when the soil was wet) was noted here in 1997. Yellow star thistle is known to occur within 200 meters and could threaten this site.

South Kurry Divide (Idaho EO #900)

The South Kurry Divide population, which contains 50 ramets, is near the West Kurry Divide #1 and #2 populations. This population is not well documented and would be revisited to determine its full extent and population size. This population is in the Stonehouse pasture of the recently vacated Pittsburg Allotment, where the permitted period of livestock use had been from March 20th to April 31st. The population is reported to be in a very steep area that was isolated from cattle by rim rock. Evidence of livestock impacts have not been observed at this site.

Through a cooperative venture with the Forest Service, the Oregon Natural Heritage program modeled probable habitat for Macfarlane's four-o'clock in the HCNRA (Murray 2001). The predictive model identified 39,090 acres of habitat in the HCNRA that may support Macfarlane's four-o'clock. This model further classified Macfarlane's four-o'clock habitat into "moderate," "high," and "very high" probability ranks. The model was compared with known sites of Macfarlane's four-o'clock on the Wallowa-Whitman National Forest. Known sites fall within each of the probability ranks (very high: 7; high: 3; moderate: 2); however, more sites are located in very high potential habitat, consistent with the development of the model.

Thirteen percent of Macfarlane's four-o'clock potential habitat is located in active allotments or administrative horse pastures, but only 0.1 percent (7 acres) is classified as very high potential habitat. Nearly all very high potential habitats are located within the recently vacated Pittsburg Allotment, portions of which were inventoried for the presence of Macfarlane's four-o'clock in 1991. The Pittsburg Allotment went into vacant status in 2002.

Appendix D. Runoff from Treated Ditches and Dry Intermittent Streams (from NMFS/Rick Golden)

Herbicides applied within ditches and intermittent stream channels are delivered primarily by leaching, dissolving directly into ditch or stream channel flow, and erosion. The contribution from erosion is likely to vary considerably among sites. The primary determinants of exposure risk from ditch/intermittent channel treatments are herbicide properties, application rate, extent of application, application timing, precipitation amount and timing, and proximity to habitat for listed salmonids.

Monitoring of storm runoff has documented that the highest concentrations of pollutants occur during the first storm following treatment (Caltrans 2005, USGS 2001). More specifically, the highest pollutant concentrations generally occur during the early part of storm runoff, relative to concentrations later in the runoff event (Caltrans 2005). The discharge of ditch/intermittent channel runoff in the early stages of the storm hydrograph is generally low, but is exposed to the greatest amount of pollutants available for dissolution. The ratio of low discharge to highest amount of available pollutant results in early runoff solute concentrations that are high relative to those occurring later in the runoff event. Runoff later in the hydrograph occurs at a higher discharge, and dissolved pollutant concentrations are lower, even though mass movement of pollutants can be greater. Therefore, exposure of listed salmonids and their critical habitat elements to the highest concentrations of herbicides resulting from application to ditches and intermittent channels is likely to occur early in storm runoff. The most significant exposure locations are at or near confluences with perennial streams.

In contrast to the well established understanding of the "first flush" effect on pollutant concentrations, little monitoring data is available regarding specific concentrations of herbicides likely to occur in runoff from treated ditches. The USGS (2001) monitoring report cited above provides data for concentrations of sulfometuron and glyphosate in runoff from treated roadside plots into ditches in western Oregon. Sulfometuron was applied at a rate of 0.23 pounds/acre, and resulted in runoff concentrations of 0.119 to 0.253 mg/l (corresponding to about 3 to 7% of amount applied) from simulated rainfall 24 hours following application. Glyphosate was applied at a rate of about 2 pounds/acre, and resulted in runoff concentrations of 0.323 – 0.736 mg/l (corresponding to about 1 to 2 percent of amount applied) from simulated rainfall 24 hours following application. The samples were collected in the initial 15 liters of runoff from simulated rainfall at a rate of 0.3 inches per hour, and lasting 0.5 to 1.4 hours. Given this sampling scenario, these concentrations are the best estimates available for what would occur in 24-hour, post-application runoff from ditch/intermittent stream applications from "first flush" events for these herbicides (per amount applied, per unit area).

The runoff concentrations likely for the herbicides in the activity description for which runoff data is not available (clopyralid, imazapyr, metsulfuron, chlorsulfuron, and sethoxydim) can be estimated from the USGS (2001) data. Ramwell *et al.* (2002) and Huang *et al.* (2004) found that herbicides with high solubility and low K_{oc} produced the highest peak concentrations and highest total yield of herbicides in roadside runoff. Krutz *et al.* (2005) stated that herbicide concentrations observed at vegetative filter strip outflows correlate positively with increasing solubility. If solubility and K_{oc} values are reasonable predictors of herbicide yield in ditch runoff, with high solubility and low K_{oc} increasing runoff risk, then it is reasonable to assume that herbicides with solubility values greater than, and K_{oc} values less than or equal to, sulfometuron are likely to be present in runoff at concentrations at least equal to that for sulfometuron. The shortest soil half-life of any of the herbicides is 5 days for sethoxydim, and the others are considerably longer, so it is reasonable to ignore half-life for estimating 24-hour post-application runoff concentrations.

Table 1 summarizes herbicide soil mobility factors (solubility and K_{oc} ratios) and application rates for seven herbicides as an example. Five example herbicides for which ditch runoff data is not available (chlorsulfuron, clopyralid, imazapyr, metsulfuron, and sethoxydim) all have K_{oc} values similar to or less than sulfometuron, and much higher solubility. Sulfometuron solubility is low (70 mg/l) relative to the other five herbicides, but a substantial portion of the amount applied appears in the initial runoff. Due to the relatively low application rate of 0.23 pounds/acre, the initial runoff only needs to reach 0.6 percent saturation to remove 10 percent of sulfometuron applied. Under circumstances where the ratio of water volume to a low-solubility organic chemical is very large, dissolution is seldom limited by solubility (Lyman 1995). Thus, at low herbicide application rates, solubility of the seven herbicides in the activity description is likely to be less important than K_{oc} as a predictor of runoff risk. It is therefore reasonable to assume that the runoff efficiency of those five herbicides will occur at a rate at least equal to that of sulfometuron following a rainstorm occurring 24 hours post-application. This assumption is consistent with groundwater movement ratings from Vogue *et al.* (1994). In addition, foliar wash-off fractions of these five herbicides were also higher than for sulfometuron (Knisel 2000), indicating that an amount greater than or equal to sulfometuron will be available for dissolution.

Table 1. Summary of herbicide soil mobility factors and application rates.

Herbicide	Solubility[1,2] (mg/l)	K_{oc}[2]	Maximum Application Rate (lbs/acre)[3]
Clopyralid	300,000	6	0.5
Imazapyr	500,000	100	1.5
Metsulfuron	9,500	35	0.15
Chlorsulfuron	7,000	40	0.25
Sethoxydim	4,390	100	0.45
Sulfometuron	70	78	0.38
Glyphosate	900,000	24,000	8

[1] Solubility values are for salts, if salts are typically the ingredient in commercial formulations
[2] From Vogue *et al.* (1994), located at http://npic.orst.edu/ppdmove.htm
[3] From product labels

The average sulfometuron 24-hour post-application concentration reported by USGS (2001) was used to extrapolate likely concentrations of the five herbicides for which comparable monitoring data was unavailable, predict exposure risk to listed salmonids and their habitat, and calculate HQ values. The equation for extrapolation of the USGS (2001) sulfometuron data to chlorsulfuron, clopyralid, imazapyr, metsulfuron, and sethoxydim was derived by treating application rate as the independent variable (x), runoff concentration as the dependent variable (y), and solving for the slope of the line intersecting y = 0, x = 0 (no herbicide was considered to be in runoff if none was applied). The average sulfometuron runoff concentration of the 24-hour simulated rainfall plots was 0.2 mg/l, and the application rate was 0.23 lbs/acre. The resulting estimate of runoff concentration is in mg/l. Thus, where m = slope and b = y intercept:

$y = mx + b$
y = (runoff concentration/application rate) * x + 0
y = (0.2 mg/l)/0.23 lbs/acre) * x + 0
mg/l in runoff = 0.87 mg/l per lb/acre * application rate in lbs/acre

The results of the extrapolation and resulting HQ values are summarized in Table 15. Runoff rates in Table 15 for sulfometuron and glyphosate are those published in USGS (2001).

The HQ values presented in Table 2 are based on the assumption of application to several hundred feet of ditch/intermittent channel adjacent to a perennial stream with occupied or critical habitat present. Herbicide treatments approaching the maximum rates for ditch/channel lengths greater than a few hundred feet are likely to occur within the project area. However, due to the generally patchy distribution of invasive plant infestations in ditches and intermittent channels, and use of conservative herbicide application methods, treatment of such large, contiguous areas near the maximum application rate is expected to be rare. Treatments of ditch/channel lengths greater than a few hundred feet at the typical rate are likely to be infrequent. Therefore, the estimated herbicide runoff concentrations and consequent HQ values displayed in Table 15 are likely to occur on a rare (for maximum HQ values) to infrequent (for typical HQ values) basis within the project area.

Based on the example analysis results presented in Table 2, the summary of the likely adverse effects to listed salmonids and their habitat from 24-hour post-application storm at ditch/intermittent channel confluences with perennial streams is:

- Glyphosate would cause sublethal effects to listed salmonids, generally reducing their fitness and cause adverse effects to their habitat by reducing algae production.

- Sethoxydim would cause sublethal effects to listed salmonids, generally reducing their fitness and adverse effects by reducing production of aquatic invertebrates, algae, and aquatic macrophytes.

- Chlorsulfuron, imazapyr, metsulfuron, and sulfometuron would be likely to cause adverse effects to salmonids habitat by reducing production of algae and aquatic macrophytes.

Actual exposure concentrations and durations at or near confluences with perennial streams will depend on a variety of factors, including the extent of the herbicide application within the ditch/intermittent stream, application rate, extent of riparian applications, and rainfall timing, intensity, and amount.

Riparian applications adjacent to ditch/intermittent stream channels may contribute additional herbicide, exacerbating exposures at confluences with perennial streams. However, due to a greater transport lag time through soils, peak herbicide exposures from riparian applications delivered via ditches and intermittent streams are likely to arrive at perennial stream confluences at a later time than the "first flush" peak. This would likely extend exposure time, but would be unlikely to increase peak exposure level.

The projected runoff concentrations and HQ values displayed in Table 2 should be interpreted with an understanding of the precision and accuracy of the USGS (2001) data upon which they are based. Although the USGS (2001) results were based on relatively ambitious quality assurance, "it is important to recognize that all of the data presented are semi quantitative in nature and that interpretations should take this into account. These data can be relied on only for order-of-magnitude representations of concentrations, and possibly for trends." Thus, the runoff concentrations and HQ values in Table 2 should be considered as estimates that may vary by an order of magnitude lower or higher. However, the runoff concentrations projected in Table 2 for clopyralid are reasonably consistent (within an order of magnitude) with roadside ditch runoff data for clopyralid reported by Huang *et al.* (2004), and collected under similar conditions.

Table 2. Projected runoff concentrations at typical and maximum application rates, and resulting HQ values.

Herbicide	Typical Application Rate (pounds/acre)	Expected Typ. Runoff Concentration (mg/l)	Maximum Application Rate (pounds/acre)	Expected Max. Runoff Concentration (mg/l)	Species Group	Effects Threshold Concentration (mg/l)	Typ Application Rate HQ values	Max Application Rate HQ values
Chlorsulfuron	0.056	0.05	0.25	0.22	Fish	2	0.02	0.11
					Aq. Invertebrates	10	0.005	0.02
					Algae	0.01	5	22
					Aq. Macrophytes	0.000047	1,036	4,625
Clopyralid	0.35	0.30	0.5	0.43	Fish	5	0.06	0.1
					Aq. Invertebrates	21	0.01	0.02
					Algae	0.69	0.4	0.6
					Aq. Macrophytes	0.69	0.4	0.6
Glyphosate	2	0.48	8	1.92	Fish	0.5	1.0	3.8
					Aq. Invertebrates	78	0.006	0.025
					Algae	0.89	0.5	2.2
					Aq. Macrophytes	3	0.2	0.6
Imazapyr	0.45	0.39	1.5	1.30	Fish	5	0.1	0.3
					Aq. Invertebrates	100	0.004	0.01
					Algae	0.02	20	65
					Aq. Macrophytes	0.013	30	100
Metsulfuron	0.03	0.03	0.15	0.13	Fish	4.50	0.01	0.03
					Aq. Invertebrates	17.00	0.002	0.01
					Algae	0.01	2.6	13
					Aq. Macrophytes	0.00016	163	815
Sethoxydim	0.3	0.26	0.45	0.39	Fish	0.06	4	7
					Aq. Invertebrates	0.26	1.0	1.5
					Algae	0.25	1.0	1.6
					Aq. Macrophytes	0.25	1.0	1.6
Sulfometuron	0.03	0.03	0.38	0.33	Fish	4.5	0.006	0.1
					Aq. Invertebrates	6.1	0.004	0.05
					Algae	0.0025	10	132
					Aq. Macrophytes	0.00021	124	1,573

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